

PALM Print Verification Using LabVIEW

A

thesis

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the requirements of the degree of

Master of Engineering

In

Electronic Instrumentation and Control Engineering

Submitted By

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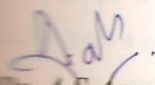
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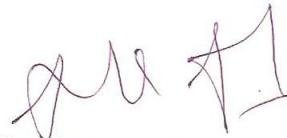
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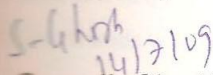
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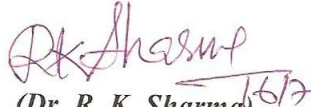
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ABSTRACT

The development of accurate and reliable security systems is a matter of wide interest, and in this context biometrics has seen as a highly effective automatic mechanism for personal authentication. Authentication by biometric verification is becoming increasingly common in corporate and public security systems, consumer products and point of sale applications. Many research groups are working on the development of the different authentication systems such as the fingerprint, iris, hand, palm print etc. by using biometrics. The palm print is the first defining characteristics and natural method to be used for recognition. Moreover, ease acceptance and non invasive nature as compared to other biometric traits make it a preferable trait to be used for authentication.

In this thesis, an automated approach to palm print recognition has been developed and discussed. Particular emphasis has been given to the alignment method, for which a new alignment algorithm has been proposed. The proposed algorithm uses the detection of fingertip, lower corner and vertex of the hand to find out the misalignment. Then a region of interest i.e. palmprint has been extracted from each image. A feature vector for each ROI has been computed and a correlation is then computed between the query and reference image. The structural similarity and dissimilarity between the different images determines the authenticity of the subject. The proposed system is reliable and user friendly as it is developed in LabVIEW 6i. The availability of datalog files in LabVIEW makes it one of the most promising candidate for its usage as a database. Datalog files can access and manipulate data and complex data structures quickly and easily. It makes writing and reading much faster. The system developed in LabVIEW detects the user in almost real time with a reasonable accuracy and repeatability. The self developed database has been used in the present work and the experiments conducted shows that the 20% FAR and 18% FRR has been achieved with the proposed method.

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Chapter 1

Biometrics

1.1 Introduction

Biometrics is the science and technology of measuring and analyzing biological data. In information technology, biometrics refers to technologies that measure and analyze human body characteristics, such as fingerprints, eye retinas and irises, voice patterns, facial patterns and hand measurements, for authentication purposes.

Authentication by biometric verification is becoming increasingly common in corporate and public security systems, consumer products and point of sale applications. In addition to security, the driving force behind biometric verification has been convenience.

Biometric devices consist of:

- A reader or scanning device
- Software that converts the scanned information into digital form and compares match points
- A database that stores the biometric data for comparison

To prevent identity theft, biometric data is usually encrypted when it's gathered. Here's how biometric verification works on the back end: To convert the biometric input, a software application is used to identify specific points of data as match points. The match points in the database are processed using an algorithm that translates that information into a numeric value. The database value is compared with the biometric input the end user has entered into the scanner and authentication is either approved or denied

1.2 Biometrics: A brief history

Measurement of physical features such as height, eye color- etc, as a method of personal identity is known to date back to the ancient Egyptians. Archaeological evidence of fingerprints being used to at least associate a person with some event or transaction is also said to date back

to ancient China, Babylonia and Assyria. But it was not until the end of the 19th century that the study of biometrics entered the realm of crime detection. Alphonse Bertillon, a French police clerk and anthropologist, pioneered a method of recording multiple body (anthropometric) measurements for criminal identification purposes. Known as ‘Bertillon age’ it was adopted by many police authorities worldwide during the 1890s, but soon became obsolete once it was recognized that people could indeed share the same physical measurements. Meanwhile, the quest for a physical identifier that was unique to each individual gained significant ground when British anthropologist, Sir Francis Galton, worked on the principle that fingerprints were permanent throughout life, and that no two people had identical fingerprints. Galton calculated the odds of prints from two people being identical to be 1 in 64 billion and also identified characteristics – known as ‘minutiae’ – that are still used today to demonstrate that two impressions made by the same finger match.

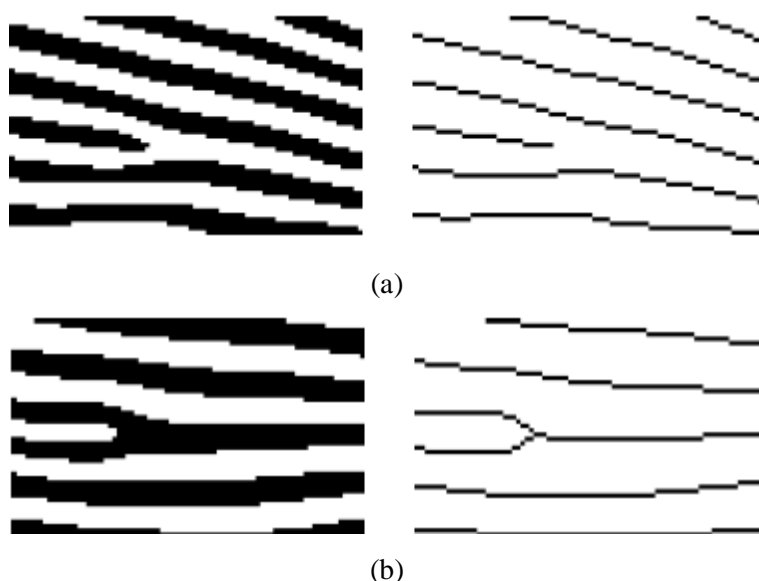


Figure 1.1 (a) Ridge Ending, (b) Bifurcation

It is the arrangement of all the minutiae in terms of their location, orientation of ridge flow and type (i.e. ridge ending or bifurcation) that make an individual’s fingerprints unique. The flow of the friction skin ridges also form the patterns – the whorl, arch and loop of each finger – that were identified by Galton. Galton’s patterns provided the basis of the first fingerprint file established in 1891 by Juan Vucetich, an Argentine police officer, who became the first to use a bloody fingerprint to prove the identity of a murderer during a criminal investigation. In 1897, Sir Edward Henry, a British police officer serving as Inspector General of the Bengal Police in

India [1], also developed an interest in the use of fingerprints for identifying criminals, even though the Bengal Police was at that time using Bertillonage. Based on Galton's observations, Henry and colleagues established a modified classification system allowing fingerprints captured on paper forms using an ink pad to be classified, filed and referenced for comparison against thousands of others. By 1901, Henry's fingerprinting system had been adopted in the UK by Scotland Yard and its use then spread through most of the world (the exception being South America, where the Vucetich system was used) to become a standard method of identity detection and verification in criminal investigations. With the advent of computers and digital technology in the 1970s, fingerprinting took on a new dimension. As a result, the UK's fingerprint service now records 120,000 sets of fingerprints each year – a volume of records that was simply untenable before computerization. Within a century, biometrics had evolved from tape measure, ink and pad techniques requiring vast manual filing and archiving resources, to an automated biometric digital scanning process using computerized storage, automated search and find/match techniques, plus extensive archiving and access systems with worldwide links. Such technology now provides for the capture and processing of biometrics information and has transformed fingerprinting techniques and procedures. It is the arrangement of all the minutiae in terms of their location, orientation of ridge flow and type (i.e. ridge ending or bifurcation) that make an individual's fingerprints unique. The flow of the friction skin ridges also forms the patterns –the whorl, arch and loop of each finger. In the mid-1960s, the Royal Canadian Mounted Police (RCMP) adopted an automated video tape-based filing system allowing identification officers to make fingerprint comparisons on-screen. A similar 'Video file System' was installed at New Scotland Yard in 1977. Around the same time, the USA's Federal Bureau of Investigation (FBI) was working with industry to build the first automated fingerprint card reader, which was implemented in 1974. Over the next five years, the FBI and other organizations in Canada, Japan and the UK, developed further core technologies including fingerprint matching hardware, plus automated classification software and hardware. By the early 1980s, this culminated in the automatic fingerprint identification system (AFIS), which allowed the automatic matching of one or many unknown fingerprints against an electronic database of known prints; another major forward step in the world of crime detection and international security. Such systems have since reduced the manual capture, store, search and match processes for fingerprints from weeks and months, to hours and minutes, and have led to

AFIS(Automated Finger Identification System) being deployed by law enforcement agencies in Europe and worldwide.

1.3 Biometric Traits

Many human characteristics proposed as biometric traits have both advantages and disadvantages. There is no so-called optimal biometric trait. The selection of biometric traits depends on requirements of applications. In this Section, a brief summary of different biometric traits is presented.

- **Deoxyribonucleic Acid (DNA)**, a nucleic acid containing all genetic instructions for development of organs, is commonly applied to forensic applications such as criminal investigation and corpse identification. Everyone has unique DNA pattern, except identical twins. DNA can be extracted from blood, hair, and skin etc, which can always be collected in crime scenes. One of major concerns of using DNA for personal identification is privacy since DNA can be collected unintentionally and contains all genetic information including genetic disorder. The whole process is too much costly.

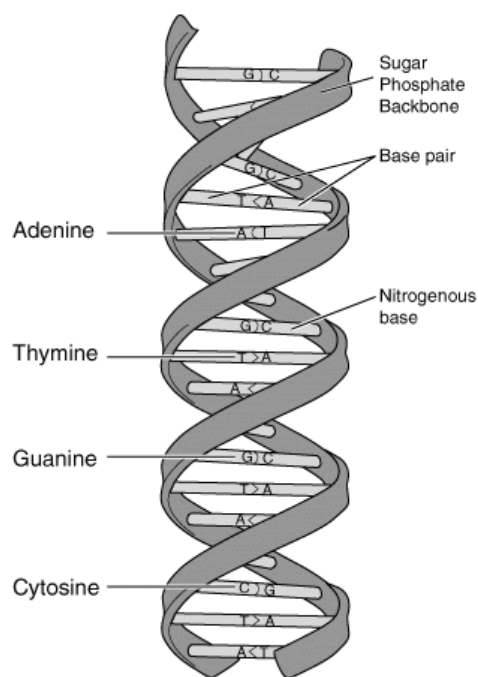


Figure 1.2: DNA

- **Face** is a widely acceptable biometric trait, which can be captured from distance and even without users' cooperation. Nevertheless, face contains limited information for personal identification. Identical twins have very similar facial features. Another inherent difficulty of using face for personal identification is that face images of a person can change a lot due to facial expression, capture environment and aging. As a result, current face recognition systems cannot support high security applications but it is an important component in surveillance systems. Accuracy can be enhanced by updating the system continuously.

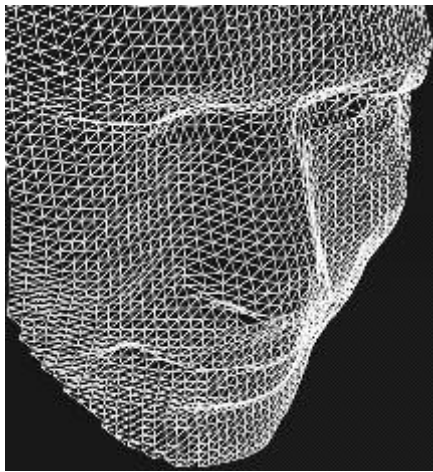


Figure 1.3: Face

- **Fingerprint**, the pattern on fingertips, is the most mature biometric technology. Fingerprints have been used for personal identification for many centuries and current automatic fingerprint systems have achieved high performance. These patterns containing rich features including orientation field, minutiae points and pores are unique for everyone. Even identical twins sharing the same DNA also have different fingerprints. The other advantage of fingerprint recognition is that fingerprint scanners are inexpensive and small, which can be embedded in laptops, mobile phones and personal digital assistants. Fingerprints are selected for many large-scale human identity management projects including the US-visit program and the Hong Kong identity card. Although fingerprint recognition has many advantages, it is still not perfect. A small portion of the population cannot provide clear fingerprint images due to aging and genetic problems.



Figure 1.4: Fingerprint

- **Iris**, the color pattern in eyes bounded by pupil and limbus, is a highly informative biometric trait. This pattern is unique and stable in whole lifetime. Current iris recognition systems can support real-time large-scale identification up to million records and capture iris images up to 3m.



Figure 1.5: Iris

- **Hand geometry** systems recognize a person based on the measurements taken from a user's hand such as width and length of fingers and size of palms. Hand geometry is a widely acceptable and robust biometric. It is commonly applied to access control. Nevertheless, the geometric features have only limited information so it is suitable only for verification, 1-to-1 comparisons. The size of the capture device is another problem limiting its applications.

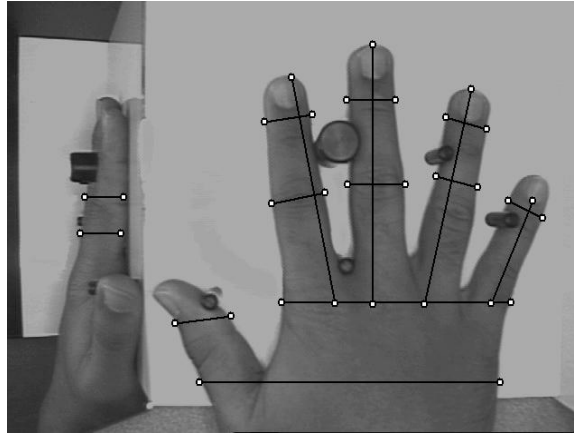


Figure 1.6: Hand Geometry

- **Palmprint**, the inner surface of palms, has rich features including principal lines, wrinkles, minutiae points, singular points and texture. These features can be used for uniquely identifying a person. Currently, there are two types of palmprint research, high resolution approach and low resolution approach. High resolution approach is suitable for forensic applications while low resolution approach is suitable for commercial applications. The representational requirements of the palm are very small (9 bytes) which is an attractive feature for bandwidth and memory limited systems.

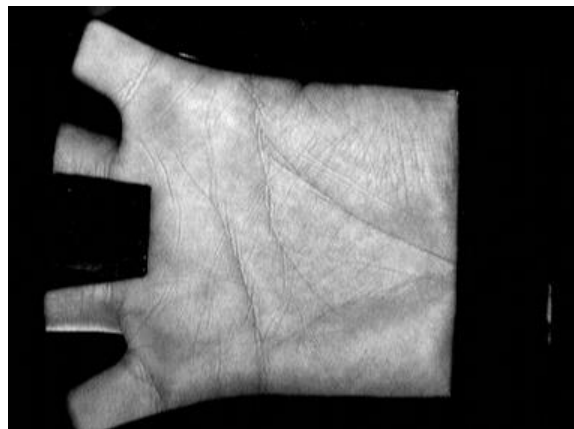


Figure 1.7: Palmprint

- **Signature**, a behavioral biometric, is widely accepted in governmental, legal and commercial transactions. Each person can have several signatures for different applications. Nevertheless, a signature cannot uniquely identify a person. Many factors can influence the consistency of signatures such as emotional and physical conditions.

Furthermore, professional forgers are capable of reproducing signatures to fool recognition systems.



Figure 1.8: Signature

- **Voice** regarded as a combination of behavioral and physiological biometrics is based on the size and shape of the appendages that generate sound. Voice recognition is commonly applied to phone-based applications and therefore, no extra input sensor is required. However, voice recognition faces several difficulties. Voice is neither distinctive nor stable. Current voice recognition systems cannot separate identical twins. Voice also changes due to medical condition, emotional state and aging.



Figure 1.9: Voice Pattern

- **Other biometrics** including gaits, lip prints, brain signals, ears, teeth, retinas, odor, keystrokes, heights, weights and genders have been proposed. They have different characteristics and different potential applications.

1.4 Design of Biometric System

A **biometric system** is essentially a pattern recognition system that operates by acquiring biometric data from an individual, extracting a feature set from the acquired data, and comparing this feature set against the template set in the database. Depending on the application context, a

biometric system may operate either in *verification* mode or *identification* mode as shown in figure 1.10.

- In the **verification mode**, the system validates a person's identity by comparing the captured biometric data with her own biometric template(s) stored system database. In such a system, an individual who desires to be recognized claims an identity, usually via a PIN (Personal Identification Number), a user name, a smart card, etc., and the system conducts a one – tone comparison to determine whether the claim is true or not. Identity verification is typically used for positive recognition, where the aim is to prevent multiple people from using the same identity.
- In the **identification mode**, the system recognizes an individual by searching the templates of all the users in the database for a match. Therefore, the system conducts a one – to - many comparison to establish an individual's identity (or fails if the subject is not enrolled in the system database) without the subject having to claim an identity (e.g., “*Whose biometric data is this?*”). Identification is a critical component in *negative recognition* applications where the system establishes whether the person is who she (implicitly or explicitly) denies to be. The purpose of negative recognition is to prevent a single person from using multiple identities. Identification may also be used in positive recognition for convenience (the user is not required to claim an identity). While traditional methods of personal recognition such as passwords, PINs, keys, and tokens may work for positive recognition, negative recognition can only established through biometrics [2].

There are three approaches to authentication. In order of least secure and least convenient to most secure and most convenient, they are:

- Something you **have** - card, token, key.
- Something you **know**- PIN, password.
- Something you **are** - a biometric.

They are often referred to as the *three pillars of authentication*. Any combination of these approaches further heightens security. Requiring all three for an application provides the highest form of security.

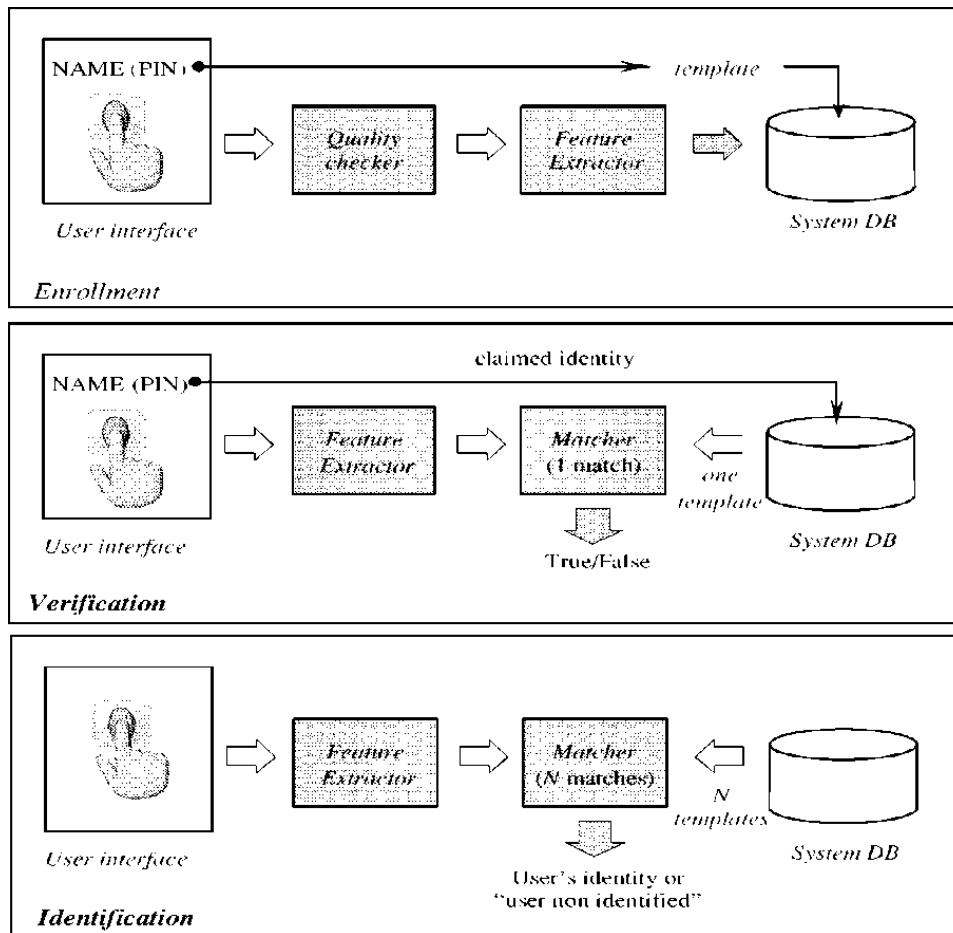


Figure 1.10: A Biometric System

Five objectives, cost, user acceptance and environment constraints, accuracy, computation speed and security should be considered when designing a biometric system. They are inter-related, as is shown in below Figure 1.11. Reducing accuracy can increase speed. Typical examples are hierarchical approaches. Reducing user acceptance can improve accuracy. For instance, users are required to provide more samples for training the system. Increasing cost can enhance security. More sensors can be embedded to collect different signals for liveness detection. In some applications, some environmental constraints such as memory usage, power consumption, size of templates, and size of devices have to be factored into a design. A biometric system installed in a PDA (personal digital assistant) requires low power and memory usage, but these requirements are not essential for access control. A practical biometric system should balance all these aspects.

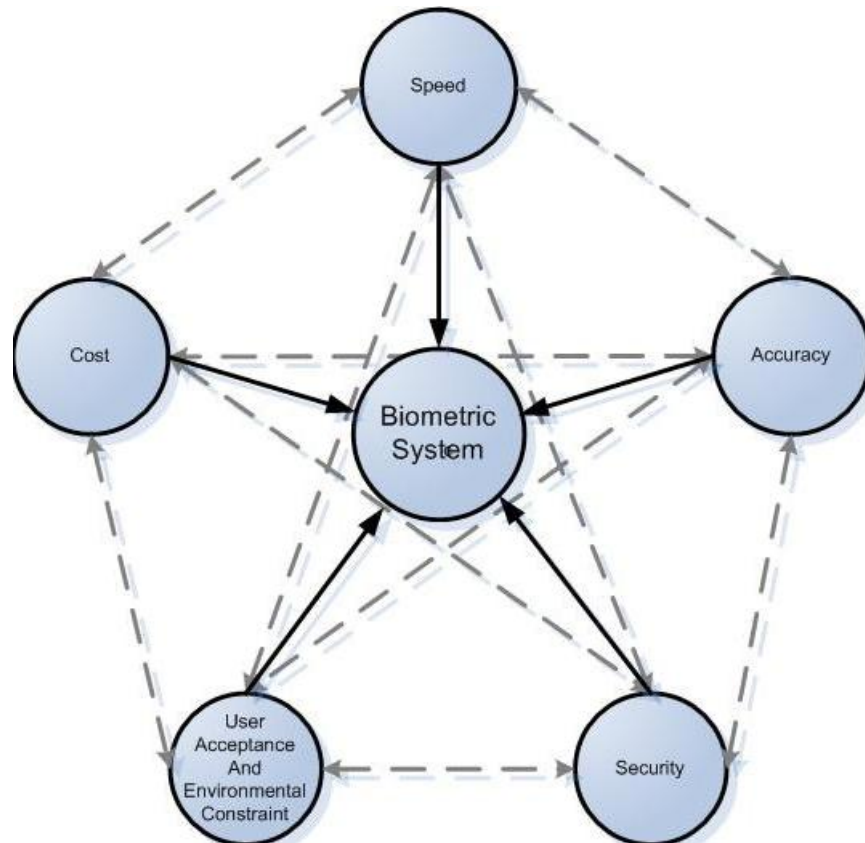


Figure 1.11: The inter relationships between different objectives for designing a biometric system

1.5 Applications

Biometrics has been used in different applications such as IT/Network Security, e-Commerce, Identification Systems, Access Control, Smart Cards etc. Specific skills and experience are required for different biometric applications - in many cases the biometric solution is a small part of the overall technology challenge. Requirements for accuracy, ease of use, response time, legacy integration, security, and privacy differ widely across these applications. Biometrics is a rapidly evolving technology that is being widely used in forensics, such as criminal identification and prison security, and that has the potential to be used in a large range of civilian application areas. Biometrics can be used to prevent unauthorized access to ATMs, cellular phones, smart cards, desktop PCs, workstations, and computer networks. It can be used during transactions conducted by telephone and Internet (electronic commerce and electronic banking). In automobiles, biometrics can replace keys with keyless entry devices. Following are the some applications of Biometrics:

- Driver's licenses, whereby drivers are expected to have multiple licenses or swapped licenses among themselves when crossing state lines or national borders.
- Canteen administration, particularly on campus where subsidized meals are available to bona fide students, a system that was being heavily abused in some areas.
- Benefit payment systems - In America, several states have saved significant amounts of money by implementing biometric verification procedures. The numbers of individuals claiming benefit has also dropped dramatically in the process, validating the systems as an effective deterrent against multiple claims.
- Border control - A notable example for this is the INSPASS trial in America where travelers were issued with a card enabling them to use the strategically based biometric terminals and bypass long immigration queues. There are other pilot systems operating elsewhere in this respect.
- Voting systems, where eligible politicians are required to verify their identity during a voting process. This is intended to stop 'proxy' voting where the vote may not go as expected.
- Junior school areas where problems are experienced with children being either molested or kidnapped.
- In addition there are numerous applications in gold and diamond mines, bullion warehouses and bank vaults as well as the more commonplace physical access control applications in industry.
- ATM machine use - Most of the leading banks are considering using biometrics for ATM machine and as a general means of combating card fraud.
- Workstation and network access
- Public identity cards
- Internet transactions
- Telephone transactions
- Gunlock - A miniature electronic fingerprint capture and verification device is being developed. When built into the authorized user of the gun would be able to fire it.
- Elections - This technology can also be integrated with voting procedure so that, the cases of fraud or bogus voting is reduced to minimal.

- Automated Border Control - This idea is covered in airport security and is very similar to that. This technology can also be implemented in railways.
- Synergistic with the border control application, is the idea of national identity card (probably a chip card) which would incorporate a biometric device.
- Using biometric enabled mouse the content of internet can also be limited for children.

1.6 Comparison of different Biometric Modalities

Each biometric technology has its strengths and limitations. No single biometrics is expected to effectively meet the needs of all the applications. A brief comparison of 10 different biometric techniques that are either widely used or under investigation, including face, fingerprint, hand geometry, palmprint, hand vein, iris, retinal pattern, voice, facial thermograms and DNA, is provided in Table 1.1. Although each of these biometric techniques, to a certain extent, possesses the above mentioned desirable properties and has been used in practical systems or has the potential to become a valid biometric technique, not many of them are acceptable (in court of law) as indisputable evidence of identity.

Table 1.1: Comparison of different Biometric modalities

	Universal ity	Distinctiven ess	Permanen ce	Collectabil ity	Perform ance	Acceptabi lity	Unspoofa bility
Fingerprint	M	H	H	M	H	M	M
Iris	H	H	H	M	H	L	H
Retina	H	H	M	L	H	L	H
Hand Geometry	M	M	M	H	M	M	M
Palmprint	M	H	H	M	H	M	M
Hand Vein	M	M	M	M	M	M	H
Voice	M	L	L	H	L	M	L
Face	H	L	M	H	L	H	L
Face Therm	H	H	L	H	M	H	H
DNA	H	H	H	L	H	L	H

*M= Medium, *H=High, *L=Low

Which biometrics should be used for a given application? The match between a biometrics and an application is determined depending upon the requirements of the given application, the characteristics of the application, and properties of the biometrics. In the context

of biometrics-based authentication systems, an application is characterized by the following properties: (i) Does the application need identification or authentication? The applications requiring an identification of a subject from a large database of identities need scalable and relatively more unique biometrics. (ii) Is it semi-automatic or completely automatic? An application may or may not afford a human operator at or near the biometric acquisition stage. In the applications deployed at remote locations with unfriendly or unsafe climate, for instance, the use of biometrics requiring operator assistance for the capture of physiological or behavioral measurement may not be feasible. (iii) Are the users habituated (or willing to be habituated) to the given biometrics? Performance of a biometrics-based system improves steadily as the subjects instinctively learn to give “good” biometric measurements. This is truer for some biometrics than others; e.g., it is more difficult to give bad retinal image than a fingerprint image. Some applications may tolerate the less effective learning phase of the application deployment for a longer time than others. (iv) Is the application covert or overt? Not all biometrics can be captured without the knowledge of the subject to be identified. Even the biometrics which could be captured without the knowledge of a subject may not be used in some countries due to privacy legislations. (v) Are the subjects cooperative or non-cooperative? Typically, applications involving non-cooperative subjects warrant the use of physiological biometrics which cannot be easily changed. For instance, it is easy to change one’s voice compared to changing one’s retinal vasculature. (vi) What are the storage requirement constraints? Different applications impose varying limits on the size of the internal representation for the chosen biometrics. (vii) How stringent are the performance requirement constraints? For example, applications demanding higher accuracies need more unique biometrics. (viii) What types of biometrics are acceptable to the users? Different biometrics are acceptable in applications deployed in different demographics depending on the cultural, ethical, social, religious, and hygienic standards of that society. The acceptability of a biometrics in an application is often a compromise between the sensitivity of a community to various perceptions/taboo and the value/convenience offered by a biometrics-based identification.

1.7 Problem Formulation

The Palmprint is the first defining characteristic and natural method to be used for recognition. Moreover, ease acceptance and non invasive nature as compared to other biometric

traits makes it a preferable trait to be used for authentication. So, we have chosen to develop a Palmprint recognition method. It is very much suitable with our limitations and resources. The aim of this thesis is to

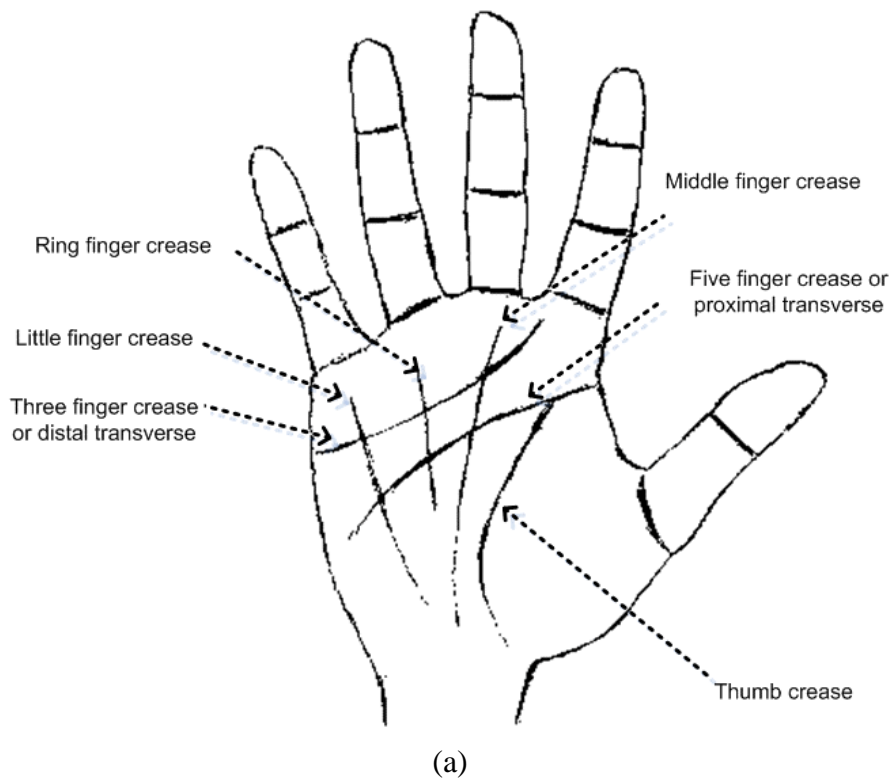
- i).** Study the different methods/ techniques of Palmprint recognition system.
- ii).** Study and implement the different pre processing techniques on a Palmprint image.
- iii).** Develop a Palmprint Authentication system using LabVIEW.
- iv).** Test the above developed authentication system for its validity using a standard database or database recorded in the laboratory.

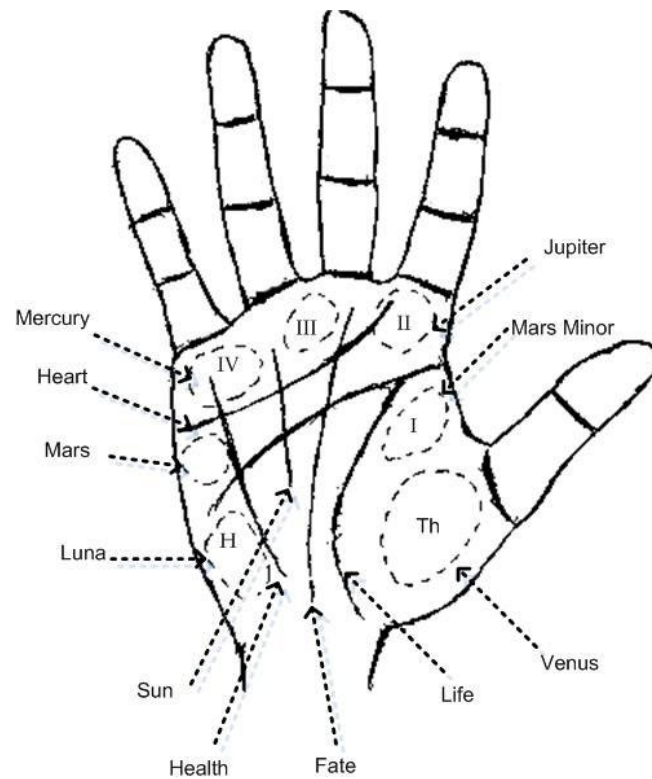
Chapter 2

Literature Survey of Palm Print Recognition

2.1 Introduction

The inner surface of our palm normally contains three flexion creases, secondary creases and ridges. The flexion and secondary creases are also called principal lines and wrinkles, respectively. The flexion creases and the main creases are formed between the 3rd and 5th months after conception [3] and petty lines appear after birth. These creases are not genetically settled. Even identical twins those are having the same DNA sequences have different palmprints [4]. These complex patterns have rich information for personal authentication. Human beings were interested in the palm lines for fortune telling long time ago. Scientists and fortunetellers name the lines and the regions differently, as shown in Figure 2.1 [5].

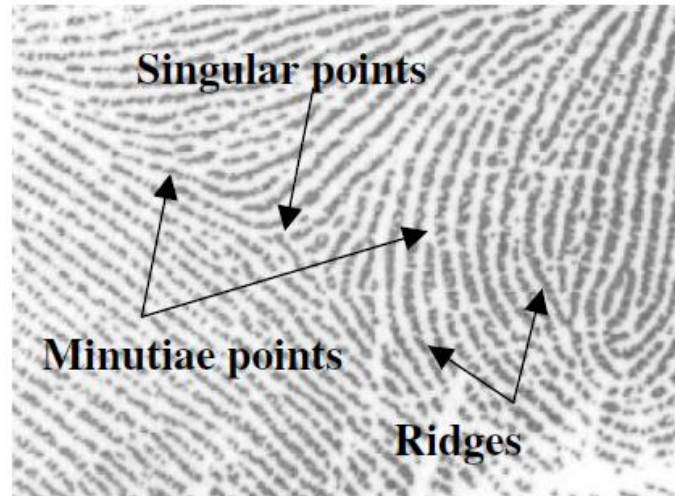




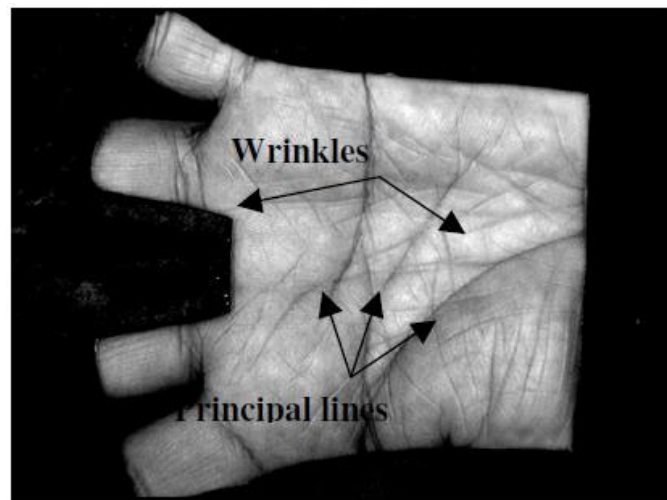
(b)

Figure 2.1: Definitions of palm lines and regions (a) from scientists and (b) from fortune-tellers.

There are two types of palmprint recognition research, high resolution and low resolution approaches. High resolution approach is suitable for forensic applications such as criminal investigation [6], while low resolution is more suitable for civil and commercial applications such as access control. Generally speaking, high resolution refers to 400 dpi or more and low resolution refers to 150 dpi or less. Figure 2.2 illustrates a part of a high resolution palmprint image and a low resolution palmprint image. In high resolution images, researchers extract ridges, singular points and minutia points as features while in low resolution images, they generally use principal lines, wrinkles and texture. At the beginning of palmprint research, the high-resolution approach was the focus [7-8] but almost all current research is focused on the low resolution approach because of the potential applications. In this chapter, low resolution approach has been concerned since it is the current approach.



(a)



(b)

Figure 2.2: Palmprint features in (a) a high resolution image and (b) a low resolution image

2.2 Current Approach

2.2.1 Overview

A palmprint recognition system generally consists of four modules: palmprint scanner, preprocessing, feature extraction and matcher. Palmprint scanner is used to collect palmprint images. Preprocessing is to setup a coordinate system to align palmprint images and to segment a part of palmprint image for feature extraction. Feature extraction step is used to obtain effective features from the preprocessed palmprint images. Finally, a matcher compares two palmprint features.

2.2.2 Palmprint Scanners

Different types of sensors have been used by the researchers to collect palmprint images like CCD-based palmprint scanners, digital cameras, digital scanners, video cameras etc. So far, only two research teams have CCD based palmprint scanners [9-10]. Figure 2.3 shows a CCD-based palmprint scanner developed by the Hong Kong Polytechnic University and Figure 2.4 shows a digital scanner developed by HP. Generally speaking, CCD-based palmprint scanners capture high quality palmprint images and align palms accurately since the scanners have pegs for guiding placement of hands. Digital scanners are cost-effective to collect palmprint images. However, they cannot support real time verification because of the scanning time. Digital cameras and video cameras are two other ways to collect palmprint images without contact. Figure 2.5(a) is a palmprint image collected by a CCD-based palmprint scanner and Figure 2.5(b) is a palmprint image collected by a digital scanner.



Figure 2.3: A CCD-based palmprint scanner



Figure 2.4: A digital scanner



(a)



(b)

Figure 2.5: Two palmprints collected by (a) a CCD-based palmprint scanner, and (b) a digital scanner

2.2.3 Preprocessing

Preprocessing is used to align different palmprint images and to segment the central parts for feature extraction. Most of the preprocessing algorithms use the key points between fingers to set up a coordinate system. Preprocessing involves generally five common steps, 1) Binarizing the palm images, 2) extracting the shape of hand and/or fingers, 3) detecting the key points, 4) establishing a coordination system and 5) extracting the central parts. The first and second steps in all the preprocessing algorithms are similar. However, the third step has several different implementations including tangent-based [9], wavelet-based [11], bisector-based [12, 13] etc. to detect the key points between fingers. Furthermore, Han detects points in the middle of fingers and constructs lines passing through fingertips and the points to setup a coordinate system [9]. All these approaches utilize only the information on the boundaries of fingers, while Kumar et al. propose to use all information in palms [14]. They fit an ellipse to a binary palmprint image. According to the orientation of the ellipse, a coordinate system is established. After obtaining the coordinate systems, central parts of palmprints are segmented. Most of the preprocessing algorithms segment square regions for feature extraction, but some of them segment circular [15] and half elliptical regions [16].

Image preprocessing is usually the, first and essential step in pattern recognition. In order to recognize a palm, four steps are devised in the pre-processing module. Image

thresholding, border tracing, wavelet-based segmentation, and ROI location are sequentially executed to obtain a square region which possesses the palm-print data. In the following contexts, all the details of each step have been presented.

Step 1: Image thresholding. The hand images of 256 gray levels are acquired from a platform scanner as shown in Figure 2.5(b). The image-thresholding operation is to Binarized the gray images to obtain the binary hand-shape images.

In this step, the histogram of gray images is analyzed to determine a threshold value. This value is automatically set at the local minimal value between 50 and 100. Since the capturing environment is stable and controlled, the threshold value is conveniently fixed in the experiments. Thus, the Binarized image can be obtained as shown in Figure 2.6.



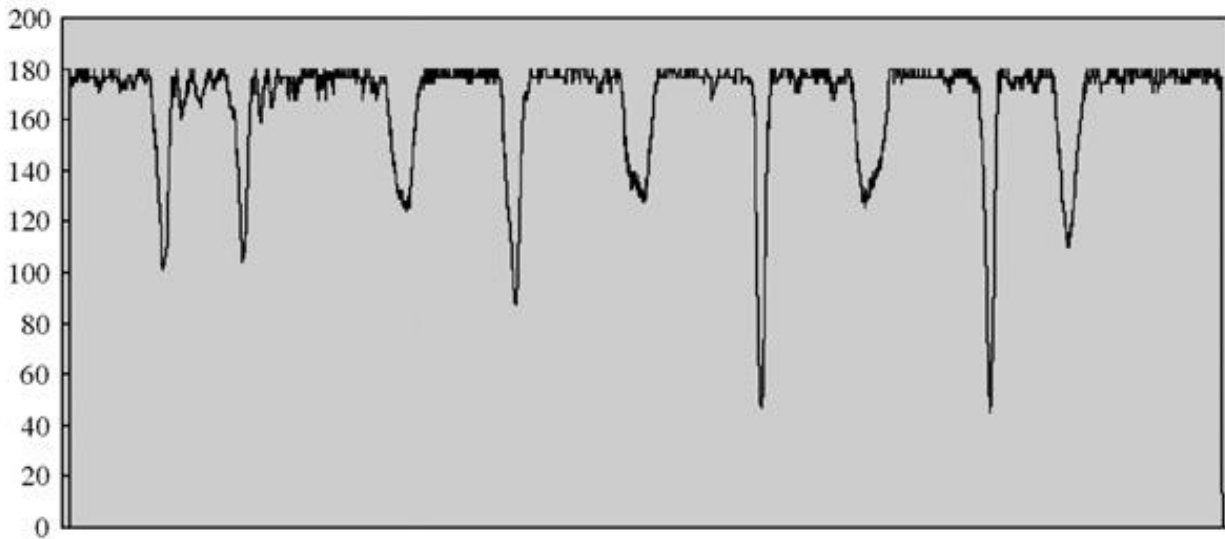
Figure 2.6: Binarized Image

Step 2: Border tracing. After the image-thresholding step, the binary images are traced to obtain the contours of hand shape by making use of the border tracing algorithm. The main purpose of this step is to find the boundary of a hand image and then locate the positions of five fingers for the determination of palm contour. A square region in the palm called ROI will be generated. At the beginning, the first point of hand shape is set at the upper-left point of a hand-shape image. The contour of hand shape is then traced in counterclockwise direction. The details of border tracing algorithm can be found in Ref. [17].

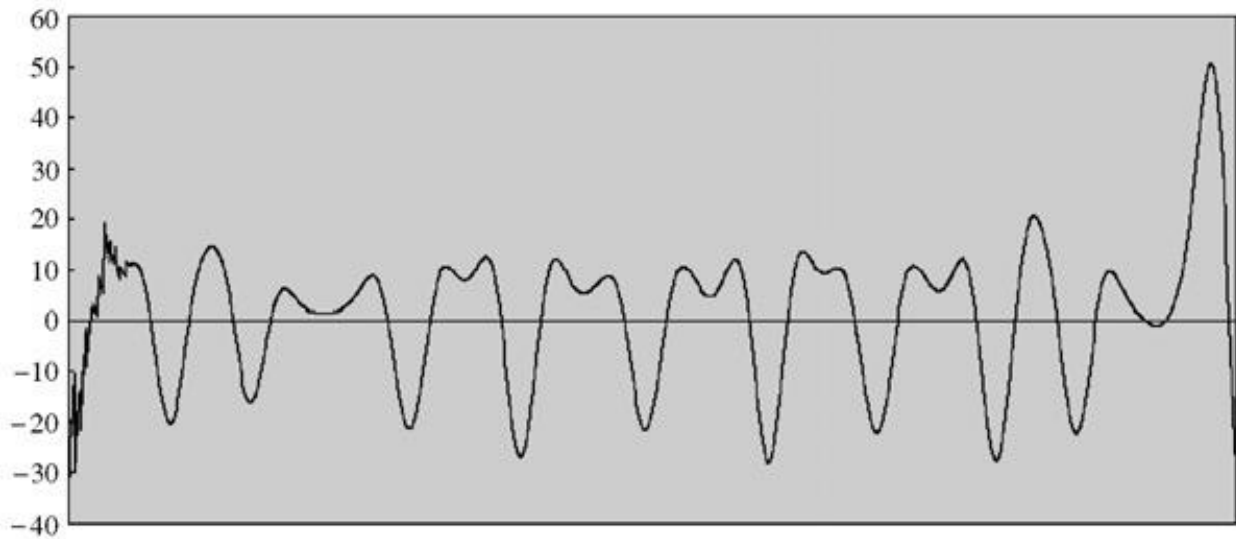
Step 3: Wavelet-based segmentation. In the previous step, the border pixels of hand shape are sequentially traced and represented by a set of coordinates $(x_i, y_i); i = 1, 2, \dots$ in this step, the wavelet-based segmentation technique is adopted to find the locations of five finger tips and four finger roots. As is known, these points are located at the corner of hand shape. According to the definition for corner, the corners should be located at the points with a high curvature or at the points whose curvature is local minimal. First, the set of coordinates is transformed into the profile of curvature as depicted in Figure 2.7(a). The profile of curvature is then transformed to multi-resolutional signals of low- and high-frequency sub-bands. Since the crucial points P_α, P_β and P_3 of corner points (see Figure 2.8(a)) determine the ROI location in the palm image, it is very important to explicitly locate the corner points of hand-shape. The wavelet transform can provide stable and effective segmented results in corner detection. Here, the transformed signals of high-frequency sub-band are depicted in Figure 2.7(b). From these signals, the corners are labeled at the local minimal points of negative magnitude which can be located between two zero-crossing points. The detected corner points are illustrated in Figure 2.8(a)

Step 4: ROI generation. In this step, we will find the region of interest (abbreviated as ROI) in the palm image which is the operating region both in the enrollment and verification processes. In acquiring the hand-images, the hands were freely put on the plate-form scanner at any position and in any direction. Fortunately, when users put their hand on the input devices in normal condition, the direction of a hand is consistent with the principal axis which is the center line of middle finger. According to the result generated in Step 3, the location of ROI is determined from points P_α, P_β, P_3 and the geometrical formula. Two points P_α and P_β are the base points to generate the ROI. First, the middle point P_o is calculated from points P_α and P_β . Then, the principal axis P_o, P_3 is obtained which is the center line of middle finger perpendicular to line P_α, P_β . The principal axis P_o, P_3 is then extended to point P_ϵ where $|P_o P_\epsilon| = |P_\alpha P_\beta|$. From point P_ϵ , the two perpendicular bisector lines denoted as $P_\epsilon P_{\epsilon 2}$ and $P_\epsilon P_{\epsilon 1}$, whose length equals 128 pixels, are found. Based on this section line $P_{\epsilon 1} P_{\epsilon 2}$, the square region $P_{\epsilon 1} P_{\epsilon 2} P_{\epsilon 3} P_{\epsilon 4}$ of size

256 by 256 is defined as the ROI, as shown in Figure 2.8(a). From these four points, the image of ROI is cut from the hand image as shown in Figure 2.8(b).



(a)



(b)

Figure 2.7: (a) The profile of curvature of hand shape; (b) the transformed profile of high-frequency sub band.

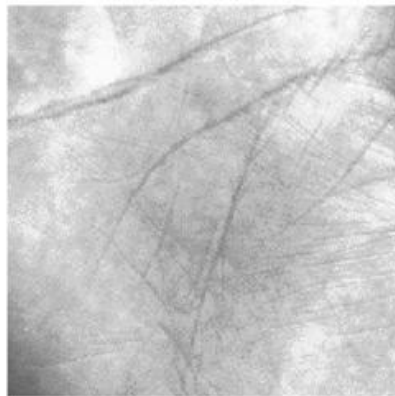
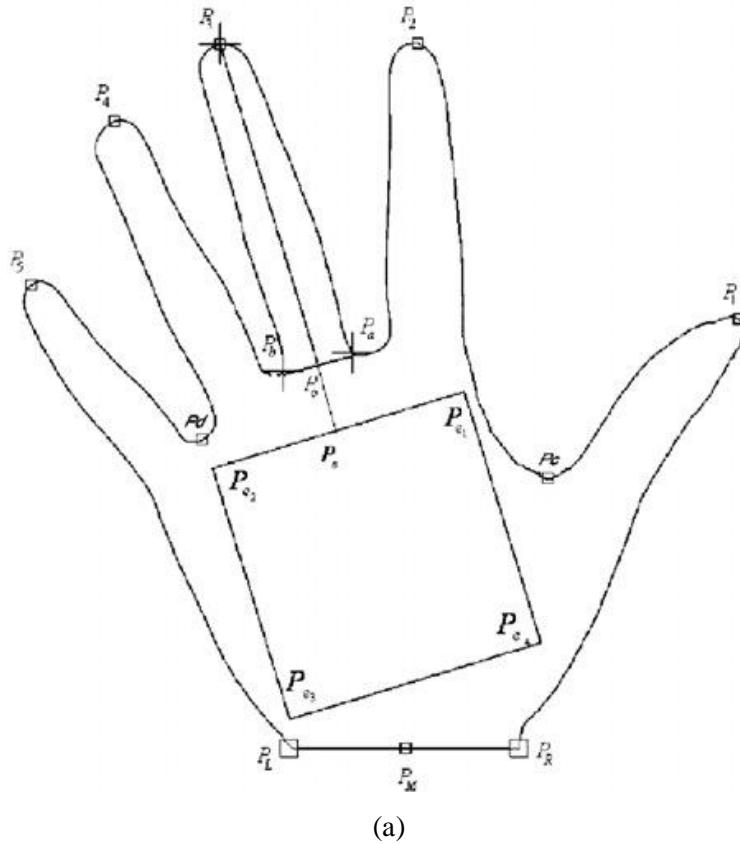


Figure 2.8: Illustration of preprocessing. (a) the key points based on finger boundary and (b) the central parts for feature extraction.

2.2.4 Feature Extraction and Matching

Comparing with image collection and preprocessing, the research of feature extraction and matching is more diverse. Feature extraction algorithms can be classified

into five categories, line-based, subspace based, local statistical-based, global statistical-based and coding-based approaches. However, some of them cannot be classified.

2.2.4.1 Line-Based Approach

Palm lines are obvious features in palmprints. Researchers employ existing edge detection methods and develop edge detectors to extract the palm lines [18, 19, 20-21]. The extracted palm lines are either matched directly or represented in other formats for effective matching. Although at the beginning of palmprint research, some researchers concentrate on line-based approach, it is not the focus of current palmprint research since it is difficult to accurately extract palm lines from low-resolution palmprint images.

There are a number of distinguishable features of the human hand. These features are the size and form of the lines on the palm, the lengths of the fingers in proportion to the palm, the length and mobility of the thumb, the hollowness of the palm, the spread of the digits and the general size and shape of the hand. In particular, the lines on a person's hand, *the palm print*, are unique to every individual; even our own two hands are never quite alike [22]. There are a number of attributes which make the lines on a person's hand distinguishable from the lines on another. These include: color, clarity, length, position within the palm, continuity and variations in thickness [23, 24].

The starting point of the proposed palm identification system is to extract the main lines of the palm from gray scale images. While the major lines on the palm, known as the life line, head line, and the heart line are the primary target for identification, any significant lines will be used by the system. These lines are then detected (using Hough transform). The lengths of the detected lines as well as the angles between them are then calculated and recorded. In the learning phase of the system, the above information is gathered from authorized users of the system. In the identification phase, images of the palms of all persons wishing to use the system (legitimate and possibly unauthorized) are captured and processed the same way. The extracted lines' lengths and inter-angles are compared with those in the data base of the system. Persons with recognized palms are accepted by the system otherwise they are rejected.

2.2.4.2 Subspace-Based Approach

Subspace-based approach involves generally in principal component analysis (PCA), linear discriminant analysis (LDA) and independent component analysis (ICA) [25, 26, 27-28]. The subspace coefficients are considered as features. Various distance measures and classifiers are used to compare the features. In addition to applying PCA, LDA and ICA directly to palmprint images, researchers embed wavelets, discrete cosine transform (DCT) and kernels in their methods [29]. A comprehensive comparison can be found in [25]. Researchers also develop new subspace algorithms and examine them on palmprints [30-31]. Generally speaking, subspace-based approach does not make use of any prior knowledge of palmprints.

2.2.4.3 Statistical Approach

Statistical approach can be further divided into local and global statistical approaches. Local statistical approach transforms images into another domain and then divides the transformed images into small regions [32-33]. Local statistics such as means and variances of each small region are calculated and regarded as features. Gabor filters, wavelets and Fourier transforms have been examined. The small regions are commonly square but some of them are elliptical and circular [34]. According to the collected papers, so far, no one investigates high order statistics for this approach. In addition to local statistics, researchers also use global statistics, which are computed from whole transformed images [35, 36]. Moments, centers of gravity and densities are considered as the global statistical features.

$$\begin{matrix} -1 & -2 & -4 & -2 & -1 \\ 0 & 0 & 0 & 0 & 0 \\ 2 & 4 & 8 & 4 & 2 \\ 0 & 0 & 0 & 0 & 0 \\ -1 & -2 & -4 & -2 & -1 \end{matrix}$$

(a)

-1	0	2	0	-1
-2	0	4	0	-2
-4	0	8	0	-4
-2	0	4	0	-2
-1	0	2	0	-1

(b)

0	-1	-4	0	2
-1	-6	0	8	0
-4	0	12	0	-4
0	8	0	-6	-1
2	0	-4	-1	0

(c)

2	0	-4	-1	0
0	8	0	-6	-1
-4	0	12	0	-4
-1	-6	0	8	0
0	-1	-4	0	2

(d)

Figure 2.9: Four kinds of “tuned masks” for global palmprint texture extraction. (a) Horizontal line. (b) Vertical line. (c) 45° line. (d) -45° line.

2.2.4.4 Coding Approach

Coding approach encodes filter responses as features [37, 38]. Gabor filters, Sobel filters are commonly applied in this approach. Phase [37, 38] and orientation [39] features have been encoded. The encoding process is to construct a bitwise representation for high speed matching. The high speed matching is performed by bitwise hamming distance or bitwise angular distance . These two bitwise distances are equivalent [40]. Although Wu et al. use the term, *code* to describe their methods,

2.2.4.5 Other Approaches

In addition to the previous approaches, some algorithms are difficult to be classified [9, 41]. These algorithms combine several image-processing methods to extract palmprint features and employ standard classifiers such as neural networks to make the final decision. In addition, Kumar and his coworkers apply correlation filter for palmprint recognition [42].

2.2.4.6 Matching

Many existing classifiers including neural networks [10,Figure 2.10], hidden Markov models and correlation filters [42] and various measures including cosine measure, weight Euclidean distance, Euclidean distance and hamming distance have been examined. Only limited researchers try to develop special distances or classifiers for palmprint recognition. Bitwise angular distance may be the only one.

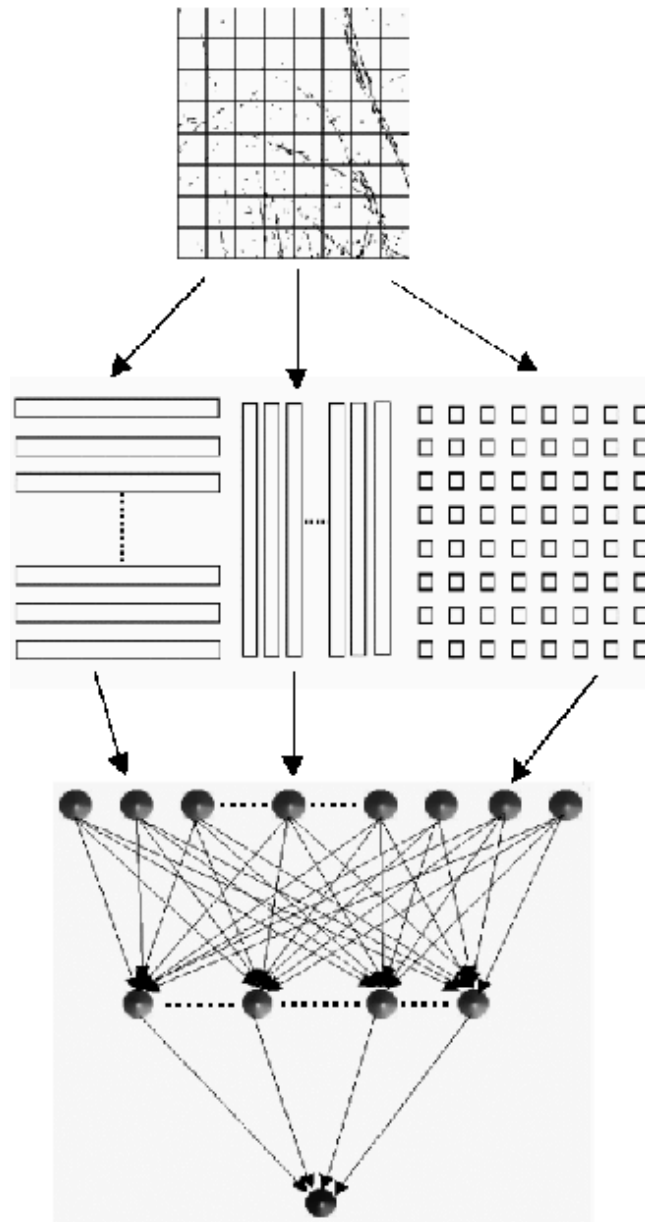


Fig 2.10: The mechanism of backpropagation neural network

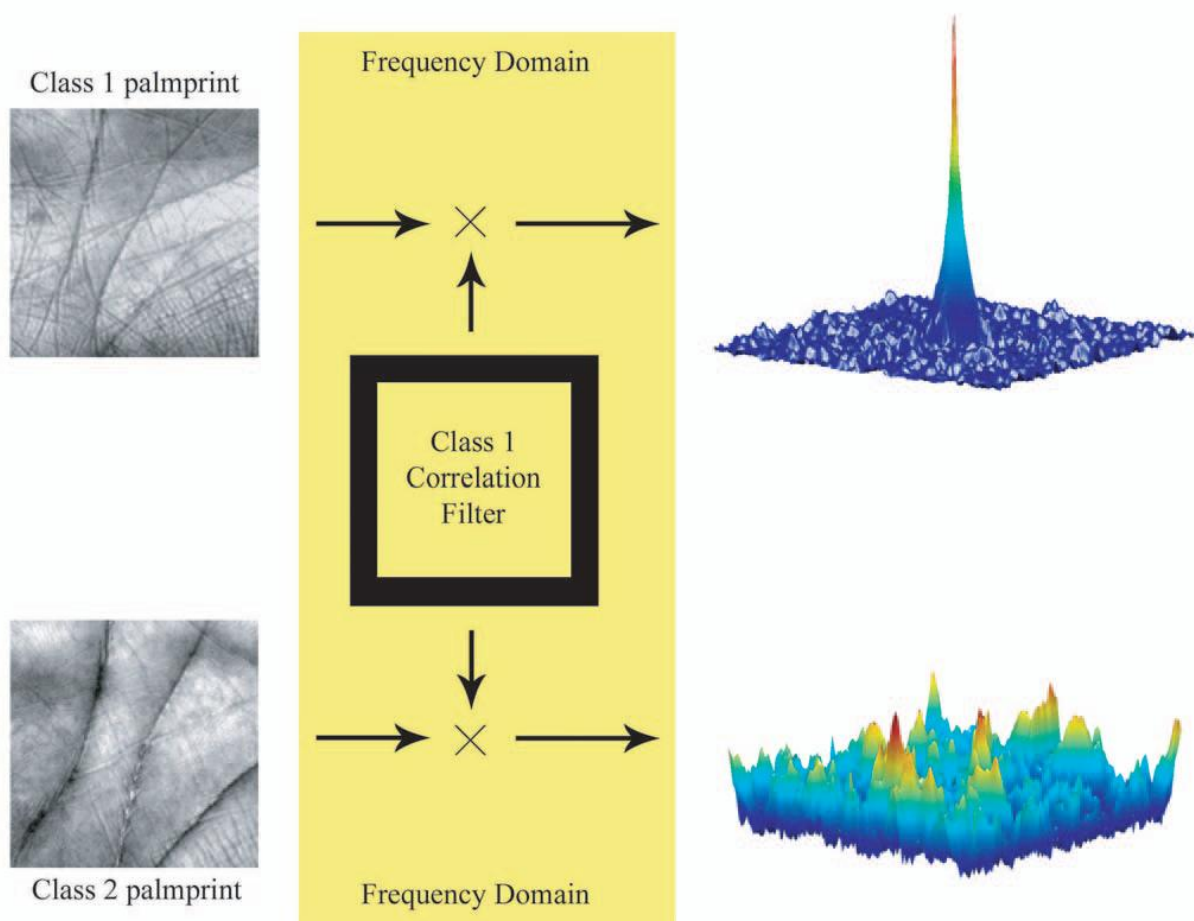


Fig. 2.11: Applying an advanced correlation filter. The palmprint on top is an authentic exemplar, and when filtered with the correlation filter of its class, yields a sharp peak. In contrast, the palmprint below belongs to an imposter, and it yields a plane with lower energy and no unique apparent peak

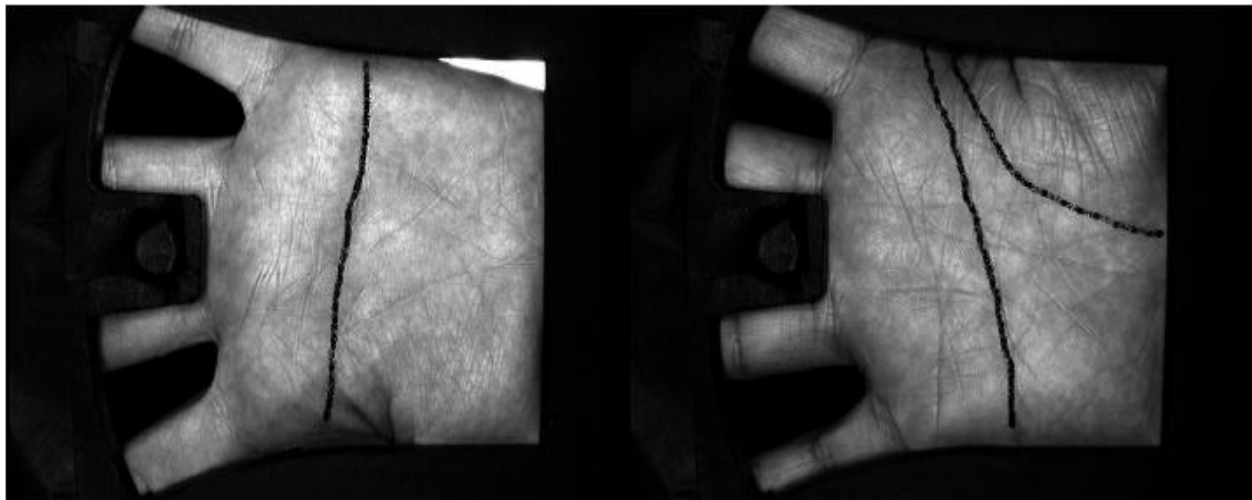
2.2.5 Identification in Large Databases

Real-time identification in large databases is a more challenging problem. Three different approaches, hierarchy, classification and brute-force, have been proposed to solve this problem. Hierarchical approach employs simple but computationally effective features to retrieve a sub-set of the templates in a given database for further comparison [43]. Although hierarchical approach increases matching speed, it sacrifices accuracy. Target palmprints are possible to be removed by the classifiers using the simple features.

Classification is another approach to address this problem. Each palmprint in a given database is assigned to a class. Wu et al. define six classes based on number of

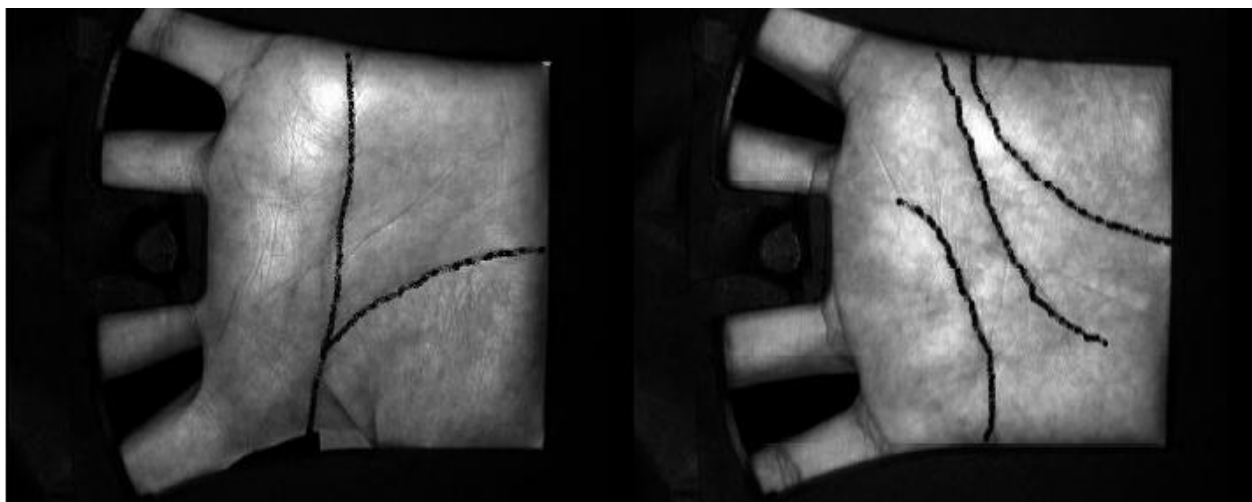
principal lines and number of their intersections. The six classes are illustrated in Figure 2.12. However, using their definitions and technique for identification is ineffective because the six classes are highly unbalanced e.g. about 80% of palmprints belonging category 5 shown in Figure 2.12(e) and their algorithm has high bin error of 4%.

The last one is brute-force approach. Brute-force approach uses one matching function to search entire databases. The advantage of this approach is to avoid introducing errors from the classification or hierarchical systems. The major challenge is to design the matching function and to identify effective features for this matching function. Daugman, has demonstrated that bitwise hamming distance can achieve this goal, real-time brute-force identification in large databases [44].



(a)

(b)



(c)

(d)



(e)

(f)

Figure 2.12: The six classes of palmprints defined by Wu et al. [45]

2.2.6 Security

Ratha and his coworkers demonstrate that biometric systems are vulnerable to many attacks including replay, database and brute-force attacks [32]. Comparing verification, fusion and identification, only limited works are related to palmprint security.

It has been analyzed that the probability of successfully using brute-force attack to break into a palmprint identification system [5] and propose cancellable palmprints for template re-issuance and template watermarking to defend replay attacks and database attacks. Sun et al. apply watermarking techniques to hid finger features in palmprint images for secure identification [40]. Connie et al. combine pseudo-random keys and palmprint features to generate cancellable palmprint representation [27] and claim that their method can achieve zero equal error rates. This result is based on an assumption that the pseudo-random keys are never lost or shared [6]. It is in fact an unrealistic assumption.

2.3 Other Issues Related to Palmprint Recognition

2.3.1 Performance Evaluation

Evaluating biometric systems is an important topic [46]. Some researchers report impressive results even using simple methods for palmprint recognition. For example, Wu et al. report an identification rate of 99.55% in a database with 3,000 images from 300 different palms based on LDA [12]; Lu et al. report an identification rate of 99.15% in a database with 3056 images from 382 palms based on PCA [13]. However, Jing et al. report identification rates of only 71.34% for PCA and 90.91% for LDA from a database with 3040 images from 190 palms]. It should be pointed out that Jing et al.'s implementations are slightly different from Wu et al.'s and Lu et al.'s implementations. However, it is not the major problem. The major performance differences are due to the difference in their evaluation schemes. Jing et al.'s database contains palmprints collected from two occasions, but Wu et al. and Lu et al. employ palmprints collected in the same occasion.

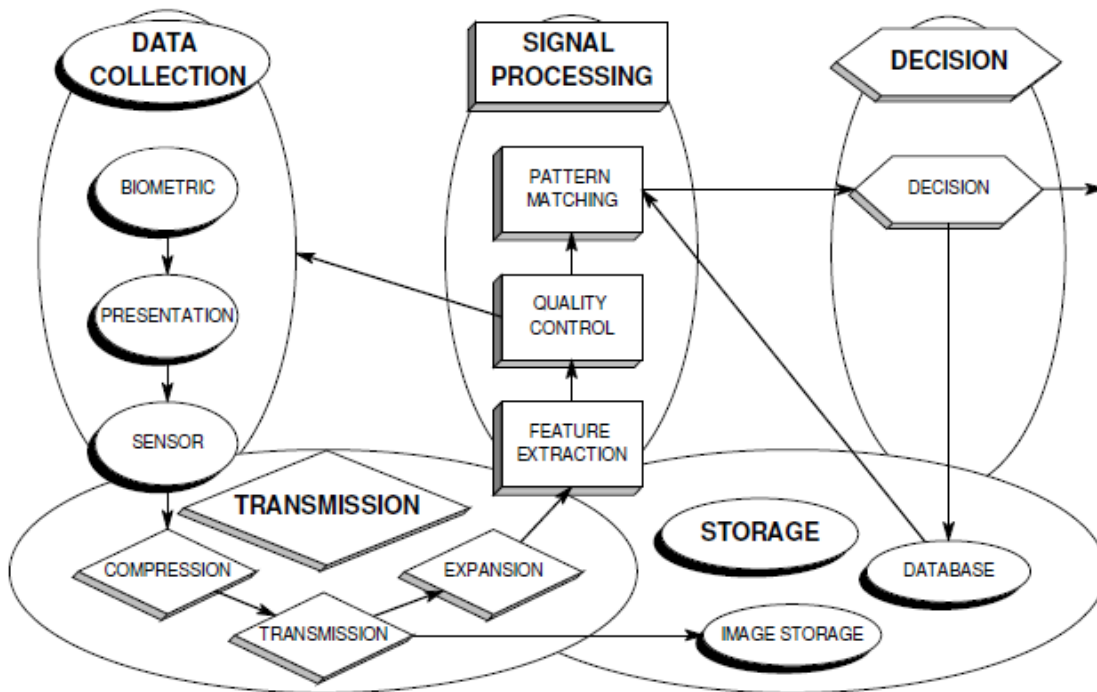
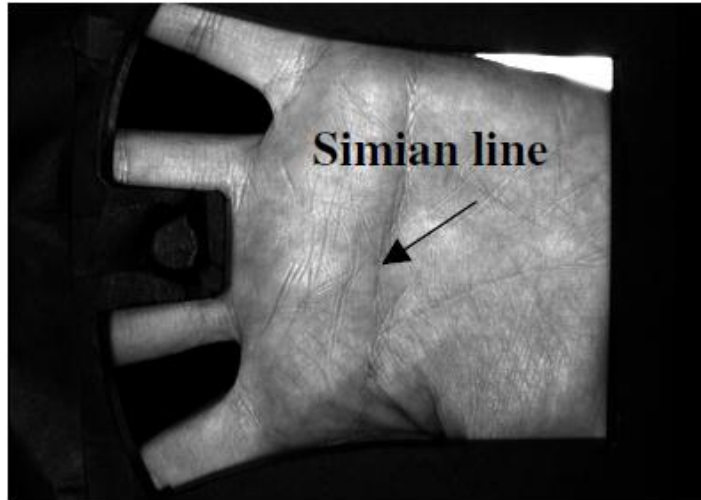


Figure 2.13: General biometrics system.

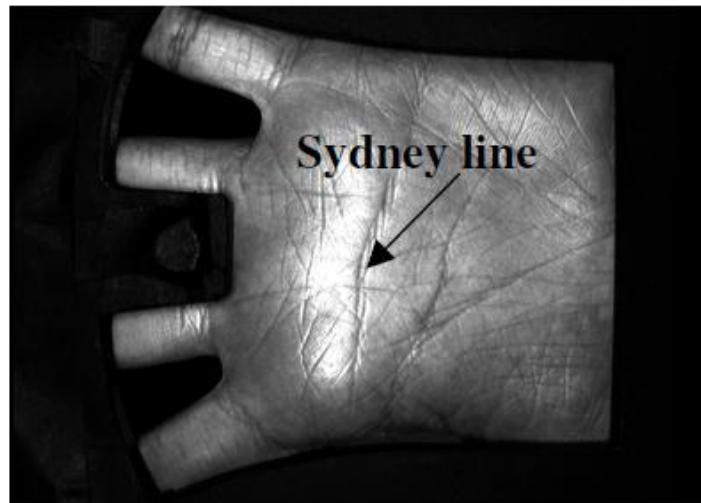
In actual applications, input palmprints and templates in a database are always collected at different occasions. For reliable performance evaluation, palmprint systems should be examined by palmprints collected from different occasions. Moreover, potential imposters would not provide their palmprints to train the systems in actual applications, so palmprints for training the systems and for evaluation should be collected from different palms. Gibbons et al. demonstrate that the performance of open systems trained by imposter's biometrics is overestimated [37]. Systems should also be examined by genetically identical palmprints since some features including the principal lines are genetically dependent [2]. The algorithms highly relying on the principal lines may not be able to classify genetically identical palmprints [14].

2.3.2 Privacy

Biometric traits contain information not only for personal identification but also for other applications. For example, deoxyribonucleic acid (DNA) is useful for diagnosing genetic problems and diabetes, respectively. Palmprints are also related to some genetic disorders. Most of the previous medical research concentrates on the abnormal flexion creases, Simian line and Sydney line shown in Figure 2.14 [47]. These abnormal palm lines always associate with Down syndrome, Aarskog syndrome, Cohen syndrome and fetal alcohol syndrome [68] but about 3% of normal population has abnormal flexion creases. Medical researchers also discover the association between density of secondary creases and schizophrenia [36]. To protect our private information in palmprints, databases have to store encrypted templates only since the line features are possible to be reconstructed from raw templates. Both traditional encryption techniques and cancellable biometrics can be used for encryption. The difference between these two approaches is that cancellable biometrics performs matching in transform domains while traditional encryption techniques require decryption before matching. In other words, decryption is not necessary for cancellable biometrics. When matching speed is an issue, e.g. identification in a large database, cancellable biometrics is more suitable for hiding the privacy information.



(a)



(b)

Figure 2.14: Abnormal palmprints.(a) simian line (b) Sydney line

Chapter 3

Palm Print Verification

3.1 Introduction

In the present day of automated world, machine is replacing the human in every aspect of life. Due to this, the security concern regarding the authenticity of the user goes on increasing. Hence, it becomes necessary to include some constrains in order to reject imposters and allow only the authorized user to access automated services. Traditional methods of PIN or password are not reliable enough to the security requirement of electronic transactions because some other unauthorized person can steal the account number and the password and the system will give the access to that unauthorized person [1]. The most reliable method is to use the characteristics of the user such as palm print, speech, fingerprint etc. The Palm print is the simplest, natural, easily acceptable way for the user recognition.

Palm print is a relatively new biometric trait which is used now a days very frequently for user authentication. Palm print textures like principle lines, wrinkles and ridges contain discriminative information which can be extracted for verification purpose. In this chapter a new Palm print verification system developed by using Laboratory Virtual Instrumentation Workbench (LabVIEW) has been discussed. The availability of datalog files in LabVIEW makes it one of the most promising candidate for its usage as a database. Datalog files can access and manipulate data and complex data structures quickly and easily. It makes writing and reading much faster. The system developed in LabVIEW detects the user in almost real time with a higher accuracy and having higher repeatability.

Palm print, the inner surface of our palm normally contains three flexion creases, secondary creases and ridges. The flexion and secondary creases are also called principal lines. These non-genetically complex patterns have rich information for personal identification. Finger prints can be stolen easily because one touches the objects directly with their fingers, so this is not a reliable one. Palm Print is more difficult to be stolen, as large part of the palm print area would not be left behind even when people are holding glasses

In this chapter we also emphasized on the alignment method of the palm image. Two different filters, Gauss and Sobel, have been used for feature extraction purpose. A feature vector has been created and matched.

3.2 Palm Database

The proposed methodology is tested on a modest sized database containing palm images from 14 individuals. All the users are Indians. Most of them are students and lecturers from Technical University. All the users are requested to give fifty palm prints of their right hand with the different placement of their hands to different angles and hence we get 700 palm prints database. These palm prints are first cropped to remove the unnecessary portions such as the wrist. The ROI's are extracted from every image with the help of the ROI extraction algorithm written in LabVIEW.

3.3 Hardware Requirement

In this experiment, a standard PC with Intel Pentium 4 processor (1.8 GHz) and 2048 MB random access memories is used. Input device is the Hewlett–Packard ScanJet 3500c optical scanner. Resolution of 150 dpi, with color output type in 256 RGB (8 bits-per channel) format is adopted when the hand images are scanned. The original size of the hand image is about 640×480 pixels but consequently, only the region of interest (ROI) of the image will be extracted and resized to 200 × 200 pixels.

3.4 Proposed Verification System

In the present work the proposed algorithm has been developed using the LabVIEW (Laboratory Virtual Instrument Engineering Workbench) 6i software. The proposed verification algorithm consists of two steps:

- i) Enrollment
- ii) Authentication (verification).

In the enrollment process new users are enrolled in the system. Each user has to enter one's name, password and his/her biometric information i.e. the palmprint. The flow chart of enrollment type module is shown in Figure 3.1.

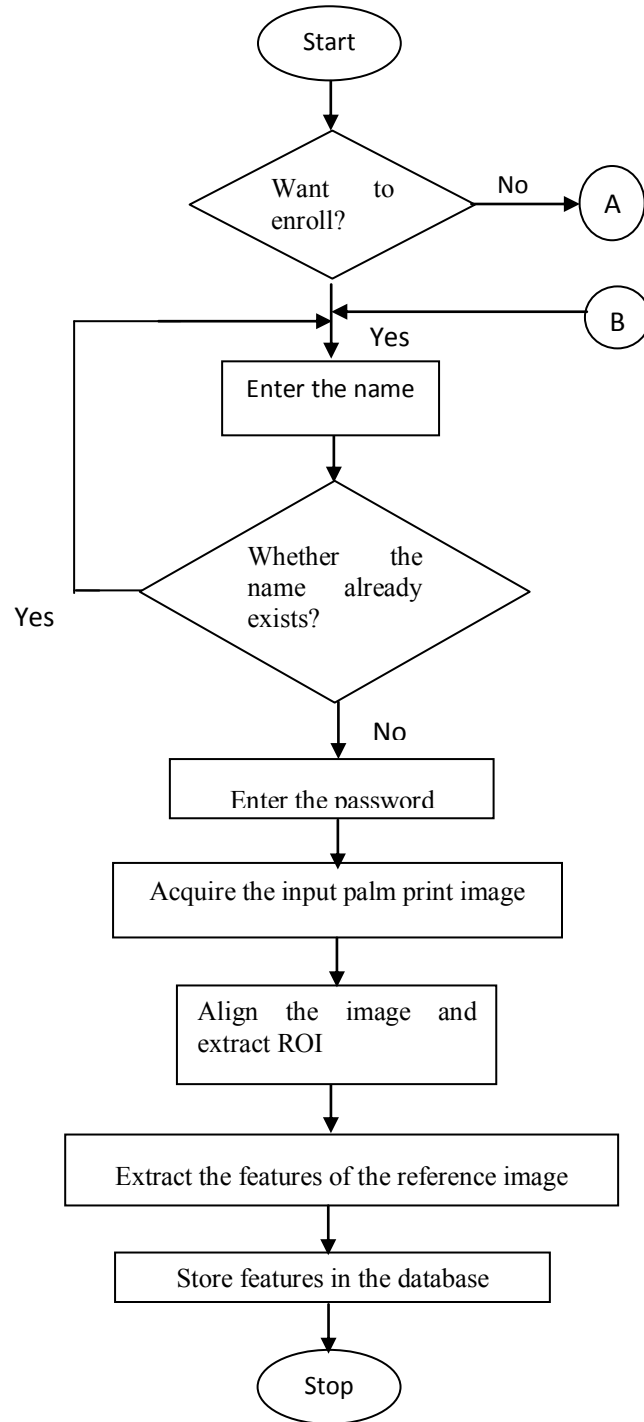


Figure 3.1 Flowchart of enrollment process

For the enrollment of the user a data record is to be maintained in the database containing the name and the password of the user. If simple text files are used the name and password get stored together as a single string. Using LabVIEW data log files [11] (which are exclusively available in LabVIEW to maintain data base of records) the information regarding the user is stored in the form of clusters. Data log files makes writing and reading much faster. It also simplifies data retrieval because the original blocks of data can be read as a record without having to read all records that precede it in the file. Random access is fast and easy with Datalog files because all it needs is to access the record as the record number. This module is designed in such a way that no two users should be of the same name although any user can have any password. Next step is to store the reference biometric information of the concerned person. The various steps required for extract and store the useful information are:

- a) Capturing the Image
- b) ROI (Region of Interest) extraction
- c) Filtering and feature extraction
- d) Feature matching and validation.

3.5 Image Acquisition

The image has been captured using a digital HP scanner under less than ambient illumination conditions. The flap of the scanner had been kept open during the acquisition process in order to obtain a uniform black background. Subjects had been asked to place their right hand on the scanner table in such a way that the fingers should not touch each other.

Image configuration has been done with the help of Imaq create subvi of LabVIEW. The configuration of the image means selecting the image type and border size (default is 3) of the image as per the requirement. Then Imaq file read subvi is use to read the file as shown in figure 3.2.

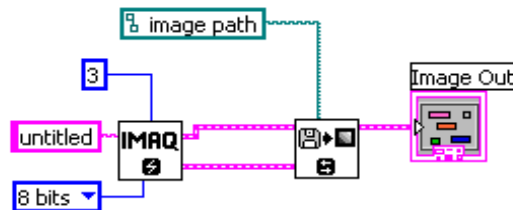


Figure 3.2: Image configuration

The outputs of the Imaq create subvi and Imaq read file subvi is shown in figure 3.3.



Figure 3.3: Palm image

3.6 Region of Interest

The selection and extraction of ROI is an important step in Palm print recognition. The ROI is selected in such a manner that it contains the maximum feature information and features can be easily extracted. Work has been done on the gray scale image so 8-bit type of image has been selected in the present case.

3.6.1 Image Alignment

In image processing applications the rotation and translation between the reference image and query image is a main issue. To sort out this issue the following new approach has been developed. The following steps have been performed to align the image.

i) Threshold the image with the help of Imaq threshold subvi as shown in figure 3.4. In this step the range to be thresholded is between 80 to 255.

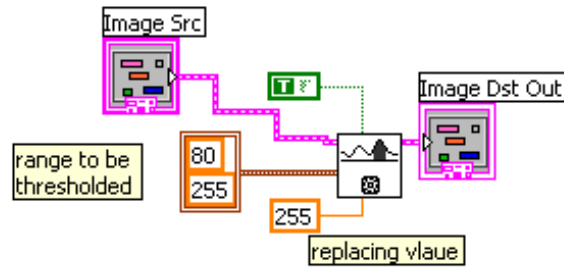


Figure 3.4: Image thresholding

The output image is shown in figure 3.5.



Figure 3.5: Thresholded image

ii) Now coordiantes of top point, vertex of image and lower left corner of the palm image has been found by following the steps below.

- (a) Start from the top left corner and search row wise for a value of 255. The first 255 value will indicate the coordinates of the top point which is the tip of the middle finger. This has been done with the help of search 1D array subvi as shown in figure 3.6.

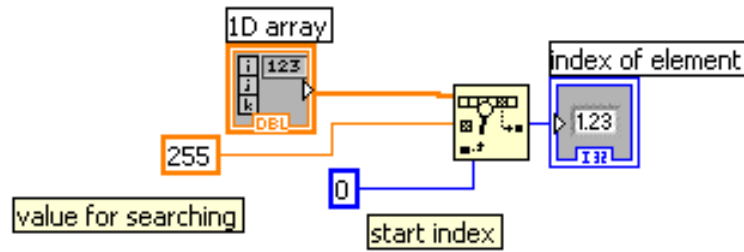


Figure 3.6: Search 1D array subvi

(b) Vertex of the image has been found by checking the last row of the figure 3.5. The coordinates of first 255 valued pixel has been noted. Similarly, the coordinates of last 255 valued pixel have been noted. The middle point of these points is the coordinate of the vertex.

(c) Lower left point of the whole image is the size of the image i.e. if the size of the image is 680 x 480, the coordinate of lower left point is (680,0).

The output of this procedure is shown in Figure 3.7. In this figure all the three point are shown.

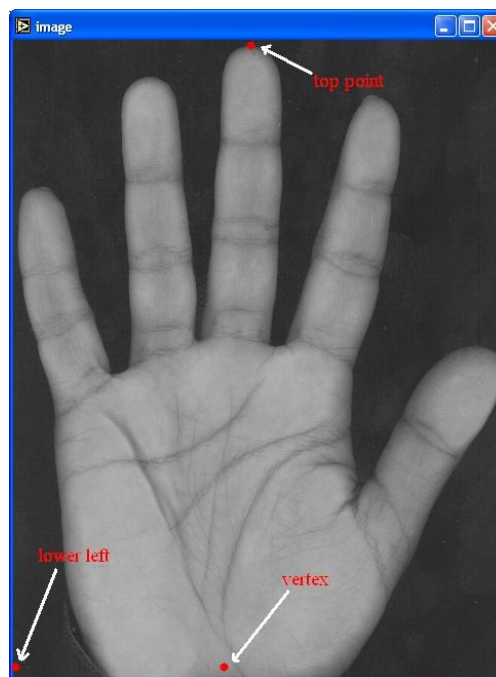
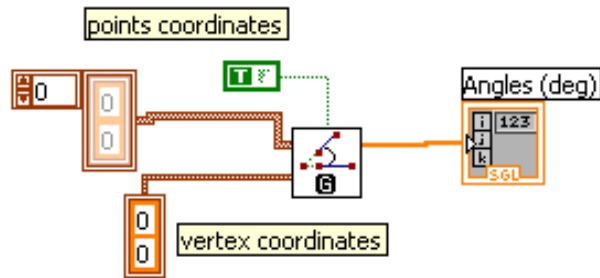
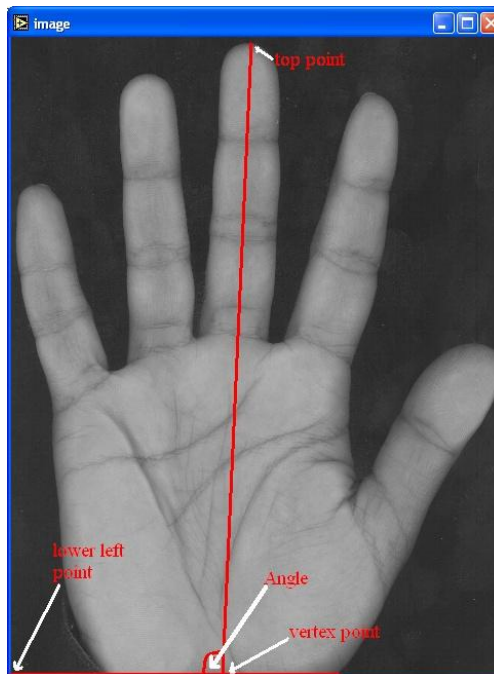


Figure 3.7: Points to find the angle

iii) After finding the above points (shown in figure 3.7), angles between these points has been calculated with the help of Imaq get angles subvi shown in figure 3.8(a). The angle between these points is shown in the figure 3.8(b).



(a)



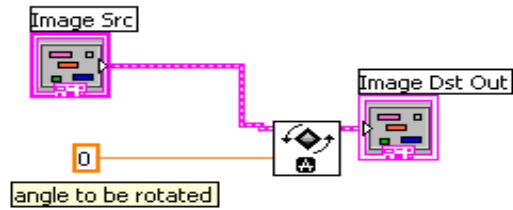
(b)

Figure 3.8: (a) Imaq Getangle subvi, (b) Angles between the points and vertex

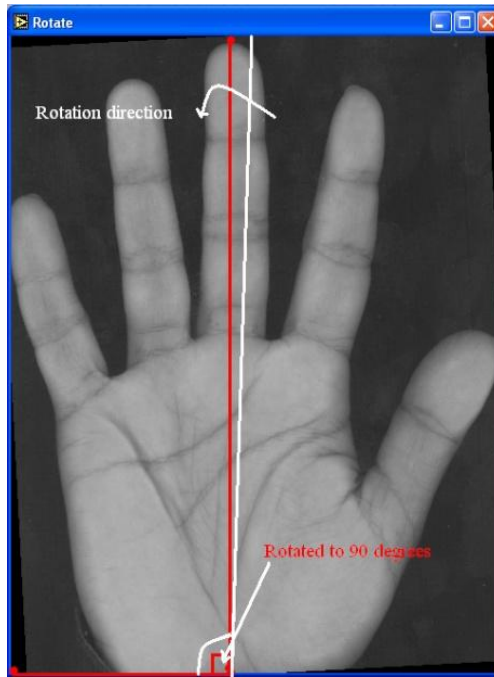
iv) Now to align the image to an angle of 90 degrees subtract the angle from 90 and then there will be two cases formed. When the value is positive the image will be rotated clockwise and when the value is negative the image is rotated anticlockwise with the help of Imaq rotate subvi as shown in figure 3.9 (a).

$$\text{Angle of rotation} = 90 - \text{angle between three points}$$

The rotation of image is shown in figure 3.9 (b).



(a)



(b)

Figure 3.9: (a) Imaq rotate subvi, (b) Rotation of image

After this process the image is aligned to an angle of 90 degrees. The aligned image is shown in figure 3.10.

3.6.2 Coordinates of ROI

Now coordinates of ROI has been found. A ROI of different sizes has been extracted from the parent image. Following are the equations which are used to find the top right coordinates of the ROI.

$$x = \text{row size} - \text{variable 1}$$

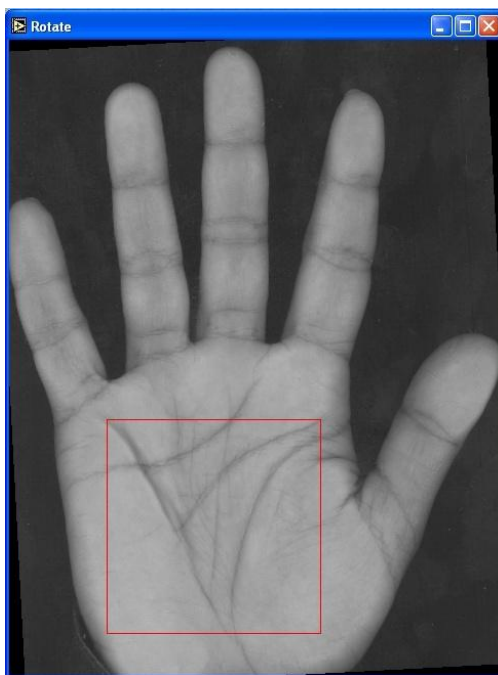
$$y = \text{vertex point column number} - \text{variable 2}$$

Here variable1, variable2, variable3 are set according to the requirement i.e. if a ROI of 200 x 200 pixels is needed then the values of variable1, variable2 are 250 and 100

respectively. Desired region has been extracted and the extracted ROI is shown in figure. 3.11.



Figure 3.10: Aligned image



(a)



(b)

Figure3.11: ROI of the Palm image

3.7 Filtering

Firstly gauss filter has been applied to the image for smoothening purpose as shown in figure 3.12.



Figure 3.12: Gauss filtered image

Then in order to extract the features out of the ROI, four directional Sobel operators have been used in $0^\circ, 45^\circ, 90^\circ$ and 135° . The kernel of gauss (figure 3.13) and sobel filters are shown in Figure 3.14. The Sobel operators are convolved with the image ROI, and four resultant directional images are obtained. The resultant images are matched pixel by pixel, and a combined directional map with the maximum pixel values is found. This resultant image is used for feature extraction and feature mapping (figure 3.16). The images obtained from the 2D convolution are 11, 12, 13 and 14 and the final image generated is

$$I_{final} = \max(11, 12, 13, 14)$$

0.011300	0.083800	0.011300
0.083800	0.619300	0.083800
0.011300	0.083800	0.011300

Figure 3.13: Gauss filter kernel

-1	0	1
-2	0	2
-1	0	1

(a)

0	1	2
-1	0	1
-2	-1	0

(b)

1	2	1
0	0	0
-1	-2	-1

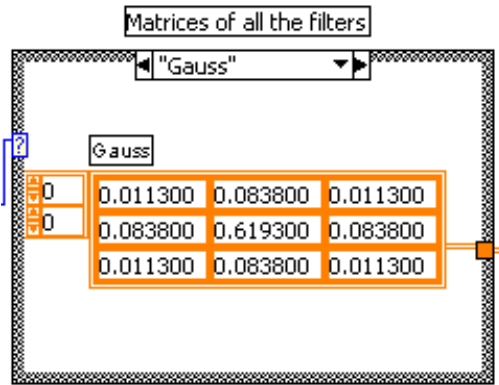
(c)

2	1	0
1	0	-1
0	-1	-2

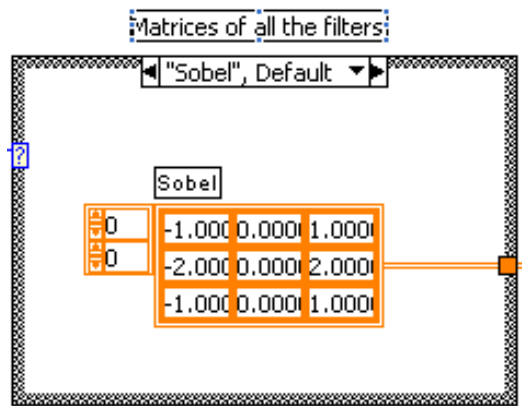
(d)

Figure 3.14: Sobel filter kernel (a) 0°, (b) 45°, (c) 90°, (d) 135°

The kernels of Gauss and Sobel filters developed in LabVIEW are shown in figure 3.15.



(a)



(b)

Figure 3.15: (a) Kernel of gauss filter (b) Kernel of sobel filter, developed in LabVIEW



Figure 3.16: Sobel Filtered image

3.8 Feature Extraction

The preprocessed ROI is divided into 67 blocks of 4 x 4 pixels each. To form the feature vector, the values of standard deviation of the intensities of the pixels in each block is calculated with an overlap of 25 percent from adjacent blocks². The overlap is to ensure that even if the ROI is offset by a few pixels, the feature mapping still remains the same. The feature vector is thus as follows:

$$Vector = \{std1, std2, std3, std4, \dots, stdN\}$$

Std_i, i=1 to N, is the standard deviation in each block and N= Number of blocks and number of features in the feature vector. This feature vector is shown in figure 3.17.

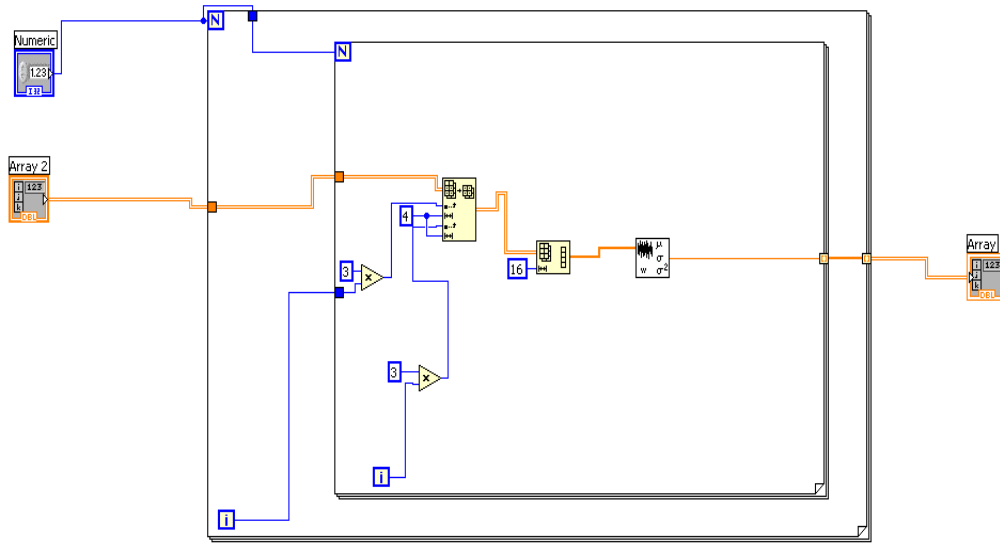


Figure 3.17: Feature vector VI

3.9 Feature Matching

Matching algorithm determines the similarity between two given data sets. Applying the matching algorithm on the input palm print image and image existing in the database does palm print verification. The palm print is said to be authentic if the result obtained after matching is more than the preset threshold value. In this approach Correlation Coefficient has been employed to find the similarity between two palm print images. The correlation coefficient is the most widely used measurement of association between two vectors. Let \mathbf{x} and \mathbf{y} be n -component

vectors for which degree of association has been calculated. For pairs of quantities (x_i, y_i) , $i=1, \dots, n$ the linear correlation coefficient r is given by the formula:

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}}$$

Where \bar{x} is the mean of the vector x and \bar{y} is the mean of the vector y . The value r lies between -1 and 1 , inclusive, with 1 meaning that the two series are identical, 0 meaning they are completely independent, and -1 meaning they are perfect opposites. The correlation coefficient is invariant under scalar transformation of the data (adding, subtracting or multiplying the vectors with a constant factor).

3.10 Experimental Setup

Finally the flow chart of the verification module is shown in the Figure 3.17. In the verification step, first of all the name and password of the user is checked if name and password are incorrect then the system gives a message “You are not an enrolled user” and stops.

If this stage is passed then the system demands for the palm image in question and after the preprocessing step, compares the two images (one in the reference pallet and other the preprocessed image in question). If the threshold value lies within the accepted limit the system will accept the identity of the user otherwise will reject it.

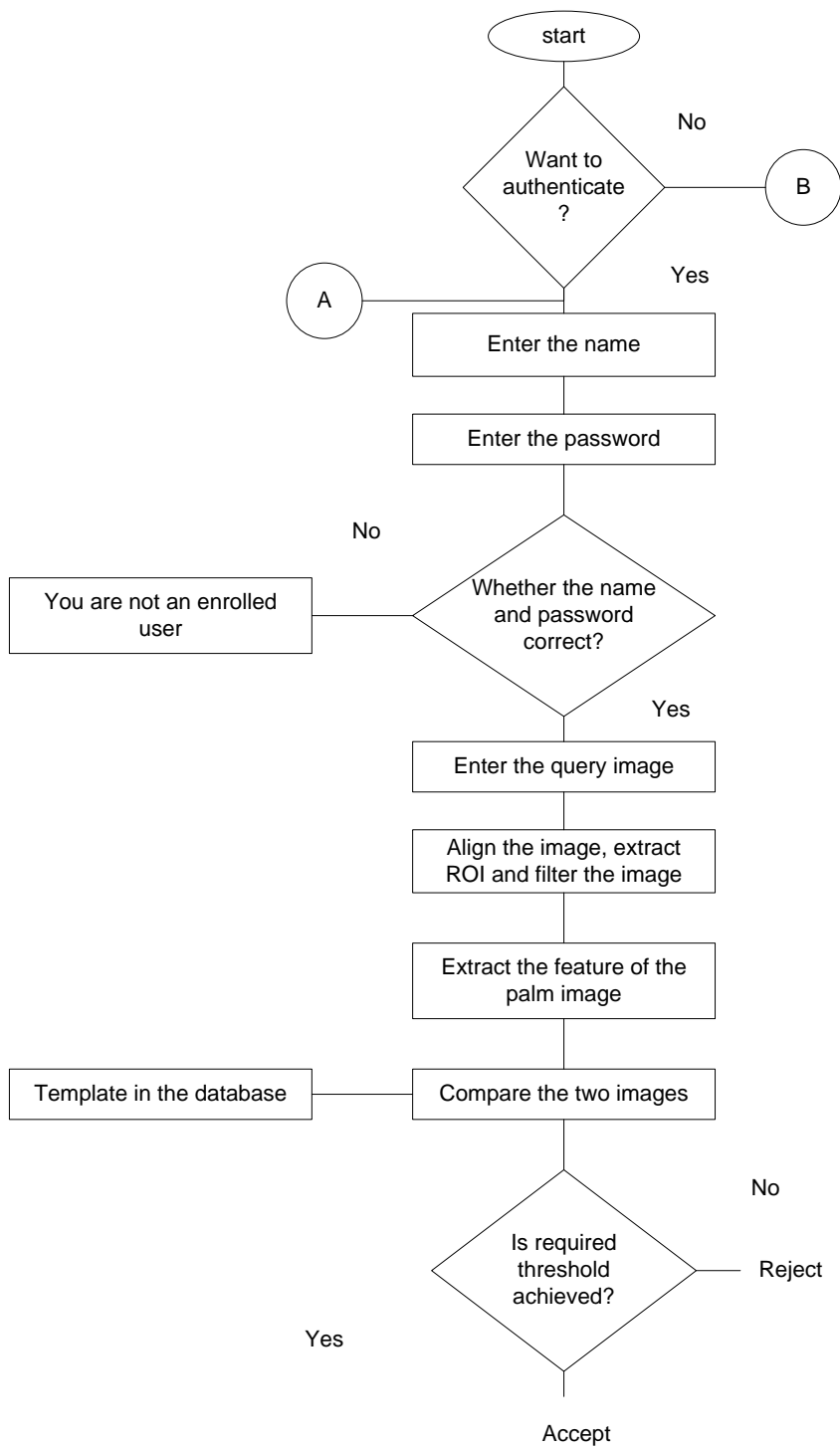


Figure 3.18: Flow chart of verification module

Chapter 4

Results and Discussion

4.1 Introduction

Palm recognition is an interdisciplinary research area, involving researchers from pattern recognition, computer vision and graphics, image processing/understanding, statistical/computing and machine learning. The experiments were made on a palm database using LabVIEW 6i. Basically feature matching has been discussed in this chapter.

LabVIEW software of Palm print Verification is having two steps:

- 1) Enrollment
- 2) Testing

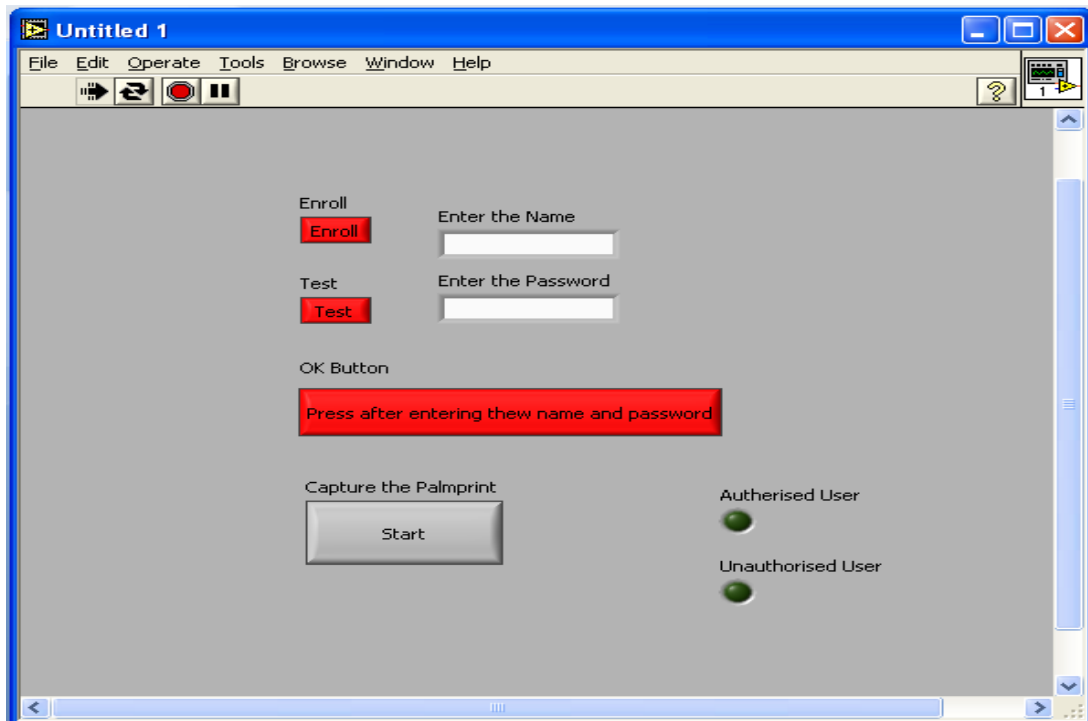


Figure 4.1: Front panel window for enrollment and testing

4.2 Enrollment

The first step is, to enroll the user in the data base. The Enrollment does the registration of new user on to the system. Enrollment asks user's name that is to be enrolled. After the person enters his name the system checks if the name previously exists in the database. If a match is found then the system prompts to enter the name again. This process is continued until the name has no match in the database. Various steps for enrollment of a user are as follows.

1. Enter the Name
2. Enter the Password
3. Enter the Palm print
4. Calculated the feature vector and stored in the file.

4.3 Testing

Verification is done by calculating the feature vector of the queue image from a user, then correlate with the stored feature vector of the previously entered user.

1. Enter Name
2. Enter password
3. If name or password is wrong a following message will be displayed "to check name and password"
4. If name and password are correct then system will ask for the next step
5. Enter the palm print in question
6. Calculate the feature vector of the test palm print
7. Apply the correlation coefficient between test image and the stored image and compare with threshold and decide the authenticity of the person.

4.4 System Processing

Let's take an example of user A to define the working of the system, in the system, the palm print has been captured firstly as shown in figure 4.2.

First step is to align the image. For this, the angle between the top point, vertex and the left bottom point has been found. The angle is 79° . Then this angle is subtracted from 90° . Image is rotated with an angle of 11° as shown in figure 4.3.



Figure 4.2: Enrolled Palm Print



Figure 4.3: Rotated Image

The ROI has been found from the rotated image of Palm as shown in figure 4.4.



Figure 4.4: ROI

All these steps are shown in the figure 4.5.

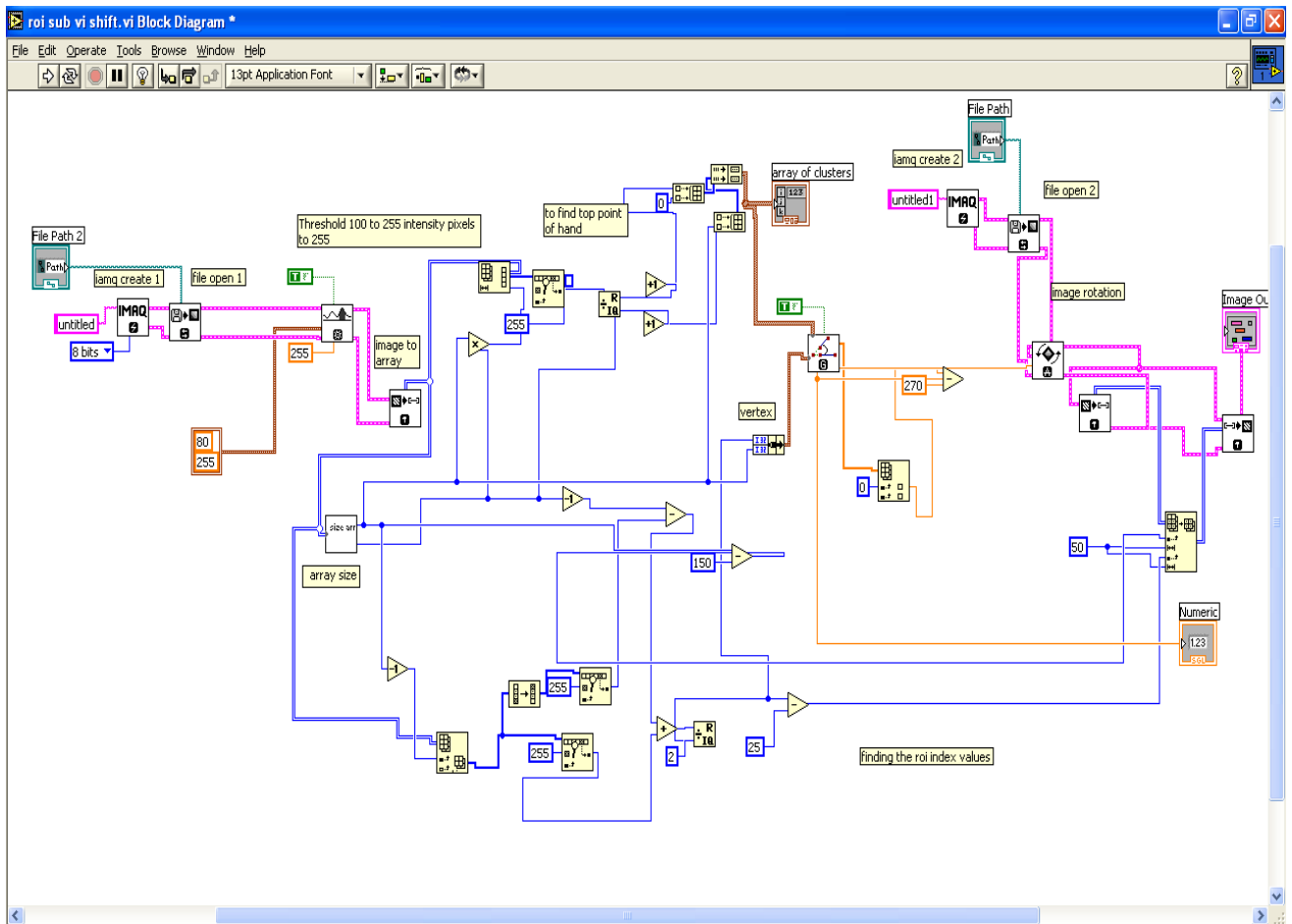


Figure 4.5: Block Diagram window for the rotation and finding ROI

Now feature vector has been calculated and stored in a file to determine the correlation coefficient to test the image whether it is authorized or not.

4.5 Performance Parameters

In this correlation score has been found, the value of correlation coefficient is between -1 to 1. It means if the score is 1 the palm is absolutely matched with the template stored in the database but if the score is -1 the palm is absolutely different to the template stored in the database. The correlation table between different palms is shown in table 4.1 for template size 200 x 200 pixels.

In the table 4.1 and 4.2 the *blue* color represents the genuine score and *black* color shows the imposter score. A,B,C.....N represents the different users and A1,A2,B1,B2..... represents the palm print of the users A,B,C etc.

Table 4.1: Correlation table for template size 200 x 200 pixels.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A1	1	-0.049	-0.048	-0.041	-0.039	-0.019	0.629	0.606	-0.025	-0.041	0.61	0.888	0.632	0.636
A2	0.621	0.526	0.484	0.511	0.501	-0.019	0.629	0.606	0.684	0.485	0.61	0.6	0.948	0.954
A3	-0.05	0.526	0.933	0.511	0.501	-0.019	0.475	-0.046	0.68	0.485	-0.039	-0.044	0.476	0.478
A4	0.772	0.526	0.513	0.541	0.529	-0.019	0.475	0.55	0.68	0.512	0.555	0.547	0.935	0.939
A5	0.783	0.526	0.503	0.53	0.519	-0.019	0.475	0.565	0.68	0.502	0.57	0.561	0.938	0.943
A6	-0.02	0.526	0.689	0.53	0.519	-0.019	0.675	-0.017	0.68	0.685	-0.017	-0.016	0.68	0.683
A7	0.901	0.744	0.686	0.53	0.519	-0.019	0.673	-0.019	0.68	0.682	-0.019	-0.016	0.677	0.681
A8	0.774	0.557	0.512	0.539	0.528	-0.019	0.673	0.552	0.68	0.511	0.558	0.549	0.936	0.94
A9	0.772	0.557	0.513	0.54	0.528	-0.019	0.673	0.55	0.68	0.512	0.556	0.547	0.936	0.94
A10	0.902	0.557	-0.042	-0.037	-0.038	-0.019	0.61	0.872	-0.024	-0.041	0.883	0.864	0.616	0.617
A11	0.901	0.557	0.687	0.719	-0.038	0.96	0.671	-0.02	0.938	0.683	-0.02	-0.02	0.674	0.679
A12	0.747	0.557	0.516	0.544	0.533	0.749	0.671	0.536	0.73	0.515	0.541	0.535	0.93	0.934
A13	0.903	0.557	-0.046	-0.041	-0.042	-0.023	0.608	0.536	-0.027	-0.044	0.883	0.864	0.613	0.615

A14	0.852	0.557	0.94	0.922	-0.042	-0.023	0.48	-0.043	0.687	-0.044	-0.037	-0.042	0.483	0.485
A15	0.904	0.557	-0.046	-0.04	-0.041	-0.023	0.608	-0.043	-0.027	-0.044	0.884	0.865	0.613	0.615
A16	0.896	0.557	0.945	0.926	-0.041	-0.023	0.48	-0.042	0.687	0.955	-0.036	-0.04	0.484	0.485
A17	0.761	0.557	0.515	0.543	0.531	-0.023	0.933	0.548	0.687	0.515	0.553	0.545	0.938	0.943
A18	0.901	0.557	0.69	0.721	0.531	-0.023	0.673	-0.015	0.687	0.685	-0.016	-0.017	0.673	0.678
A19	0.772	0.557	0.513	0.54	0.528	-0.023	0.673	0.55	0.687	0.512	0.556	0.547	0.935	0.94
A20	0.776	0.557	0.51	0.536	0.524	-0.023	0.673	0.555	0.687	0.508	0.561	0.552	0.935	0.94
A21	0.901	0.557	0.945	0.927	0.524	-0.023	0.484	-0.042	0.689	0.508	-0.036	-0.04	0.486	0.487
A22	0.874	0.554	0.51	0.535	0.525	-0.023	0.484	0.558	0.689	0.508	0.564	0.554	0.94	0.944
A23	-0.02	0.75	0.692	0.535	0.525	-0.023	0.674	-0.016	0.689	0.687	-0.017	-0.018	0.673	0.679
A24	0.901	0.919	0.94	0.535	0.525	0.71	0.48	-0.042	0.689	0.947	-0.036	-0.042	0.483	0.485
A25	0.901	0.75	0.692	0.535	0.525	0.955	0.673	-0.017	0.689	0.686	-0.018	-0.019	0.672	0.678
A26	0.901	-0.04	-0.04	-0.036	0.525	-0.018	0.61	0.871	-0.023	-0.039	0.882	0.864	0.616	0.618
A27	0.908	0.749	0.69	0.722	0.525	-0.018	0.674	-0.015	-0.023	0.685	-0.016	-0.017	0.673	0.679
A28	0.785	0.749	0.69	0.722	0.525	-0.018	0.674	-0.015	-0.023	0.685	-0.016	-0.017	0.673	0.679
A29	0.771	0.558	0.513	0.54	0.528	-0.018	0.674	0.55	-0.023	0.512	0.556	0.547	0.935	0.94
A30	0.905	-0.049	-0.049	-0.042	-0.043	-0.025	0.61	0.55	-0.026	-0.047	0.885	0.866	0.613	0.616
A31	0.718	0.761	-0.049	0.733	-0.043	-0.025	0.672	-0.017	0.938	0.697	-0.018	-0.019	0.676	0.682
A32	0.887	0.552	0.506	0.533	0.523	-0.025	0.672	0.567	0.713	0.506	0.573	0.563	0.94	0.945
A33	0.901	0.749	0.689	0.721	0.523	-0.025	0.673	-0.014	0.931	0.684	-0.015	-0.016	0.673	0.679
A34	0.901	0.75	0.691	0.723	0.523	-0.025	0.675	-0.014	0.935	0.688	-0.015	-0.016	0.676	0.682
A35	0.816	0.75	0.69	0.722	0.523	-0.025	0.674	-0.015	0.932	0.685	-0.015	-0.017	0.674	0.68
A36	0.816	0.927	0.69	0.926	0.523	0.702	0.474	-0.045	0.683	0.685	-0.038	-0.042	0.478	0.479
A37	0.929	-0.047	-0.051	-0.044	-0.043	-0.023	0.623	-0.045	-0.026	-0.046	0.903	0.881	0.628	0.631
A38	0.929	-0.047	-0.051	0.918	0.937	-0.023	0.476	-0.044	0.682	-0.046	-0.038	-0.043	0.477	0.48
A39	0.929	-0.047	-0.051	0.922	0.94	-0.023	0.48	-0.042	0.687	-0.046	-0.036	-0.041	0.484	0.486
A40	0.58	-0.047	-0.051	0.536	0.524	0.734	0.48	0.559	0.716	-0.046	0.565	0.556	0.936	0.942
A41	0.948	-0.047	-0.053	-0.046	-0.047	-0.024	0.623	0.559	-0.027	-0.046	0.905	0.883	0.627	0.632

A42	0.937	-0.047	-0.049	-0.043	-0.04	-0.017	0.63	0.559	-0.024	-0.043	0.909	0.887	0.636	0.638
A43	0.937	-0.047	0.689	-0.043	-0.04	-0.017	0.672	-0.016	0.932	0.684	-0.016	-0.018	0.672	0.678
A44	0.901	-0.047	-0.04	-0.043	-0.037	-0.018	0.61	0.871	-0.024	-0.039	0.882	0.864	0.616	0.618
A45	0.901	-0.047	0.935	-0.043	-0.037	0.703	0.476	-0.044	0.682	0.946	-0.038	-0.042	0.477	0.48
A46	0.901	-0.047	0.7	-0.043	-0.037	0.953	0.672	-0.017	0.937	0.697	-0.018	-0.019	0.674	0.679
A47	0.901	-0.047	0.941	-0.043	-0.037	0.687	0.469	-0.038	0.671	0.671	-0.032	-0.033	0.472	0.475
A48	0.901	-0.047	0.933	-0.043	-0.037	0.687	0.476	-0.046	0.682	0.682	-0.039	-0.043	0.476	0.479
A49	0.572	-0.047	0.514	0.541	0.529	0.687	0.929	0.55	0.722	0.512	0.555	0.547	0.935	0.94
A50	0.906	-0.042	-0.043	-0.036	-0.038	-0.015	0.621	0.55	-0.019	-0.04	0.89	0.873	0.624	0.628
B1	-0.049	1	-0.043	-0.036	-0.038	-0.015	0.512	-0.041	0.737	0.945	-0.032	-0.035	0.515	0.514
B2	-0.043	0.939	-0.043	-0.036	-0.038	-0.015	0.526	-0.037	-0.037	-0.037	-0.033	-0.04	0.527	0.527
B3	-0.043	0.939	-0.04	-0.035	-0.035	-0.015	0.66	-0.037	-0.029	-0.037	0.951	0.948	0.666	0.67
B4	-0.043	0.939	0.47	0.496	0.485	0.684	0.66	0.655	0.665	0.472	0.659	0.661	0.968	0.974
B5	-0.048	0.953	0.943	0.953	0.949	0.684	0.506	-0.042	-0.042	-0.042	-0.032	-0.041	0.508	0.508
B6	-0.048	0.953	-0.042	-0.038	-0.035	-0.02	0.624	-0.042	-0.03	-0.036	0.898	0.908	0.632	0.635
B7	-0.048	0.953	0.475	0.501	0.49	0.689	0.945	0.627	0.669	0.476	0.63	0.636	0.953	0.958
B8	-0.048	0.953	-0.043	-0.041	-0.038	-0.022	0.648	0.627	-0.032	-0.039	0.936	0.955	0.653	0.658
B9	-0.019	0.738	0.677	0.712	0.693	-0.022	0.673	-0.014	0.94	0.674	-0.016	-0.018	0.677	0.68
B10	-0.052	0.948	0.677	0.938	0.935	-0.022	0.513	-0.044	0.742	0.674	-0.037	-0.048	0.516	0.515
B11	-0.052	0.948	-0.043	-0.038	-0.037	-0.022	0.631	0.905	-0.031	-0.036	0.91	0.918	0.64	0.642
B12	-0.019	0.739	0.678	-0.038	0.694	-0.022	0.676	-0.016	0.943	0.676	-0.017	-0.012	0.68	0.684
B13	-0.051	0.948	0.678	-0.038	0.694	-0.022	0.514	-0.043	0.74	0.931	-0.036	-0.048	0.516	0.515
B14	-0.019	0.738	0.676	-0.038	0.693	-0.022	0.673	-0.014	0.94	0.674	-0.015	-0.018	0.677	0.68
B15	-0.051	0.948	0.676	-0.038	0.935	-0.022	0.514	-0.043	0.74	0.931	-0.036	-0.048	0.516	0.515
B16	-0.016	0.738	0.677	-0.038	0.695	0.683	0.677	-0.015	0.944	0.675	-0.016	-0.012	0.68	0.685
B17	-0.043	0.945	0.677	-0.038	0.695	0.683	0.515	-0.038	0.738	0.675	-0.031	-0.039	0.518	0.518
B18	-0.048	0.947	0.677	-0.038	0.695	0.683	0.513	-0.04	0.737	0.675	-0.033	-0.044	0.515	0.515
B19	-0.051	0.946	0.677	-0.038	0.695	0.683	0.517	-0.044	0.745	0.675	-0.037	-0.047	0.519	0.518

B20	-0.051	0.946	0.472	0.499	0.487	0.683	0.517	0.662	0.662	0.472	0.666	0.666	0.972	0.977
B21	0.623	0.946	0.471	0.497	0.487	0.684	0.517	0.647	0.663	0.473	0.65	0.66	0.963	0.969
B22	-0.042	0.948	0.937	0.497	0.944	0.684	0.52	-0.034	0.663	0.94	-0.028	-0.038	0.522	0.522
B23	-0.021	0.739	0.677	0.497	0.691	0.684	0.671	-0.017	0.663	0.673	-0.019	-0.022	0.675	0.678
B24	-0.051	0.946	0.927	0.497	0.691	0.684	0.517	-0.044	0.663	0.929	-0.037	-0.047	0.519	0.518
B25	-0.048	0.948	0.931	0.497	0.691	0.752	0.513	-0.04	0.663	0.932	-0.033	-0.044	0.515	0.514
B26	-0.019	0.738	0.677	0.497	0.693	0.955	0.672	-0.015	0.663	0.674	-0.016	-0.018	0.677	0.68
B27	0.635	0.738	0.47	0.497	0.484	0.682	0.672	0.666	0.661	0.471	0.67	0.666	0.973	0.98
B28	0.635	0.513	0.47	0.497	0.484	0.682	0.672	0.666	0.661	0.471	0.67	0.666	0.973	0.98
B29	0.885	0.948	-0.043	-0.042	-0.038	-0.022	0.644	0.666	-0.032	-0.038	0.931	0.949	0.651	0.655
B30	0.893	0.948	-0.038	-0.036	-0.036	-0.021	0.652	0.666	-0.03	-0.036	0.942	0.949	0.659	0.664
B31	0.893	0.948	-0.04	-0.039	-0.037	-0.019	0.654	0.666	-0.029	-0.037	0.942	0.956	0.66	0.665
B32	0.902	0.948	-0.038	-0.034	-0.033	-0.017	0.665	0.666	-0.027	-0.034	0.955	0.951	0.67	0.675
B33	0.898	0.948	-0.038	-0.034	-0.034	-0.018	0.659	0.666	-0.028	-0.035	0.948	0.95	0.665	0.671
B34	0.628	0.513	0.47	0.496	0.485	0.684	0.659	0.655	0.665	0.472	0.659	0.661	0.968	0.974
B35	0.637	0.511	0.468	0.494	0.482	0.68	0.659	0.67	0.659	0.469	0.673	0.668	0.975	0.981
B36	-0.044	0.964	0.468	0.945	0.482	0.68	0.521	-0.037	0.659	0.469	-0.03	-0.038	0.525	0.523
B37	-0.02	0.754	0.688	0.725	0.482	0.68	0.675	-0.019	0.659	0.685	-0.018	-0.018	0.679	0.682
B38	-0.022	0.741	0.679	0.713	0.693	0.68	0.67	-0.019	0.659	0.675	-0.02	-0.021	0.675	0.678
B39	-0.051	0.946	0.679	0.936	0.934	0.68	0.517	-0.043	0.659	0.675	-0.037	-0.047	0.519	0.518
B40	0.639	0.946	0.466	0.493	0.48	0.679	0.517	0.673	0.657	0.467	0.677	0.668	0.976	0.982
B41	-0.044	0.974	0.945	0.951	0.946	0.75	0.516	-0.037	0.738	0.941	-0.03	-0.035	0.52	0.518
B42	-0.021	0.756	0.691	0.729	0.706	0.962	0.674	-0.019	0.943	0.688	-0.018	-0.018	0.678	0.682
B43	0.896	-0.04	-0.04	-0.035	-0.035	-0.018	0.659	0.945	-0.028	-0.036	0.949	0.948	0.665	0.67
B44	-0.051	0.946	0.927	-0.035	-0.035	0.757	0.517	-0.044	0.745	0.929	-0.037	-0.047	0.519	0.518
B45	-0.023	0.742	0.679	-0.035	0.694	0.958	0.67	-0.02	0.938	0.676	-0.02	-0.022	0.675	0.678
B46	0.643	0.514	0.468	0.495	0.481	0.679	0.67	0.677	0.657	0.468	0.682	0.666	0.979	0.985
B47	-0.017	0.752	0.691	0.495	0.481	0.679	0.675	-0.018	0.947	0.689	-0.017	-0.016	0.678	0.681

B48	-0.049	0.951	0.691	0.495	0.481	0.679	0.507	-0.041	0.727	0.938	-0.032	-0.042	0.51	0.51
B49	-0.018	0.738	0.676	0.495	0.692	0.679	0.673	-0.014	0.939	0.673	-0.015	-0.018	0.677	0.68
B50	0.64	0.738	0.466	0.492	0.481	0.678	0.673	0.675	0.657	0.467	0.68	0.667	0.978	0.984
C1	-0.048	0.946	1	0.95	0.481	0.691	0.47	-0.039	0.675	0.467	-0.035	-0.038	0.475	0.471
C2	-0.048	0.945	0.969	0.948	0.481	0.687	0.465	-0.039	0.672	0.467	-0.037	-0.039	0.474	0.465
C3	0.627	0.516	0.969	0.498	0.484	0.679	0.965	0.663	0.658	0.472	0.668	0.657	0.973	0.975
C4	0.894	-0.037	0.969	-0.038	-0.037	-0.021	0.657	0.936	-0.031	-0.037	0.944	0.931	0.664	0.662
C5	0.626	0.516	0.969	0.498	0.484	0.679	0.965	0.663	0.658	0.472	0.667	0.656	0.973	0.975
C6	0.895	-0.032	0.969	-0.03	-0.029	-0.012	0.671	0.663	-0.02	-0.03	0.95	0.931	0.673	0.674
C7	0.894	-0.029	0.969	-0.028	-0.027	-0.011	0.67	0.663	-0.019	-0.028	0.95	0.931	0.674	0.675
C8	0.626	0.518	0.48	0.5	0.487	0.681	0.67	0.659	0.663	0.473	0.664	0.654	0.972	0.975
C9	0.625	0.518	0.48	0.499	0.487	0.682	0.67	0.658	0.663	0.473	0.663	0.655	0.972	0.975
C10	-0.052	0.928	0.948	0.93	0.937	0.682	0.482	-0.044	0.692	0.473	-0.039	-0.043	0.488	0.483
C11	-0.046	0.932	0.948	0.932	0.942	0.682	0.486	-0.037	0.694	0.473	-0.03	-0.034	0.493	0.489
C12	-0.017	0.734	0.948	0.706	0.688	0.682	0.668	-0.009	0.924	0.67	-0.009	-0.009	0.673	0.672
C13	0.625	0.518	0.479	0.499	0.487	0.681	0.668	0.659	0.662	0.473	0.665	0.655	0.972	0.975
C14	0.895	-0.038	0.948	-0.039	-0.037	-0.021	0.656	0.936	-0.031	-0.037	0.944	0.93	0.664	0.662
C15	0.625	0.518	0.948	0.499	0.487	0.681	0.656	0.659	0.662	0.473	0.665	0.655	0.972	0.975
C16	-0.019	0.518	0.679	0.704	0.687	0.943	0.667	-0.011	0.922	0.67	-0.01	-0.01	0.673	0.672
C17	-0.05	0.518	0.948	0.933	0.687	0.712	0.48	-0.041	0.692	0.953	-0.035	-0.041	0.488	0.484
C18	-0.026	0.518	0.675	0.696	0.676	0.932	0.659	-0.016	0.914	0.663	-0.017	-0.018	0.662	0.66
C19	0.625	0.518	0.948	0.499	0.487	0.682	0.966	0.658	0.663	0.473	0.664	0.655	0.972	0.975
C20	0.626	0.518	0.478	0.499	0.486	0.681	0.966	0.66	0.661	0.473	0.666	0.655	0.972	0.975
C21	-0.051	0.518	0.948	0.933	0.486	0.681	0.485	-0.043	0.696	0.95	-0.038	-0.042	0.489	0.487
C22	-0.026	0.518	0.676	0.703	0.683	0.681	0.661	-0.018	0.921	0.668	-0.017	-0.02	0.666	0.665
C23	-0.027	0.518	0.948	0.695	0.675	0.681	0.656	-0.018	0.913	0.662	-0.017	-0.021	0.659	0.658
C24	-0.027	0.518	0.948	0.499	0.487	0.682	0.966	0.658	0.663	0.473	0.664	0.655	0.972	0.975
C25	-0.027	0.518	0.948	0.696	0.677	0.931	0.657	-0.017	0.914	0.664	-0.017	-0.021	0.66	0.659

C26	-0.027	0.519	0.948	0.5	0.488	0.682	0.657	0.658	0.663	0.473	0.663	0.655	0.972	0.975
C27	-0.027	-0.039	0.756	-0.038	-0.039	-0.022	0.648	0.658	-0.032	-0.037	0.932	0.921	0.654	0.653
C28	-0.027	-0.039	0.954	-0.038	-0.039	-0.022	0.648	0.923	-0.032	-0.037	0.932	0.921	0.654	0.653
C29	-0.027	0.518	0.954	0.499	0.487	0.682	0.648	0.658	0.663	0.472	0.664	0.654	0.972	0.975
C30	-0.027	-0.04	0.954	-0.039	-0.039	-0.023	0.647	0.923	-0.032	-0.037	0.932	0.921	0.654	0.653
C31	-0.027	-0.033	0.954	-0.032	-0.031	-0.02	0.652	0.929	-0.029	-0.03	0.934	0.925	0.659	0.657
C32	-0.027	-0.033	0.954	0.934	0.943	-0.02	0.481	-0.043	0.692	-0.03	-0.038	-0.042	0.486	0.482
C33	-0.027	-0.033	0.946	0.928	0.936	-0.02	0.479	-0.042	0.69	-0.03	-0.037	-0.043	0.483	0.48
C34	-0.027	-0.033	0.948	0.929	0.937	-0.02	0.482	-0.044	0.693	-0.03	-0.04	-0.043	0.488	0.483
C35	-0.027	-0.033	0.948	0.498	0.485	0.682	0.964	0.657	0.661	0.473	0.663	0.653	0.97	0.973
C36	-0.027	-0.032	0.948	-0.032	-0.031	-0.021	0.657	0.938	-0.03	-0.029	0.944	0.927	0.663	0.663
C37	-0.027	0.931	0.955	0.933	-0.031	0.707	0.477	-0.042	0.688	0.952	-0.039	-0.046	0.483	0.477
C38	-0.027	0.515	0.756	0.498	0.484	0.681	0.964	0.659	0.659	0.472	0.665	0.653	0.971	0.974
C39	-0.027	-0.037	0.946	-0.038	-0.037	-0.021	0.657	0.659	-0.031	-0.037	0.944	0.93	0.664	0.662
C40	-0.027	0.516	0.946	0.497	0.484	0.681	0.964	0.659	0.66	0.472	0.664	0.653	0.971	0.974
C41	-0.027	0.512	0.946	0.495	0.484	0.683	0.966	0.664	0.66	0.471	0.666	0.653	0.974	0.975
C42	-0.027	0.943	0.966	0.495	0.484	0.696	0.471	-0.037	0.678	0.966	-0.035	-0.041	0.479	0.472
C43	-0.024	0.725	0.673	0.698	0.679	0.696	0.658	-0.015	0.678	0.665	-0.016	-0.017	0.664	0.661
C44	0.895	-0.037	0.756	-0.038	-0.037	-0.021	0.657	0.936	-0.031	-0.037	0.944	0.931	0.664	0.662
C45	-0.025	0.725	0.672	0.698	0.678	-0.021	0.657	-0.016	-0.016	0.664	-0.017	-0.017	0.663	0.66
C46	0.9	-0.042	0.947	-0.039	-0.038	-0.021	0.66	-0.016	-0.03	-0.036	0.949	0.932	0.664	0.666
C47	0.905	-0.038	0.947	-0.035	-0.036	-0.021	0.669	-0.016	-0.027	-0.033	0.96	0.938	0.675	0.676
C48	-0.026	0.725	0.947	0.698	0.677	-0.021	0.655	-0.016	0.917	0.663	-0.018	-0.022	0.661	0.659
C49	0.625	0.518	0.947	0.499	0.486	-0.021	0.966	0.659	0.663	0.472	0.664	0.654	0.972	0.974
C50	-0.051	0.518	0.947	0.499	0.937	-0.021	0.478	-0.04	0.691	0.95	-0.036	-0.041	0.484	0.481
D1	-0.041	0.954	0.95	1	0.959	-0.021	0.491	-0.035	0.712	0.949	-0.031	-0.035	0.496	0.496
D2	-0.01	0.724	0.664	1	0.678	-0.021	0.667	-0.012	0.932	0.661	-0.01	-0.016	0.667	0.672
D3	-0.01	0.515	0.471	1	0.484	-0.021	0.966	0.665	0.659	0.469	0.67	0.653	0.97	0.977

D4	-0.01	-0.029	-0.034	0.938	-0.03	-0.021	0.656	0.665	-0.023	-0.033	0.937	0.952	0.658	0.663
D5	-0.038	-0.029	0.94	0.938	0.942	-0.021	0.495	-0.031	0.7	0.939	-0.025	-0.031	0.498	0.5
D6	0.889	-0.031	-0.035	0.938	-0.03	-0.021	0.652	-0.031	-0.022	-0.029	0.93	0.931	0.656	0.659
D7	-0.019	0.73	0.671	0.705	0.688	-0.021	0.665	-0.016	0.929	0.668	-0.016	-0.009	0.666	0.671
D8	-0.019	-0.03	-0.036	-0.03	-0.032	-0.021	0.657	-0.016	-0.022	-0.034	0.937	0.952	0.658	0.663
D9	-0.048	0.93	0.931	0.94	0.941	-0.021	0.5	-0.044	0.719	-0.034	-0.036	-0.044	0.501	0.503
D10	0.618	0.515	0.471	0.94	0.486	0.686	0.959	0.647	0.668	0.47	0.653	0.656	0.962	0.969
D11	-0.02	0.729	0.669	0.702	0.687	0.686	0.663	-0.018	0.929	0.666	-0.018	-0.008	0.663	0.669
D12	0.603	0.528	0.484	0.511	0.5	0.694	0.953	0.629	0.676	0.484	0.634	0.638	0.957	0.963
D13	-0.048	0.528	0.933	0.939	0.942	0.694	0.498	-0.042	0.714	0.484	-0.036	-0.043	0.499	0.5
D14	0.617	0.516	0.472	0.939	0.487	0.686	0.959	0.646	0.668	0.471	0.652	0.655	0.962	0.969
D15	0.619	0.515	0.472	0.939	0.485	0.685	0.96	0.649	0.667	0.469	0.655	0.655	0.963	0.97
D16	-0.046	0.932	0.936	0.939	0.946	0.685	0.5	-0.041	0.667	0.936	-0.035	-0.037	0.502	0.503
D17	-0.017	0.729	0.672	0.705	0.69	0.685	0.666	-0.015	0.667	0.936	-0.014	-0.012	0.666	0.672
D18	0.621	0.515	0.472	0.705	0.485	0.684	0.962	0.652	0.666	0.47	0.658	0.655	0.965	0.972
D19	0.885	-0.029	-0.034	0.705	-0.03	-0.017	0.656	0.928	-0.024	-0.032	0.936	0.953	0.657	0.663
D20	-0.049	-0.029	0.935	0.941	0.945	-0.017	0.494	-0.043	0.711	0.932	-0.037	-0.044	0.496	0.497
D21	-0.049	-0.036	-0.039	0.941	-0.034	-0.017	0.656	0.929	-0.024	-0.037	0.936	0.947	0.657	0.662
D22	-0.049	-0.036	0.474	0.941	0.488	0.688	0.656	0.651	0.668	0.473	0.656	0.655	0.966	0.973
D23	-0.049	-0.036	0.936	0.942	0.945	0.688	0.656	-0.041	0.71	0.933	-0.035	-0.042	0.498	0.499
D24	0.617	-0.036	0.472	0.499	0.487	0.686	0.656	0.646	0.668	0.471	0.652	0.655	0.962	0.969
D25	0.621	-0.036	0.472	0.499	0.485	0.684	0.656	0.653	0.665	0.47	0.658	0.655	0.965	0.972
D26	-0.018	-0.036	0.661	0.695	0.677	0.684	0.656	-0.018	0.665	0.656	-0.015	-0.015	0.659	0.665
D27	-0.016	-0.036	0.667	0.701	0.679	0.684	0.662	-0.014	0.665	0.658	-0.014	-0.015	0.662	0.668
D28	-0.016	-0.036	0.667	0.701	0.679	0.684	0.662	-0.014	0.665	0.658	-0.014	-0.015	0.662	0.668
D29	-0.048	-0.036	0.667	0.94	0.941	0.684	0.5	-0.043	0.665	0.658	-0.035	-0.043	0.501	0.503
D30	-0.049	-0.036	0.667	0.941	0.945	0.684	0.494	-0.042	0.665	0.658	-0.037	-0.043	0.496	0.497
D31	-0.043	-0.036	0.667	0.945	0.944	0.684	0.506	-0.037	0.665	0.934	-0.031	-0.038	0.507	0.509

D32	-0.014	-0.036	0.67	0.706	0.682	0.684	0.666	-0.012	0.923	0.662	-0.013	-0.017	0.666	0.672
D33	-0.014	-0.036	-0.031	-0.03	-0.029	-0.011	0.666	0.938	-0.021	-0.032	0.945	0.943	0.668	0.673
D34	0.617	-0.036	0.472	0.499	0.487	-0.011	0.666	0.646	0.668	0.472	0.652	0.655	0.962	0.969
D35	-0.045	-0.036	0.472	0.944	0.948	-0.011	0.495	-0.038	0.706	0.936	-0.033	-0.039	0.497	0.498
D36	-0.043	-0.036	0.472	0.951	0.944	-0.011	0.509	-0.037	0.727	0.935	-0.031	-0.041	0.51	0.512
D37	-0.002	-0.036	0.67	0.713	0.685	-0.011	0.673	0.001	0.927	0.665	-0.001	-0.008	0.674	0.68
D38	0.624	-0.036	0.473	0.713	0.484	0.681	0.965	0.66	0.662	0.47	0.664	0.654	0.969	0.976
D39	0.624	-0.036	-0.034	0.713	-0.03	-0.016	0.656	0.66	-0.023	-0.033	0.937	0.952	0.658	0.663
D40	-0.013	-0.036	0.667	0.701	0.677	-0.016	0.662	0.66	0.917	0.658	-0.012	-0.015	0.662	0.669
D41	0.904	-0.036	-0.035	0.959	-0.03	-0.013	0.672	0.66	-0.021	-0.032	0.959	0.945	0.676	0.681
D42	-0.039	-0.036	0.963	0.959	0.965	0.691	0.469	-0.034	0.675	0.97	-0.03	-0.035	0.472	0.472
D43	-0.014	-0.036	0.668	0.701	0.679	0.691	0.662	-0.012	0.916	0.66	-0.013	-0.017	0.662	0.669
D44	-0.014	-0.036	-0.034	0.701	-0.031	-0.016	0.656	-0.012	-0.024	-0.033	0.937	0.952	0.657	0.663
D45	-0.014	-0.036	-0.027	-0.02	-0.026	-0.01	0.667	-0.012	-0.019	-0.03	0.948	0.941	0.67	0.675
D46	-0.01	-0.036	0.673	0.729	0.686	-0.01	0.666	-0.008	0.93	0.667	-0.009	-0.014	0.669	0.674
D47	-0.009	-0.036	0.67	0.71	0.685	-0.01	0.666	-0.005	0.928	0.666	-0.009	-0.015	0.665	0.669
D48	-0.041	-0.036	0.67	0.943	0.946	-0.01	0.495	-0.035	0.704	0.939	-0.029	-0.035	0.497	0.499
D49	0.616	-0.036	0.472	0.499	0.487	0.686	0.959	0.646	0.668	0.471	0.652	0.655	0.962	0.969
D50	-0.042	-0.036	0.472	0.944	0.946	0.686	0.494	-0.036	0.703	0.471	-0.03	-0.036	0.496	0.498
E1	-0.039	-0.036	0.472	0.959	1	0.686	0.482	-0.038	0.689	0.471	-0.032	-0.03	0.485	0.485
E2	0.911	-0.036	-0.035	-0.031	1	-0.019	0.672	0.954	-0.026	-0.032	0.965	0.94	0.677	0.681
E3	-0.005	-0.036	0.674	0.703	1	-0.019	0.674	-0.013	0.924	0.674	-0.012	-0.007	0.676	0.68
E4	-0.009	0.736	0.678	0.709	0.939	-0.019	0.665	-0.014	0.923	0.677	-0.016	-0.013	0.669	0.674
E5	0.905	-0.037	-0.038	-0.036	0.939	-0.019	0.67	-0.014	-0.026	-0.034	0.961	0.935	0.673	0.677
E6	-0.039	-0.037	0.93	-0.036	0.939	-0.019	0.498	-0.036	0.709	0.936	-0.032	-0.038	0.502	0.502
E7	-0.01	-0.037	0.675	-0.036	0.939	-0.019	0.674	-0.013	0.936	0.676	-0.014	-0.015	0.677	0.68
E8	-0.007	-0.037	0.679	-0.036	0.939	-0.019	0.668	-0.016	0.924	0.677	-0.015	-0.012	0.671	0.676
E9	-0.044	-0.037	0.679	-0.036	0.948	-0.02	0.484	-0.043	0.695	0.937	-0.036	-0.038	0.487	0.489

E10	-0.044	-0.037	0.679	-0.036	0.948	-0.02	0.484	-0.044	0.694	0.938	-0.037	-0.038	0.487	0.489
E11	-0.038	-0.037	0.679	-0.036	0.938	-0.02	0.499	-0.035	0.711	0.933	-0.031	-0.037	0.502	0.503
E12	-0.008	-0.037	0.672	-0.036	0.693	-0.02	0.675	-0.011	0.936	0.675	-0.013	-0.013	0.677	0.681
E13	-0.042	-0.037	0.942	-0.036	0.95	0.713	0.484	-0.043	0.691	0.943	-0.034	-0.034	0.486	0.487
E14	-0.042	-0.035	-0.036	-0.032	0.95	-0.02	0.665	0.951	-0.029	-0.031	0.958	0.935	0.669	0.674
E15	-0.005	0.736	0.678	0.707	0.95	-0.02	0.67	-0.013	0.923	0.677	-0.011	-0.007	0.673	0.678
E16	-0.038	0.918	0.926	0.924	0.936	-0.02	0.498	-0.036	0.707	0.928	-0.031	-0.036	0.5	0.503
E17	0.908	-0.033	-0.037	-0.032	0.936	-0.017	0.672	0.956	-0.024	-0.031	0.963	0.94	0.676	0.68
E18	0.906	-0.032	-0.033	-0.028	0.936	-0.018	0.667	0.952	-0.026	-0.028	0.96	0.937	0.672	0.677
E19	-0.044	0.936	0.938	0.94	0.948	0.716	0.484	-0.043	0.695	-0.028	-0.036	-0.038	0.487	0.489
E20	-0.042	0.938	0.942	0.939	0.948	0.713	0.483	-0.044	0.691	-0.028	-0.035	-0.035	0.486	0.487
E21	-0.042	-0.034	-0.038	-0.031	0.948	-0.017	0.67	0.957	-0.025	-0.032	0.963	0.941	0.675	0.68
E22	-0.007	0.741	0.682	0.714	0.701	-0.017	0.673	-0.015	0.931	0.681	-0.014	-0.012	0.677	0.681
E23	-0.006	0.739	0.68	0.711	0.701	-0.017	0.671	-0.015	0.924	0.679	-0.013	-0.009	0.674	0.678
E24	-0.044	0.936	0.937	0.94	0.948	-0.017	0.484	-0.043	0.695	0.937	-0.036	-0.038	0.487	0.489
E25	0.639	0.512	0.47	0.495	0.948	0.677	0.484	0.671	0.655	0.472	0.677	0.661	0.976	0.982
E26	0.639	-0.035	-0.036	-0.032	0.701	-0.02	0.665	0.671	-0.029	-0.031	0.958	0.935	0.669	0.674
E27	0.639	-0.03	-0.031	-0.026	0.701	-0.017	0.668	0.671	-0.025	-0.026	0.96	0.936	0.673	0.677
E28	0.639	-0.03	-0.031	-0.026	0.701	-0.017	0.668	0.671	-0.025	-0.026	0.96	0.936	0.673	0.677
E29	-0.044	0.936	-0.031	-0.026	0.948	0.715	0.484	-0.043	0.695	0.937	-0.036	-0.038	0.487	0.489
E30	0.639	0.512	0.469	0.494	0.948	0.678	0.484	0.67	0.655	0.471	0.677	0.661	0.975	0.981
E31	0.909	-0.036	-0.035	-0.033	0.948	-0.019	0.484	0.956	-0.027	-0.032	0.964	0.94	0.674	0.679
E32	-0.041	0.949	-0.035	0.95	0.963	0.704	0.477	-0.044	0.682	0.965	-0.036	-0.033	0.48	0.481
E33	0.905	-0.03	-0.03	-0.027	0.963	-0.017	0.669	-0.044	-0.025	-0.026	0.96	0.937	0.673	0.677
E34	-0.008	0.736	0.678	0.71	0.963	0.946	0.666	-0.014	0.923	0.677	-0.016	-0.013	0.669	0.674
E35	0.905	-0.03	-0.03	-0.027	0.701	-0.017	0.669	-0.014	-0.025	-0.026	0.96	0.936	0.673	0.678
E36	0.909	-0.038	-0.035	-0.033	0.701	-0.017	0.67	-0.014	-0.026	-0.031	0.964	0.942	0.676	0.679
E37	0.639	0.51	0.469	0.494	0.484	0.678	0.972	0.67	0.657	0.47	0.676	0.66	0.978	0.984

E38	-0.039	0.94	0.949	0.94	0.951	0.678	0.483	-0.043	0.688	0.47	-0.034	-0.033	0.486	0.486
E39	-0.044	0.936	0.937	0.94	0.948	0.678	0.484	-0.043	0.695	0.47	-0.036	-0.038	0.487	0.489
E40	0.906	-0.034	-0.034	-0.032	-0.03	-0.016	0.671	0.952	-0.024	-0.031	0.961	0.937	0.674	0.679
E41	0.641	0.507	0.466	0.49	0.484	0.679	0.972	0.673	0.656	0.468	0.677	0.664	0.977	0.983
E42	0.909	-0.034	-0.035	-0.033	-0.03	-0.015	0.675	0.673	-0.024	-0.033	0.965	0.94	0.679	0.683
E43	-0.039	0.942	0.953	0.941	0.953	-0.015	0.48	-0.042	0.684	0.958	-0.034	-0.033	0.483	0.483
E44	0.905	-0.035	-0.036	-0.032	0.701	-0.02	0.665	-0.042	-0.029	-0.031	0.958	0.935	0.669	0.674
E45	0.64	0.508	0.465	0.49	0.701	0.677	0.97	0.671	0.655	0.467	0.676	0.661	0.975	0.981
E46	0.911	-0.036	-0.036	-0.033	0.701	-0.015	0.672	0.671	-0.023	-0.032	0.963	0.941	0.678	0.682
E47	-0.045	0.947	0.966	-0.033	0.971	0.689	0.468	-0.043	0.672	0.976	-0.035	-0.036	0.471	0.472
E48	-0.036	0.946	0.961	-0.033	0.96	0.696	0.474	-0.04	0.675	0.968	-0.032	-0.029	0.477	0.478
E49	-0.044	0.936	0.937	-0.033	0.948	0.696	0.484	-0.043	0.695	0.937	-0.036	-0.038	0.487	0.489
E50	0.906	-0.036	-0.037	-0.035	-0.03	-0.017	0.671	-0.043	-0.024	-0.034	0.96	0.936	0.674	0.678
F1	-0.019	0.748	0.691	0.723	0.708	1	0.673	-0.018	0.936	0.688	-0.017	-0.019	0.676	0.678
F2	0.908	-0.037	-0.035	-0.031	-0.032	1	0.673	-0.018	-0.027	-0.032	0.966	0.94	0.677	0.681
F3	-0.013	0.742	0.683	0.714	0.699	0.953	0.67	-0.014	0.933	0.681	-0.011	-0.013	0.678	0.681
F4	0.907	-0.031	-0.032	-0.027	-0.028	0.953	0.674	-0.014	-0.019	-0.029	0.964	0.938	0.678	0.682
F5	0.634	0.512	0.468	0.494	0.483	0.953	0.97	0.67	0.66	0.469	0.678	0.659	0.977	0.983
F6	0.898	-0.035	-0.033	-0.031	-0.032	0.953	0.667	0.945	-0.023	-0.033	0.951	0.934	0.67	0.673
F7	0.632	0.516	0.474	0.499	0.487	0.953	0.972	0.667	0.666	0.473	0.672	0.657	0.977	0.982
F8	-0.037	0.947	0.964	0.955	0.965	0.953	0.472	-0.028	0.679	0.973	-0.024	-0.03	0.475	0.476
F9	-0.039	0.948	0.965	0.955	0.965	0.953	0.47	-0.031	0.68	0.973	-0.027	-0.032	0.474	0.474
F10	0.637	0.511	0.469	0.497	0.483	0.677	0.47	0.676	0.661	0.469	0.68	0.66	0.976	0.982
F11	0.905	-0.036	-0.035	-0.033	-0.034	-0.02	0.672	0.676	-0.025	-0.035	0.963	0.942	0.675	0.679
F12	-0.007	0.743	0.683	-0.033	0.698	0.954	0.679	-0.003	0.941	0.681	-0.004	-0.008	0.683	0.688
F13	-0.037	0.947	0.964	-0.033	0.698	0.954	0.473	-0.028	0.678	0.681	-0.024	-0.029	0.476	0.477
F14	-0.04	0.948	0.965	-0.033	0.698	0.954	0.47	-0.031	0.68	0.681	-0.027	-0.033	0.474	0.474
F15	-0.008	0.74	0.682	-0.033	0.698	0.952	0.676	-0.005	0.94	0.68	-0.006	-0.011	0.676	0.681

F16	0.635	0.514	0.471	0.498	0.485	0.952	0.676	0.674	0.661	0.471	0.679	0.662	0.977	0.984
F17	-0.012	0.743	0.683	0.498	0.699	0.955	0.675	-0.009	0.944	0.682	-0.009	-0.014	0.679	0.684
F18	-0.037	0.948	0.964	0.498	0.699	0.955	0.472	-0.03	0.678	0.682	-0.024	-0.031	0.476	0.476
F19	-0.04	0.947	0.965	0.498	0.699	0.955	0.47	-0.031	0.68	0.682	-0.027	-0.033	0.474	0.474
F20	0.906	-0.028	-0.03	-0.024	-0.027	0.707	0.676	-0.031	-0.016	-0.026	0.964	0.938	0.679	0.682
F21	0.91	-0.032	-0.032	-0.029	-0.03	0.707	0.676	-0.031	-0.021	-0.03	0.967	0.944	0.68	0.684
F22	-0.008	0.741	0.68	0.718	0.697	0.953	0.677	-0.005	0.942	0.679	-0.006	-0.011	0.68	0.685
F23	-0.008	0.513	0.468	0.496	0.483	0.678	0.677	0.674	0.661	0.47	0.679	0.66	0.976	0.982
F24	-0.008	-0.031	-0.032	-0.027	-0.028	0.707	0.674	0.956	-0.019	-0.029	0.964	0.938	0.678	0.682
F25	-0.008	-0.028	-0.03	-0.024	-0.027	0.707	0.676	0.957	-0.016	-0.026	0.964	0.938	0.679	0.682
F26	-0.039	0.948	0.965	0.955	0.965	0.707	0.47	-0.031	0.68	0.973	-0.027	-0.032	0.474	0.474
F27	0.637	0.512	0.468	0.496	0.483	0.707	0.47	0.674	0.661	0.47	0.68	0.66	0.976	0.983
F28	0.637	0.512	0.468	0.496	0.483	0.707	0.47	0.674	0.661	0.47	0.68	0.66	0.976	0.983
F29	0.637	0.511	0.469	0.498	0.485	0.707	0.47	0.675	0.662	0.47	0.68	0.66	0.976	0.982
F30	-0.012	0.74	0.68	0.715	0.696	0.953	0.673	-0.011	0.937	0.679	-0.009	-0.014	0.676	0.68
F31	0.909	-0.028	-0.029	-0.023	-0.025	0.953	0.677	-0.011	-0.017	-0.025	0.966	0.94	0.681	0.684
F32	-0.012	0.748	0.688	0.72	0.703	0.959	0.677	-0.012	0.939	0.687	-0.009	-0.012	0.68	0.685
F33	0.636	0.512	0.468	0.496	0.483	0.959	0.677	0.673	0.659	0.469	0.68	0.66	0.976	0.982
F34	0.637	0.511	0.469	0.498	0.484	0.959	0.677	0.675	0.661	0.47	0.68	0.66	0.976	0.982
F35	0.637	0.512	0.468	0.496	0.483	0.959	0.677	0.673	0.659	0.469	0.68	0.66	0.976	0.982
F36	-0.014	0.745	0.687	0.722	0.483	0.962	0.676	-0.01	0.941	0.685	-0.011	-0.016	0.676	0.68
F37	0.636	0.515	0.471	0.497	0.485	0.962	0.676	0.673	0.66	0.472	0.68	0.661	0.978	0.985
F38	0.636	0.512	0.468	0.495	0.482	0.962	0.676	0.673	0.659	0.469	0.68	0.661	0.977	0.983
F39	0.637	0.511	0.469	0.498	0.484	0.962	0.676	0.675	0.662	0.47	0.68	0.66	0.976	0.982
F40	0.636	0.512	0.468	0.495	0.482	0.677	0.676	0.673	0.659	0.469	0.68	0.661	0.977	0.983
F41	-0.018	0.749	0.691	0.724	0.482	0.969	0.673	-0.016	0.939	0.69	-0.015	-0.019	0.675	0.678
F42	-0.014	0.744	0.686	0.716	0.482	0.967	0.679	-0.017	0.938	0.684	-0.013	-0.015	0.678	0.683
F43	-0.013	0.74	0.68	0.713	0.696	0.954	0.672	-0.014	0.935	0.679	-0.011	-0.014	0.677	0.681

F44	-0.04	0.948	0.964	0.956	0.696	0.954	0.47	-0.031	0.68	0.973	-0.027	-0.033	0.473	0.474
F45	0.635	0.511	0.468	0.494	0.482	0.679	0.971	0.671	0.66	0.468	0.678	0.66	0.977	0.983
F46	-0.046	0.95	0.968	0.953	0.967	0.707	0.466	-0.042	0.674	0.468	-0.035	-0.037	0.471	0.471
F47	0.638	0.513	0.472	0.496	0.487	0.707	0.974	0.673	0.659	0.472	0.68	0.661	0.978	0.985
F48	-0.039	0.947	0.965	0.951	0.966	0.707	0.468	-0.036	0.672	0.472	-0.028	-0.033	0.475	0.474
F49	0.907	-0.031	-0.032	-0.027	-0.028	0.707	0.674	0.956	-0.019	-0.029	0.964	0.938	0.678	0.682
F50	-0.01	0.741	0.682	0.713	0.698	0.952	0.672	-0.012	0.934	0.68	-0.008	-0.011	0.679	0.682
G1	0.629	0.512	0.47	0.491	0.482	0.673	1	0.666	0.655	0.467	0.673	0.653	0.969	0.974
G2	-0.047	0.937	0.954	0.94	0.954	0.677	0.97	-0.043	0.662	0.467	-0.038	-0.04	0.462	0.459
G3	-0.048	0.939	0.953	0.941	0.952	0.68	0.97	-0.045	0.664	0.467	-0.039	-0.044	0.46	0.457
G4	-0.046	0.935	0.953	0.936	0.952	0.681	0.97	-0.045	0.667	0.467	-0.038	-0.043	0.464	0.462
G5	-0.048	0.94	0.953	0.942	0.953	0.681	0.97	-0.046	0.666	0.467	-0.04	-0.044	0.46	0.457
G6	0.634	0.512	0.468	0.496	0.483	0.676	0.97	0.668	0.66	0.471	0.673	0.656	0.972	0.978
G7	-0.012	0.735	0.674	0.711	0.69	0.943	0.97	-0.017	0.93	0.672	-0.018	-0.02	0.666	0.669
G8	0.634	0.512	0.471	0.494	0.483	0.673	0.97	0.669	0.656	0.471	0.674	0.655	0.971	0.975
G9	-0.045	0.934	0.952	0.935	0.951	0.681	0.762	-0.044	0.666	0.956	-0.038	-0.042	0.464	0.462
G10	0.634	0.512	0.471	0.494	0.483	0.673	0.97	0.668	0.655	0.471	0.673	0.655	0.971	0.975
G11	-0.046	0.938	0.471	0.943	0.483	0.686	0.97	-0.046	0.671	0.963	-0.039	-0.044	0.463	0.461
G12	-0.047	0.938	0.471	0.942	0.483	0.684	0.97	-0.047	0.67	0.964	-0.04	-0.045	0.462	0.459
G13	-0.019	0.727	0.67	0.7	0.683	0.684	0.97	-0.019	0.917	0.663	-0.02	-0.024	0.66	0.66
G14	-0.019	0.729	0.672	0.702	0.686	0.684	0.762	-0.022	0.915	0.663	-0.021	-0.025	0.657	0.657
G15	0.635	0.511	0.471	0.494	0.483	0.672	0.97	0.669	0.655	0.471	0.674	0.656	0.972	0.975
G16	-0.046	0.936	0.955	0.94	0.952	0.685	0.762	-0.045	0.672	0.96	-0.039	-0.044	0.464	0.462
G17	0.892	-0.028	-0.03	-0.025	-0.026	-0.015	0.762	0.938	-0.021	-0.026	0.946	0.922	0.666	0.666
G18	0.634	0.511	0.471	0.494	0.483	0.672	0.97	0.669	0.654	0.47	0.673	0.655	0.972	0.975
G19	-0.045	0.935	0.953	0.936	0.483	0.681	0.97	-0.044	0.667	0.47	-0.038	-0.042	0.464	0.462
G20	-0.045	0.936	0.954	0.937	0.483	0.679	0.97	-0.043	0.665	0.47	-0.037	-0.043	0.464	0.461
G21	0.895	-0.026	-0.026	-0.025	0.483	-0.017	0.97	-0.043	-0.02	-0.021	0.947	0.924	0.666	0.666

G22	-0.048	0.94	0.958	0.942	-0.024	0.684	0.97	-0.046	0.671	-0.021	-0.039	-0.045	0.464	0.461
G23	-0.046	0.938	0.956	0.939	-0.024	0.681	0.97	-0.043	0.667	-0.021	-0.038	-0.043	0.464	0.461
G24	0.89	-0.031	-0.029	-0.029	-0.029	-0.022	0.97	-0.043	-0.023	-0.025	0.944	0.918	0.66	0.66
G25	-0.045	0.937	0.955	0.939	0.954	0.68	0.97	-0.042	0.666	0.96	-0.037	-0.042	0.464	0.462
G26	0.635	0.513	0.472	0.495	0.484	0.672	0.969	0.669	0.655	0.471	0.674	0.655	0.972	0.976
G27	0.889	-0.03	-0.029	-0.028	-0.027	-0.02	0.969	0.669	-0.023	-0.027	0.944	0.918	0.662	0.662
G28	0.889	-0.03	-0.029	-0.028	-0.027	-0.02	0.969	0.936	-0.023	-0.027	0.944	0.918	0.662	0.662
G29	-0.02	0.729	0.671	-0.028	0.687	-0.02	0.969	-0.023	0.915	0.663	-0.022	-0.026	0.657	0.657
G30	-0.016	0.728	0.671	-0.028	0.685	-0.02	0.969	-0.016	0.921	0.664	-0.018	-0.021	0.663	0.662
G31	-0.021	0.734	0.676	-0.028	0.688	-0.02	0.662	-0.025	0.923	0.669	-0.022	-0.026	0.663	0.663
G32	0.634	0.515	0.474	0.498	0.487	0.675	0.972	0.67	0.657	0.473	0.676	0.657	0.975	0.978
G33	-0.046	0.939	0.954	0.94	0.487	0.681	0.461	-0.042	0.667	0.959	-0.038	-0.043	0.464	0.461
G34	0.635	0.512	0.472	0.495	0.484	0.672	0.969	0.669	0.655	0.471	0.674	0.655	0.972	0.976
G35	0.89	-0.03	-0.029	-0.027	-0.026	-0.019	0.969	0.936	-0.024	-0.027	0.944	0.918	0.662	0.662
G36	0.893	-0.031	-0.03	-0.029	-0.03	-0.024	0.969	0.941	-0.026	-0.026	0.953	0.923	0.661	0.662
G37	-0.05	0.941	-0.03	0.943	0.957	0.682	0.969	-0.045	0.666	0.964	-0.041	-0.044	0.463	0.461
G38	-0.02	0.734	0.672	0.708	0.688	0.682	0.969	-0.019	0.922	0.668	-0.021	-0.024	0.661	0.661
G39	0.89	-0.031	-0.029	-0.028	-0.029	-0.023	0.659	0.936	-0.023	-0.024	0.944	0.918	0.66	0.66
G40	-0.046	0.939	0.955	0.941	0.952	0.681	0.462	-0.042	0.667	-0.024	-0.037	-0.042	0.464	0.461
G41	-0.048	0.939	0.958	0.939	0.957	0.684	0.465	-0.047	0.666	-0.024	-0.04	-0.041	0.463	0.461
G42	-0.045	0.941	0.958	0.943	0.958	0.682	0.462	-0.04	0.665	-0.024	-0.036	-0.037	0.467	0.464
G43	-0.045	0.94	0.954	0.941	0.952	0.682	0.46	-0.042	0.667	-0.024	-0.038	-0.041	0.463	0.46
G44	0.635	0.512	0.471	0.495	0.484	0.672	0.969	0.669	0.655	0.471	0.674	0.655	0.972	0.976
G45	-0.044	0.94	0.955	0.942	0.953	0.682	0.969	-0.041	0.668	0.471	-0.037	-0.041	0.465	0.462
G46	-0.052	0.939	0.958	0.941	0.959	0.683	0.969	-0.05	0.667	0.471	-0.043	-0.044	0.46	0.458
G47	0.889	-0.027	-0.031	-0.029	-0.028	-0.019	0.969	0.937	-0.027	-0.029	0.951	0.923	0.664	0.665
G48	-0.022	0.732	0.668	0.706	0.685	0.933	0.969	-0.022	0.918	0.665	-0.021	-0.025	0.657	0.657
G49	0.635	0.512	0.471	0.495	0.484	0.672	0.97	0.669	0.655	0.471	0.674	0.655	0.972	0.976

G50	-0.045	0.939	0.952	0.94	0.951	0.681	0.46	-0.042	0.666	0.96	-0.038	-0.041	0.463	0.46
H1	0.901	-0.041	-0.039	-0.035	-0.038	-0.018	0.666	1	0.666	-0.037	0.958	0.93	0.67	0.674
H2	-0.022	0.72	0.673	0.692	0.681	-0.018	0.656	1	0.666	0.658	-0.023	-0.019	0.66	0.658
H3	-0.019	0.717	0.662	0.692	0.673	-0.018	0.647	1	0.666	0.652	-0.022	-0.022	0.657	0.654
H4	-0.043	0.931	0.951	0.933	0.673	0.678	0.458	1	0.665	0.652	-0.036	-0.04	0.461	0.46
H5	-0.042	0.932	0.953	0.934	0.673	0.677	0.456	0.946	0.661	0.652	-0.037	-0.037	0.465	0.46
H6	-0.023	0.725	0.672	0.697	0.678	0.939	0.658	0.946	0.661	0.661	-0.017	-0.019	0.666	0.665
H7	0.891	-0.036	-0.033	-0.037	-0.034	-0.021	0.66	0.946	0.661	-0.038	0.95	0.926	0.662	0.666
H8	-0.017	0.716	0.66	0.693	0.671	-0.021	0.652	0.946	0.661	0.657	-0.017	-0.02	0.655	0.655
H9	-0.019	0.714	0.658	0.69	0.67	-0.021	0.649	0.946	0.661	0.656	-0.018	-0.023	0.653	0.653
H10	-0.017	0.716	0.66	0.693	0.671	-0.021	0.652	0.946	0.661	0.657	-0.017	-0.02	0.655	0.655
H11	0.634	0.508	0.468	0.49	0.478	0.675	0.652	0.673	0.656	0.465	0.678	0.66	0.976	0.98
H12	0.634	0.508	0.467	0.491	0.478	0.675	0.652	0.673	0.655	0.465	0.677	0.661	0.976	0.98
H13	0.634	-0.038	-0.034	-0.034	-0.036	-0.021	0.659	0.948	-0.024	-0.035	0.947	0.925	0.662	0.664
H14	0.634	-0.038	-0.035	-0.034	-0.038	-0.02	0.658	0.948	-0.024	-0.037	0.946	0.924	0.661	0.665
H15	-0.018	0.716	0.662	0.691	0.671	0.925	0.65	-0.01	0.91	0.656	-0.018	-0.022	0.654	0.653
H16	0.892	-0.033	-0.03	-0.032	-0.031	-0.017	0.664	0.945	-0.024	-0.034	0.949	0.929	0.666	0.67
H17	-0.02	0.723	0.669	0.696	0.676	0.937	0.658	0.945	0.919	0.658	-0.018	-0.018	0.665	0.664
H18	-0.021	0.714	0.662	0.69	0.67	0.924	0.648	0.945	0.909	0.654	-0.019	-0.022	0.653	0.653
H19	0.633	0.506	0.464	0.489	0.475	0.672	0.648	0.945	0.656	0.464	0.676	0.659	0.972	0.976
H20	-0.043	0.932	0.953	0.932	0.947	0.678	0.458	0.945	0.664	0.958	-0.036	-0.039	0.462	0.46
H21	-0.043	0.937	0.956	0.936	0.95	0.681	0.461	0.945	0.667	0.962	-0.035	-0.037	0.465	0.464
H22	-0.043	0.936	0.959	0.937	0.951	0.681	0.46	0.945	0.666	0.962	-0.037	-0.038	0.467	0.464
H23	0.634	0.507	0.466	0.49	0.476	0.673	0.967	0.945	0.656	0.463	0.677	0.66	0.973	0.977
H24	-0.019	0.714	0.658	0.69	0.669	0.924	0.649	0.945	0.911	0.656	-0.018	-0.022	0.653	0.653
H25	-0.043	0.932	0.954	0.933	0.948	0.678	0.458	0.945	0.664	0.958	-0.036	-0.038	0.463	0.461
H26	-0.019	0.714	0.657	0.69	0.67	0.924	0.649	0.945	0.911	0.656	-0.018	-0.023	0.652	0.653
H27	-0.044	0.932	0.955	0.933	0.67	0.677	0.457	0.945	0.662	0.957	-0.037	-0.039	0.462	0.46

H28	-0.044	0.932	0.955	0.933	0.67	0.677	0.457	0.945	0.662	0.957	-0.037	-0.039	0.462	0.46
H29	-0.019	0.714	0.658	0.69	0.669	0.924	0.649	0.945	0.662	0.656	-0.018	-0.022	0.653	0.653
H30	-0.021	0.717	0.664	0.691	0.672	0.925	0.649	0.945	0.662	0.654	-0.021	-0.021	0.654	0.653
H31	-0.045	0.935	0.954	0.939	0.951	0.681	0.458	0.736	0.668	0.964	-0.036	-0.041	0.461	0.46
H32	-0.024	0.724	0.67	0.699	0.68	0.681	0.652	0.736	0.916	0.662	-0.024	-0.025	0.656	0.656
H33	-0.024	0.717	0.663	0.69	0.672	0.681	0.647	0.736	0.91	0.653	-0.024	-0.025	0.653	0.652
H34	-0.019	0.714	0.658	0.69	0.669	0.681	0.649	0.736	0.911	0.656	-0.018	-0.022	0.653	0.653
H35	0.887	-0.043	-0.039	-0.042	-0.042	-0.025	0.654	0.736	-0.028	-0.041	0.944	0.923	0.656	0.659
H36	0.896	-0.038	-0.036	-0.034	-0.037	-0.02	0.663	0.958	-0.025	-0.038	0.951	0.93	0.666	0.67
H37	0.897	-0.039	-0.037	-0.035	-0.036	-0.023	0.66	0.954	-0.023	-0.036	0.952	0.929	0.663	0.666
H38	-0.02	0.718	0.662	0.693	0.673	0.926	0.647	-0.02	-0.023	0.654	-0.021	-0.023	0.654	0.654
H39	-0.019	0.714	0.658	0.691	0.669	0.924	0.649	0.736	-0.023	0.656	-0.018	-0.022	0.653	0.653
H40	-0.021	0.717	0.662	0.692	0.672	0.925	0.646	0.736	0.909	0.654	-0.022	-0.023	0.653	0.653
H41	-0.043	0.936	0.955	0.939	0.672	0.681	0.46	-0.03	0.67	0.965	-0.036	-0.039	0.463	0.463
H42	-0.046	0.937	0.959	0.936	0.672	0.682	0.457	-0.04	0.663	0.963	-0.04	-0.04	0.463	0.459
H43	0.634	0.506	0.463	0.489	0.476	0.674	0.965	0.672	0.655	0.461	0.675	0.66	0.973	0.977
H44	-0.019	0.714	0.658	0.69	0.669	0.924	0.649	-0.01	0.911	0.656	-0.018	-0.022	0.653	0.653
H45	-0.019	-0.039	-0.036	-0.038	-0.039	-0.021	0.655	0.942	-0.026	-0.039	0.942	0.923	0.657	0.661
H46	-0.019	-0.039	-0.039	-0.035	-0.038	-0.02	0.662	0.983	-0.023	-0.037	0.955	0.929	0.668	0.672
H47	-0.049	0.936	0.958	0.936	0.952	0.681	0.455	0.983	0.661	0.963	-0.042	-0.042	0.461	0.458
H48	0.634	0.507	0.464	0.489	0.477	0.674	0.965	0.983	0.656	0.462	0.674	0.66	0.973	0.977
H49	-0.044	0.931	0.951	0.489	0.947	0.678	0.458	0.983	0.666	0.959	-0.036	-0.04	0.461	0.46
H50	-0.043	0.933	0.953	0.489	0.949	0.678	0.456	0.983	0.661	0.957	-0.037	-0.038	0.465	0.46
I1	-0.025	0.737	0.675	0.489	0.689	0.936	0.655	-0.022	1	0.673	-0.022	-0.029	0.656	0.657
I2	0.637	0.51	0.467	0.489	0.481	0.676	0.97	0.672	0.707	0.468	0.678	0.66	0.974	0.978
I3	0.633	0.512	0.469	0.489	0.481	0.678	0.968	0.667	0.707	0.466	0.673	0.657	0.973	0.977
I4	-0.021	0.728	0.673	0.489	0.682	0.943	0.661	-0.013	0.935	0.665	-0.015	-0.022	0.663	0.665
I5	0.896	-0.039	-0.039	-0.039	-0.039	-0.021	0.658	0.94	0.707	-0.04	0.947	0.931	0.661	0.664

I6	0.636	0.514	0.472	0.496	0.484	0.681	0.658	0.667	0.707	0.471	0.672	0.659	0.974	0.98
I7	0.636	0.514	0.472	0.496	0.484	0.681	0.658	0.667	0.707	0.471	0.672	0.66	0.975	0.98
I8	0.897	-0.027	-0.03	-0.026	-0.03	-0.014	0.659	0.938	0.707	-0.028	0.948	0.929	0.665	0.667
I9	-0.02	0.728	0.673	0.703	0.682	0.943	0.662	-0.012	0.936	0.665	-0.014	-0.021	0.665	0.667
I10	0.897	-0.028	-0.031	-0.027	-0.031	-0.014	0.659	-0.012	0.936	-0.028	0.947	0.929	0.665	0.667
I11	0.636	0.513	0.471	0.495	0.483	0.679	0.659	0.67	0.936	0.47	0.674	0.66	0.976	0.981
I12	0.636	-0.035	-0.039	-0.035	-0.035	-0.017	0.665	0.67	0.936	-0.036	0.954	0.937	0.668	0.671
I13	0.636	0.511	0.469	0.494	0.48	0.678	0.665	0.669	0.936	0.468	0.672	0.657	0.971	0.976
I14	0.634	0.514	0.471	0.497	0.482	0.679	0.665	0.667	0.936	0.469	0.671	0.656	0.972	0.976
I15	-0.018	0.724	0.671	0.7	0.681	0.679	0.665	-0.013	0.936	0.662	-0.016	-0.023	0.663	0.665
I16	0.638	0.512	0.47	0.496	0.482	0.678	0.97	0.672	0.936	0.469	0.677	0.66	0.976	0.98
I17	-0.05	0.924	0.938	0.931	0.941	0.678	0.487	-0.043	0.708	0.939	-0.036	-0.047	0.49	0.489
I18	-0.056	0.918	0.931	0.927	0.936	0.678	0.482	-0.045	0.708	0.931	-0.039	-0.053	0.483	0.483
I19	0.634	0.514	0.471	0.497	0.482	0.679	0.966	0.667	0.708	0.469	0.671	0.656	0.972	0.976
I20	0.635	0.512	0.469	0.495	0.48	0.678	0.967	0.67	0.708	0.468	0.673	0.658	0.972	0.977
I21	0.637	0.513	0.471	0.496	0.482	0.679	0.97	0.672	0.708	0.469	0.676	0.66	0.976	0.98
I22	-0.05	0.924	0.938	0.929	0.94	0.721	0.487	-0.043	0.707	0.94	-0.036	-0.048	0.488	0.488
I23	0.635	0.511	0.468	0.493	0.48	0.678	0.487	0.67	0.661	0.467	0.674	0.658	0.972	0.977
I24	-0.02	0.728	0.673	0.703	0.682	0.678	0.662	-0.013	0.935	0.665	-0.014	-0.022	0.664	0.666
I25	-0.056	0.918	0.931	0.927	0.682	0.678	0.483	-0.045	0.708	0.932	-0.04	-0.053	0.484	0.484
I26	-0.019	0.727	0.673	0.703	0.682	0.678	0.662	-0.012	0.936	0.664	-0.014	-0.021	0.665	0.667
I27	0.636	0.511	0.468	0.493	0.48	0.676	0.662	0.672	0.936	0.467	0.676	0.659	0.973	0.977
I28	0.636	0.511	0.468	0.493	0.48	0.676	0.662	0.672	0.936	0.467	0.676	0.659	0.973	0.977
I29	0.897	-0.03	-0.033	-0.028	-0.032	-0.016	0.657	0.936	0.936	-0.03	0.946	0.929	0.663	0.665
I30	-0.055	0.918	0.93	0.926	0.936	0.719	0.484	-0.045	0.707	0.933	-0.04	-0.052	0.484	0.484
I31	0.903	-0.033	-0.035	-0.031	-0.034	-0.017	0.662	0.945	0.707	-0.032	0.953	0.935	0.668	0.67
I32	-0.021	0.733	0.676	-0.031	0.69	-0.017	0.665	-0.016	0.94	0.672	-0.019	-0.026	0.666	0.667
I33	-0.054	0.919	0.931	-0.031	0.933	-0.017	0.481	-0.046	0.94	0.934	-0.039	-0.051	0.481	0.48

I34	-0.055	0.92	0.931	-0.031	0.936	0.722	0.485	-0.044	0.94	0.93	-0.037	-0.05	0.487	0.486
I35	0.897	-0.035	-0.035	-0.035	-0.037	-0.016	0.661	0.94	0.94	-0.034	0.948	0.932	0.665	0.666
I36	0.635	0.513	0.471	0.496	0.483	0.677	0.661	0.673	0.94	0.471	0.676	0.658	0.975	0.979
I37	0.639	0.51	0.467	0.494	0.48	0.676	0.661	0.675	0.71	0.468	0.679	0.661	0.975	0.979
I38	0.635	0.512	0.47	0.494	0.48	0.678	0.661	0.668	0.659	0.468	0.673	0.658	0.972	0.977
I39	0.897	-0.029	-0.033	-0.028	-0.032	-0.016	0.657	0.668	-0.02	-0.03	0.946	0.929	0.663	0.665
I40	0.635	0.512	0.47	0.495	0.481	0.678	0.657	0.667	0.66	0.469	0.673	0.657	0.972	0.977
I41	-0.054	0.924	0.929	0.932	0.481	0.678	0.49	-0.047	0.728	0.923	-0.038	-0.049	0.49	0.489
I42	-0.051	0.944	0.96	0.951	0.481	0.698	0.468	-0.043	0.728	0.965	-0.036	-0.045	0.471	0.47
I43	0.897	-0.034	-0.034	-0.035	-0.036	-0.02	0.658	0.939	0.728	-0.034	0.946	0.931	0.661	0.664
I44	-0.021	0.728	0.673	0.703	0.682	-0.02	0.661	-0.013	0.935	0.665	-0.015	-0.022	0.664	0.666
I45	0.897	-0.034	-0.034	-0.034	-0.036	-0.02	0.658	0.939	0.935	-0.034	0.947	0.931	0.661	0.664
I46	-0.053	0.932	0.933	0.943	0.941	-0.02	0.491	-0.047	0.74	0.928	-0.038	-0.048	0.491	0.489
I47	-0.048	0.945	0.963	0.95	0.961	0.692	0.465	-0.039	0.74	0.97	-0.034	-0.042	0.468	0.468
I48	0.634	0.514	0.471	0.496	0.483	0.678	0.465	0.668	0.74	0.469	0.674	0.657	0.973	0.978
I49	0.897	-0.029	-0.032	-0.028	-0.032	-0.016	0.658	0.937	0.74	-0.029	0.946	0.929	0.663	0.665
I50	0.635	0.515	0.472	0.497	0.484	0.678	0.969	0.668	0.661	0.47	0.674	0.657	0.973	0.978
J1	-0.041	0.945	0.966	0.949	0.966	0.688	0.467	-0.037	0.673	1	-0.031	-0.031	0.472	0.471
J2	-0.041	0.946	0.966	0.948	0.965	0.688	0.469	-0.034	0.673	0.976	-0.03	-0.03	0.473	0.472
J3	0	0.742	0.681	0.714	0.701	0.688	0.686	-0.001	0.936	0.976	-0.001	-0.001	0.69	0.691
J4	0.636	0.511	0.471	0.495	0.485	0.677	0.972	0.671	0.656	0.976	0.678	0.66	0.975	0.981
J5	0.899	-0.038	-0.037	-0.035	-0.033	-0.021	0.666	0.948	-0.025	0.976	0.954	0.929	0.666	0.67
J6	0.903	-0.035	-0.036	-0.035	-0.032	-0.015	0.671	0.95	-0.023	0.976	0.96	0.936	0.673	0.678
J7	-0.005	0.743	0.683	0.715	0.7	0.961	0.686	-0.007	0.943	0.682	-0.007	-0.005	0.689	0.693
J8	-0.034	0.945	0.965	0.947	0.965	0.686	0.473	-0.032	0.67	0.977	-0.024	-0.023	0.476	0.476
J9	-0.005	0.742	0.685	0.714	0.702	0.686	0.682	-0.007	0.934	0.977	-0.004	-0.003	0.684	0.688
J10	-0.006	0.743	0.685	0.716	0.703	0.686	0.682	-0.007	0.934	0.977	-0.005	-0.004	0.683	0.688
J11	0.637	0.512	0.47	0.494	0.484	0.679	0.682	0.671	0.66	0.47	0.678	0.662	0.977	0.984

J12	0.904	-0.034	-0.035	-0.032	-0.031	-0.015	0.671	0.95	-0.022	0.977	0.96	0.934	0.673	0.678
J13	-0.008	0.743	0.685	0.716	-0.031	0.953	0.68	-0.009	0.935	0.977	-0.007	-0.006	0.683	0.687
J14	0.636	0.51	0.47	0.493	0.484	0.676	0.68	0.671	0.656	0.977	0.679	0.66	0.975	0.981
J15	0.637	0.51	0.47	0.494	0.484	0.676	0.68	0.672	0.656	0.977	0.678	0.66	0.976	0.982
J16	0.904	-0.037	-0.037	-0.035	-0.033	-0.019	0.668	0.95	-0.027	0.977	0.96	0.936	0.67	0.675
J17	-0.031	0.946	0.967	0.95	0.968	0.687	0.475	-0.029	0.671	0.979	-0.024	-0.023	0.479	0.478
J18	0.635	0.511	0.47	0.494	0.484	0.676	0.475	0.672	0.657	0.469	0.678	0.66	0.976	0.981
J19	0.9	-0.042	-0.04	-0.04	-0.038	-0.023	0.664	0.672	-0.032	-0.04	0.957	0.931	0.665	0.67
J20	-0.034	0.945	0.965	0.948	0.965	0.686	0.473	-0.031	0.67	0.977	-0.023	-0.023	0.477	0.477
J21	0.637	0.511	0.469	0.495	0.485	0.677	0.473	0.673	0.658	0.977	0.679	0.661	0.977	0.983
J22	0.903	-0.038	-0.037	-0.035	-0.032	-0.02	0.668	0.952	-0.027	0.977	0.961	0.935	0.67	0.674
J23	-0.034	0.945	0.965	0.948	-0.032	0.686	0.472	-0.031	0.67	0.978	-0.024	-0.024	0.478	0.477
J24	0.9	-0.042	-0.04	-0.04	-0.038	-0.023	0.664	-0.031	-0.032	0.978	0.958	0.931	0.666	0.67
J25	-0.006	0.742	0.684	0.718	0.703	0.952	0.682	-0.031	0.934	0.978	-0.005	-0.004	0.686	0.688
J26	0.9	-0.042	-0.04	-0.04	-0.038	-0.023	0.664	-0.031	-0.032	0.978	0.957	0.931	0.665	0.67
J27	0.9	-0.038	-0.038	-0.035	-0.035	-0.021	0.666	-0.031	-0.028	0.978	0.957	0.93	0.669	0.672
J28	0.9	-0.038	-0.038	-0.035	-0.035	-0.021	0.666	-0.031	-0.028	0.978	0.957	0.93	0.669	0.672
J29	0.636	0.511	0.47	0.494	0.484	0.677	0.666	0.671	0.656	0.469	0.678	0.66	0.975	0.981
J30	-0.033	0.945	0.964	0.948	0.965	0.685	0.472	-0.03	0.67	0.978	-0.024	-0.024	0.477	0.476
J31	0.636	0.515	0.474	0.498	0.488	0.679	0.973	0.671	0.66	0.472	0.678	0.661	0.978	0.983
J32	-0.006	0.746	0.687	0.721	0.707	0.956	0.685	-0.006	0.938	0.689	-0.004	-0.005	0.689	0.69
J33	0.901	-0.038	-0.036	-0.034	-0.034	-0.021	0.666	0.95	-0.028	-0.04	0.957	0.93	0.669	0.672
J34	-0.032	0.945	-0.036	0.946	-0.034	0.686	0.474	-0.031	0.67	0.977	-0.022	-0.021	0.477	0.477
J35	-0.006	0.74	0.682	0.714	-0.034	0.686	0.683	-0.005	0.936	0.682	-0.004	-0.004	0.687	0.69
J36	-0.006	-0.039	-0.04	-0.037	-0.037	-0.021	0.666	0.949	-0.028	0.789	0.96	0.935	0.67	0.673
J37	-0.037	0.948	0.966	0.951	-0.037	0.687	0.471	-0.034	0.672	0.982	-0.027	-0.026	0.476	0.475
J38	-0.004	0.741	0.684	0.715	-0.037	0.954	0.684	-0.005	0.937	0.684	-0.004	-0.005	0.688	0.69
J39	-0.032	0.945	0.684	0.946	-0.037	0.686	0.474	-0.031	0.67	0.977	-0.022	-0.021	0.477	0.477

J40	-0.033	0.945	0.684	0.947	-0.037	0.686	0.473	-0.029	0.67	0.978	-0.023	-0.024	0.479	0.477
J41	-0.036	0.946	0.684	0.949	-0.037	0.688	0.473	-0.033	0.673	0.985	-0.025	-0.025	0.477	0.475
J42	0.636	0.516	0.473	0.5	0.489	0.68	0.473	0.671	0.661	0.985	0.677	0.661	0.979	0.983
J43	-0.032	0.946	0.473	0.947	0.965	0.686	0.475	-0.028	0.671	0.978	-0.021	-0.022	0.48	0.478
J44	-0.003	0.743	0.687	0.716	0.705	0.953	0.684	-0.004	0.934	0.789	-0.001	0.001	0.686	0.69
J45	0.638	0.51	0.469	0.493	0.483	0.676	0.684	0.673	0.658	0.789	0.677	0.66	0.977	0.981
J46	0.638	0.516	0.473	0.5	0.489	0.68	0.684	0.671	0.66	0.789	0.678	0.662	0.978	0.982
J47	-0.039	0.947	0.966	0.949	0.489	0.688	0.469	-0.036	0.671	0.982	-0.029	-0.028	0.474	0.474
J48	0.636	0.511	0.469	0.494	0.484	0.677	0.469	0.672	0.659	0.469	0.676	0.66	0.976	0.981
J49	-0.002	0.744	0.687	0.494	0.484	0.677	0.685	-0.004	0.934	0.687	0	0.001	0.687	0.691
J50	-0.004	0.742	0.684	0.494	0.484	0.677	0.685	-0.004	0.937	0.684	-0.004	-0.004	0.688	0.689
K1	0.908	-0.032	-0.035	-0.031	-0.032	-0.017	0.673	0.958	-0.022	-0.031	1	0.937	0.675	0.679
K2	-0.047	0.941	-0.035	0.945	0.961	0.705	0.479	-0.042	0.684	0.966	0.734	-0.04	0.48	0.48
K3	0.634	0.513	0.47	0.496	0.486	0.674	0.967	0.667	0.655	0.47	0.734	0.655	0.97	0.975
K4	-0.023	0.734	0.676	0.71	0.691	0.674	0.652	-0.027	0.919	0.672	0.734	-0.027	0.649	0.654
K5	0.634	0.512	0.469	0.495	0.485	0.674	0.652	0.667	0.655	0.469	0.734	0.656	0.971	0.975
K6	-0.049	0.947	0.966	0.951	0.963	0.692	0.465	-0.045	0.674	0.469	0.734	-0.041	0.468	0.467
K7	0.912	-0.034	-0.034	-0.031	-0.03	-0.016	0.672	0.954	-0.026	-0.032	0.965	0.941	0.675	0.678
K8	-0.024	0.737	0.679	0.713	0.695	-0.016	0.653	-0.025	0.92	0.675	0.965	-0.026	0.651	0.656
K9	0.903	-0.032	-0.032	-0.031	-0.031	-0.019	0.667	-0.025	-0.028	-0.032	0.962	0.933	0.669	0.673
K10	0.903	-0.032	-0.032	-0.031	-0.032	-0.02	0.667	0.947	-0.029	-0.032	0.962	0.933	0.669	0.672
K11	-0.026	0.744	0.69	0.722	0.703	-0.02	0.663	-0.024	-0.029	0.681	0.962	-0.026	0.661	0.664
K12	0.636	0.516	0.475	0.5	0.488	0.68	0.663	0.67	0.659	0.472	0.962	0.659	0.973	0.979
K13	0.633	0.514	0.473	0.498	0.487	0.673	0.663	0.667	0.655	0.471	0.962	0.656	0.967	0.974
K14	-0.046	0.945	0.961	0.949	0.961	0.688	0.464	-0.043	0.674	0.471	0.962	-0.039	0.465	0.465
K15	0.633	0.514	0.473	0.498	0.487	0.673	0.464	0.667	0.655	0.472	0.962	0.656	0.967	0.974
K16	0.633	-0.035	-0.034	-0.033	-0.031	-0.018	0.672	0.955	-0.026	-0.034	0.965	0.94	0.674	0.678
K17	0.635	0.513	0.472	0.499	0.487	0.678	0.672	0.67	0.657	0.471	0.965	0.659	0.971	0.977

K18	-0.021	0.737	0.681	0.715	0.697	0.933	0.654	-0.025	0.919	0.676	0.965	-0.025	0.65	0.655
K19	0.903	-0.032	-0.032	-0.031	-0.031	-0.019	0.667	0.947	-0.028	-0.032	0.962	0.933	0.669	0.673
K20	-0.022	0.738	0.682	0.715	0.698	0.934	0.654	-0.025	0.92	0.677	0.962	-0.025	0.65	0.655
K21	-0.026	0.743	0.689	0.719	0.698	0.944	0.658	-0.027	0.926	0.682	0.962	-0.027	0.656	0.66
K22	0.907	-0.031	-0.032	-0.03	-0.03	-0.017	0.673	0.952	-0.025	-0.032	0.965	0.939	0.675	0.678
K23	0.903	-0.032	-0.033	-0.029	-0.031	-0.019	0.67	0.948	-0.027	-0.032	0.962	0.933	0.671	0.674
K24	0.903	-0.032	-0.032	-0.031	-0.032	-0.019	0.667	0.947	-0.028	-0.032	0.962	0.933	0.669	0.673
K25	-0.023	0.737	0.681	0.716	0.699	-0.019	0.655	-0.025	0.92	0.677	0.962	-0.026	0.651	0.656
K26	0.634	0.513	0.471	0.497	0.485	0.674	0.966	0.667	0.655	0.47	0.962	0.656	0.968	0.974
K27	0.633	0.513	0.471	0.499	0.487	0.673	0.967	0.667	0.654	0.47	0.962	0.656	0.968	0.974
K28	0.633	0.513	0.471	0.499	0.487	0.673	0.967	0.667	0.654	0.47	0.676	0.656	0.968	0.974
K29	0.903	-0.032	-0.032	-0.031	-0.032	-0.019	0.667	0.947	-0.029	-0.032	0.962	0.933	0.669	0.673
K30	-0.023	0.739	0.683	0.718	0.702	0.935	0.654	-0.025	0.917	0.68	-0.02	-0.027	0.652	0.656
K31	0.908	-0.033	-0.034	-0.032	-0.033	-0.019	0.671	0.952	-0.028	-0.033	0.967	0.938	0.673	0.676
K32	0.638	0.512	0.47	0.497	0.485	0.675	0.971	0.672	0.655	0.47	0.967	0.66	0.974	0.978
K33	-0.021	0.735	0.677	0.714	0.697	0.675	0.654	-0.024	0.916	0.673	0.967	-0.026	0.651	0.654
K34	0.634	0.512	0.47	0.496	0.483	0.674	0.966	0.667	0.654	0.469	0.677	0.656	0.968	0.974
K35	-0.021	0.737	0.68	0.717	0.7	0.935	0.655	-0.024	0.917	0.677	-0.02	-0.026	0.653	0.655
K36	-0.019	0.74	0.677	0.711	0.696	0.945	0.662	-0.021	0.932	0.674	-0.02	-0.023	0.664	0.666
K37	0.635	0.51	0.468	0.496	0.482	0.674	0.662	0.668	0.653	0.467	0.678	0.657	0.97	0.974
K38	-0.045	0.943	0.961	0.948	0.962	0.687	0.463	-0.042	0.67	0.971	-0.04	-0.038	0.466	0.465
K39	0.634	0.512	0.47	0.496	0.483	0.674	0.966	0.667	0.654	0.469	0.677	0.656	0.968	0.974
K40	-0.022	0.736	0.679	0.496	0.699	0.937	0.655	-0.024	0.917	0.676	-0.02	-0.026	0.653	0.655
K41	0.636	0.514	0.469	0.495	0.484	0.676	0.968	0.668	0.661	0.47	0.682	0.658	0.973	0.978
K42	0.907	-0.032	-0.035	-0.029	-0.032	-0.015	0.674	0.955	-0.023	-0.031	0.967	0.936	0.674	0.678
K43	-0.021	0.733	0.675	0.71	0.695	0.937	0.656	-0.023	0.92	0.671	0.967	-0.026	0.655	0.657
K44	-0.046	0.944	0.961	0.948	0.96	0.688	0.463	-0.043	0.674	0.971	0.967	-0.039	0.465	0.465
K45	0.635	0.512	0.468	0.496	0.484	0.674	0.968	0.668	0.655	0.468	0.967	0.656	0.97	0.974

K46	0.908	-0.031	-0.035	-0.03	-0.032	-0.015	0.672	0.956	-0.02	-0.032	0.979	0.937	0.676	0.679
K47	0.634	0.517	0.475	0.502	0.491	0.679	0.672	0.668	0.656	0.473	0.979	0.656	0.972	0.977
K48	0.635	0.511	0.468	0.496	0.484	0.674	0.672	0.667	0.655	0.468	0.979	0.656	0.97	0.975
K49	-0.046	0.944	0.961	0.948	0.96	0.688	0.463	-0.043	0.673	0.971	-0.04	-0.039	0.465	0.465
K50	0.634	0.511	0.468	0.496	0.484	0.675	0.463	0.666	0.655	0.467	0.674	0.655	0.97	0.974
L1	0.888	-0.035	-0.038	-0.035	-0.03	-0.019	0.653	0.93	-0.029	-0.031	0.937	1	0.658	0.662
L2	0.628	0.516	0.475	0.499	0.486	0.686	0.653	0.661	0.666	0.472	0.666	1	0.974	0.979
L3	-0.001	0.727	0.673	0.699	0.681	0.686	0.68	0.005	0.921	0.662	0.007	1	0.682	0.685
L4	-0.046	0.924	0.926	0.93	0.935	0.733	0.503	-0.038	0.713	0.927	-0.03	1	0.507	0.504
L5	0.574	0.524	0.481	0.504	0.493	0.691	0.503	0.604	0.674	0.477	0.609	1	0.939	0.946
L6	0.588	0.526	0.48	0.505	0.494	0.69	0.503	0.622	0.675	0.479	0.627	0.755	0.953	0.959
L7	0.589	0.525	0.48	0.505	0.494	0.691	0.503	0.624	0.676	0.479	0.629	0.755	0.955	0.96
L8	-0.047	0.924	0.926	0.93	0.935	0.733	0.503	-0.039	0.713	0.927	-0.031	0.755	0.506	0.504
L9	0.85	-0.035	-0.04	-0.036	-0.034	-0.017	0.621	0.884	-0.024	-0.031	0.89	0.899	0.628	0.63
L10	-0.046	0.924	0.926	-0.036	0.934	0.733	0.503	-0.038	0.713	0.927	-0.03	0.899	0.507	0.504
L11	0.01	0.731	0.675	-0.036	0.684	0.941	0.694	0.018	0.928	0.666	0.02	0.899	0.697	0.699
L12	0.008	0.732	0.676	-0.036	0.683	0.942	0.693	0.018	0.928	0.666	0.018	0.899	0.695	0.698
L13	-0.045	0.925	0.676	-0.036	0.936	0.733	0.504	-0.037	0.712	0.666	-0.029	0.899	0.508	0.505
L14	-0.045	0.925	0.676	-0.036	0.935	0.734	0.504	-0.037	0.714	0.666	-0.029	0.899	0.507	0.506
L15	0.004	0.725	0.668	0.699	0.681	0.938	0.684	0.01	0.92	0.664	0.013	0.021	0.686	0.687
L16	-0.046	0.929	0.668	0.934	0.681	0.735	0.505	-0.04	0.714	0.664	-0.034	-0.03	0.507	0.505
L17	-0.046	0.929	0.668	0.934	0.681	0.73	0.5	-0.04	0.711	0.664	-0.035	-0.03	0.503	0.501
L18	-0.046	0.926	0.668	0.931	0.681	0.732	0.504	-0.038	0.711	0.664	-0.029	-0.03	0.507	0.504
L19	0.004	0.725	0.666	0.697	0.679	0.938	0.683	0.011	0.92	0.664	0.013	0.022	0.686	0.687
L20	0.848	-0.035	-0.039	-0.035	-0.033	-0.017	0.622	0.883	-0.023	-0.032	0.891	0.901	0.628	0.63
L21	-0.042	0.93	0.933	0.935	-0.033	0.739	0.508	-0.036	0.718	0.934	-0.03	0.901	0.511	0.509
L22	0.586	0.531	0.486	0.51	0.499	0.699	0.508	0.614	0.681	0.486	0.619	0.901	0.952	0.957
L23	0.585	0.524	0.478	0.503	0.492	0.691	0.508	0.612	0.674	0.478	0.617	0.901	0.945	0.949

L24	-0.045	0.925	0.926	0.93	0.492	0.691	0.504	-0.037	0.714	0.478	-0.029	0.901	0.508	0.506
L25	-0.047	0.925	0.929	0.931	0.492	0.691	0.502	-0.039	0.71	0.478	-0.03	0.899	0.506	0.503
L26	0.85	-0.035	-0.04	-0.035	-0.034	-0.017	0.621	-0.039	-0.024	-0.031	0.889	0.899	0.628	0.63
L27	0.847	-0.028	-0.034	-0.029	-0.027	-0.009	0.631	-0.039	-0.016	-0.028	0.892	0.901	0.633	0.638
L28	0.847	-0.028	-0.034	-0.029	-0.027	-0.009	0.631	0.885	-0.016	-0.028	0.892	0.901	0.633	0.638
L29	0.587	0.524	0.478	0.504	0.492	0.693	0.938	0.61	0.674	0.479	0.614	0.901	0.944	0.948
L30	0.003	0.727	0.672	0.7	0.682	0.939	0.681	0.007	0.921	0.665	0.009	0.901	0.684	0.685
L31	0.856	-0.035	-0.041	-0.036	-0.036	-0.02	0.628	0.894	-0.03	-0.034	0.901	0.91	0.632	0.635
L32	0.86	-0.03	-0.033	-0.029	-0.027	-0.014	0.636	0.899	-0.021	-0.03	0.907	0.918	0.639	0.644
L33	0.579	0.525	0.48	0.505	0.493	0.693	0.938	0.607	0.675	0.479	0.612	0.918	0.943	0.948
L34	0.003	0.726	0.667	0.697	0.68	0.937	0.683	0.01	0.675	0.662	0.013	0.918	0.685	0.686
L35	0.58	0.526	0.481	0.506	0.494	0.694	0.683	0.608	0.676	0.48	0.613	0.918	0.943	0.949
L36	-0.041	0.928	0.927	0.937	0.494	0.741	0.51	-0.033	0.676	0.925	-0.026	0.918	0.513	0.514
L37	-0.004	0.735	0.679	0.707	0.689	0.951	0.682	-0.002	0.676	0.672	-0.002	-0	0.684	0.685
L38	-0.048	0.928	0.939	0.934	0.689	0.726	0.497	-0.041	0.676	0.936	-0.034	-0.04	0.501	0.499
L39	0.85	-0.035	-0.04	-0.036	-0.034	-0.017	0.621	0.884	-0.024	-0.031	0.89	0.899	0.628	0.63
L40	0.579	0.526	0.482	0.506	0.494	0.693	0.939	0.608	0.675	0.48	0.612	0.899	0.943	0.949
L41	-0.013	0.732	0.676	0.708	0.688	0.693	0.672	-0.008	0.932	0.669	-0.009	0.899	0.677	0.678
L42	-0.013	-0.029	-0.028	-0.028	-0.024	-0.017	0.656	0.929	-0.024	-0.026	0.935	0.899	0.658	0.662
L43	-0.047	0.928	0.94	0.934	-0.024	0.725	0.497	-0.04	0.705	0.936	-0.033	0.899	0.501	0.499
L44	-0.047	-0.035	-0.04	-0.036	-0.034	-0.017	0.621	-0.04	-0.024	-0.031	0.889	0.899	0.627	0.629
L45	-0.047	-0.026	-0.031	-0.027	-0.025	-0.006	0.634	-0.04	-0.015	-0.027	0.894	0.901	0.636	0.642
L46	0.883	-0.038	-0.042	-0.038	-0.034	-0.022	0.645	-0.04	-0.032	-0.035	0.927	0.978	0.65	0.653
L47	-0.039	0.932	0.941	0.938	-0.034	0.731	0.505	-0.033	0.711	0.933	-0.026	0.978	0.506	0.506
L48	0.841	-0.023	-0.027	-0.024	-0.023	-0.002	0.635	-0.033	-0.011	-0.025	0.891	0.894	0.636	0.641
L49	-0.046	0.924	0.926	0.93	0.935	0.733	0.503	-0.033	0.713	0.927	-0.03	0.894	0.507	0.505
L50	0.842	-0.024	-0.028	-0.025	-0.024	-0.003	0.635	-0.033	-0.013	-0.025	0.891	0.896	0.636	0.641
M1	0.632	0.515	0.475	0.496	0.485	0.676	0.635	0.67	0.656	0.472	0.675	0.658	1	0.979

M2	0.635	0.51	0.465	0.493	0.478	0.674	0.635	0.671	0.656	0.466	0.676	0.658	0.975	0.979
M3	-0.052	0.933	0.953	0.934	0.954	0.676	0.456	-0.045	0.659	0.962	-0.039	-0.042	0.461	0.457
M4	0.634	0.506	0.464	0.487	0.477	0.676	0.456	0.672	0.653	0.464	0.675	0.661	0.976	0.977
M5	0.885	-0.029	-0.032	-0.032	-0.031	-0.018	0.655	0.935	-0.026	-0.03	0.942	0.92	0.976	0.661
M6	-0.044	0.937	0.956	0.941	-0.031	0.683	0.463	-0.04	0.665	0.966	-0.037	-0.036	0.976	0.464
M7	-0.017	0.733	0.678	0.706	0.691	0.683	0.667	-0.016	0.922	0.674	-0.019	-0.017	0.976	0.669
M8	0.635	0.505	0.464	0.487	0.477	0.675	0.968	0.671	0.653	0.464	0.675	0.661	0.976	0.977
M9	0.634	0.505	0.464	0.488	0.477	0.676	0.968	0.672	0.652	0.464	0.675	0.661	0.976	0.977
M10	0.635	0.505	0.464	0.487	0.477	0.675	0.968	0.671	0.653	0.463	0.675	0.661	0.976	0.977
M11	0.891	-0.037	-0.035	-0.036	-0.036	-0.018	0.659	0.941	-0.026	-0.037	0.948	0.927	0.667	0.666
M12	-0.045	0.938	0.955	0.94	0.955	0.684	0.463	-0.039	0.663	0.967	-0.035	-0.035	0.468	0.465
M13	0.634	0.505	0.464	0.488	0.477	0.674	0.463	0.671	0.653	0.464	0.675	0.661	0.975	0.977
M14	0.887	-0.038	-0.035	-0.038	-0.039	-0.014	0.663	0.941	-0.025	-0.038	0.945	0.92	0.975	0.665
M15	-0.023	0.727	0.676	-0.038	0.69	0.932	0.655	-0.019	0.912	0.671	-0.023	-0.017	0.975	0.656
M16	-0.049	0.939	0.957	-0.038	0.954	0.686	0.46	-0.04	0.665	0.967	-0.037	-0.04	0.975	0.463
M17	-0.022	0.737	0.68	-0.038	0.695	0.946	0.664	-0.019	0.922	0.68	-0.022	-0.018	0.975	0.666
M18	0.888	-0.042	-0.04	-0.041	-0.042	-0.018	0.66	-0.019	-0.028	-0.041	0.945	0.92	0.975	0.662
M19	0.887	-0.038	-0.035	-0.038	-0.039	-0.014	0.663	-0.019	-0.025	-0.038	0.946	0.92	0.975	0.665
M20	0.635	0.506	0.465	0.489	0.479	0.673	0.663	0.671	0.654	0.465	0.675	0.66	0.975	0.978
M21	0.893	-0.037	-0.037	-0.038	-0.038	-0.016	0.664	0.671	-0.026	-0.037	0.951	0.927	0.797	0.669
M22	-0.05	0.937	-0.037	0.939	-0.038	0.683	0.459	-0.04	0.663	0.967	-0.039	-0.04	0.797	0.461
M23	-0.021	0.73	-0.037	0.704	-0.038	0.934	0.659	-0.02	0.914	0.673	-0.022	-0.019	0.797	0.66
M24	0.887	-0.038	-0.035	-0.038	-0.039	-0.014	0.663	0.941	-0.025	-0.038	0.946	0.92	0.797	0.665
M25	0.635	0.507	0.465	0.489	0.479	0.674	0.97	0.67	0.654	0.465	0.675	0.66	0.975	0.978
M26	0.634	0.505	0.464	0.487	0.477	0.676	0.968	0.672	0.652	0.464	0.675	0.661	0.976	0.977
M27	0.885	-0.039	-0.04	-0.041	-0.04	-0.018	0.658	0.937	-0.028	-0.039	0.944	0.92	0.797	0.661
M28	0.885	-0.039	-0.04	-0.041	-0.04	-0.018	0.658	0.937	-0.028	-0.039	0.944	0.92	0.797	0.661
M29	-0.022	0.726	0.675	-0.041	0.687	0.936	0.655	-0.016	0.912	0.67	-0.022	-0.017	0.797	0.658

M30	0.634	0.509	0.467	0.49	0.482	0.674	0.655	0.669	0.654	0.467	0.675	0.659	0.974	0.978
M31	-0.047	0.937	0.96	0.49	0.482	0.684	0.461	-0.041	0.664	0.467	-0.039	-0.034	0.974	0.464
M32	-0.045	0.936	0.958	0.49	0.482	0.681	0.464	-0.038	0.663	0.467	-0.033	-0.033	0.974	0.466
M33	-0.051	0.933	0.953	0.49	0.482	0.677	0.457	-0.042	0.66	0.467	-0.04	-0.041	0.974	0.458
M34	0.634	0.505	0.464	0.49	0.477	0.676	0.457	0.672	0.652	0.467	0.675	0.661	0.976	0.977
M35	-0.051	0.933	0.952	0.934	0.952	0.677	0.457	-0.043	0.66	0.467	-0.04	-0.041	0.976	0.457
M36	0.895	-0.033	-0.029	-0.032	-0.032	-0.014	0.667	0.948	-0.024	-0.031	0.954	0.929	0.675	0.672
M37	0.898	-0.039	-0.037	-0.04	-0.039	-0.019	0.665	0.946	-0.026	-0.038	0.953	0.928	0.672	0.67
M38	0.634	0.51	0.468	0.49	0.481	0.675	0.968	0.668	0.653	0.467	0.675	0.661	0.973	0.978
M39	0.888	0.51	-0.036	-0.038	-0.039	-0.014	0.663	0.941	-0.025	-0.038	0.946	0.92	0.669	0.665
M40	0.885	0.51	-0.039	-0.039	-0.039	-0.017	0.655	0.935	-0.029	-0.038	0.942	0.921	0.661	0.66
M41	0.633	0.51	0.472	0.492	0.484	0.676	0.968	0.67	0.656	0.469	0.674	0.658	0.984	0.978
M42	-0.023	0.51	0.687	0.709	0.698	0.937	0.664	-0.021	0.918	0.68	-0.02	-0.02	0.984	0.663
M43	0.635	0.51	0.469	0.491	0.482	0.674	0.968	0.669	0.653	0.467	0.676	0.661	0.974	0.978
M44	0.888	0.51	-0.036	-0.038	-0.039	-0.014	0.663	0.941	-0.025	-0.038	0.946	0.921	0.669	0.665
M45	0.635	0.51	0.469	0.492	0.483	0.675	0.969	0.669	0.653	0.468	0.676	0.661	0.974	0.978
M46	-0.052	0.51	0.959	0.492	0.953	0.683	0.458	-0.045	0.664	0.963	-0.039	-0.039	0.797	0.462
M47	-0.022	0.51	0.687	0.492	0.698	0.94	0.663	-0.02	0.916	0.681	-0.019	-0.02	0.797	0.665
M48	-0.052	0.51	0.954	0.492	0.698	0.677	0.457	-0.045	0.659	0.963	-0.04	-0.042	0.797	0.458
M49	0.888	0.51	-0.035	-0.038	-0.039	-0.014	0.663	-0.045	-0.025	-0.038	0.946	0.921	0.797	0.665
M50	0.887	0.51	-0.035	-0.035	-0.034	-0.019	0.656	-0.045	-0.027	-0.033	0.944	0.922	0.797	0.662
N1	0.636	0.51	0.471	0.496	0.485	0.678	0.974	0.674	0.657	0.471	0.679	0.662	0.979	1
N2	0.636	0.51	0.47	0.496	0.485	0.676	0.972	0.674	0.658	0.47	0.679	0.662	0.978	0.985
N3	0.904	0.51	-0.04	-0.035	-0.035	-0.018	0.67	0.954	-0.026	-0.037	0.961	0.934	0.673	0.985
N4	-0.013	0.51	0.68	0.712	0.695	-0.018	0.672	-0.013	0.933	0.678	-0.014	-0.013	0.676	0.985
N5	0.635	0.51	0.471	0.496	0.484	0.68	0.972	0.671	0.658	0.471	0.676	0.659	0.977	0.984
N6	-0.006	0.51	0.682	0.496	0.699	0.68	0.682	-0.009	0.938	0.679	-0.007	-0.008	0.684	0.984
N7	0.905	0.51	-0.031	-0.028	-0.027	-0.008	0.68	0.955	-0.016	-0.03	0.964	0.938	0.682	0.984

N8	0.905	0.51	-0.033	-0.028	-0.028	-0.016	0.672	0.955	-0.023	-0.029	0.961	0.938	0.675	0.984
N9	-0.012	0.51	0.679	0.711	0.695	0.951	0.673	-0.011	0.934	0.678	-0.012	-0.012	0.678	0.984
N10	-0.04	0.51	0.965	0.949	0.964	0.686	0.463	-0.037	0.668	0.974	-0.032	-0.034	0.47	0.984
N11	0.64	0.51	0.47	0.495	0.484	0.677	0.974	0.674	0.657	0.47	0.68	0.665	0.979	0.986
N12	-0.036	0.51	0.967	0.495	0.967	0.688	0.469	-0.033	0.671	0.978	-0.027	-0.027	0.475	0.986
N13	-0.012	0.51	0.677	0.495	0.694	0.949	0.673	-0.01	0.93	0.676	-0.01	-0.012	0.677	0.986
N14	-0.04	0.51	0.966	0.948	0.964	0.686	0.465	-0.036	0.668	0.975	-0.03	-0.032	0.472	0.704
N15	-0.04	0.51	-0.032	-0.027	-0.027	-0.012	0.674	0.955	-0.02	-0.028	0.96	0.936	0.677	0.704
N16	-0.012	0.51	0.682	0.716	0.7	0.957	0.677	-0.012	0.938	0.682	-0.013	-0.01	0.681	0.704
N17	-0.04	0.51	0.966	0.95	0.967	0.687	0.465	-0.036	0.669	0.978	-0.031	-0.033	0.472	0.704
N18	0.906	0.51	-0.031	-0.025	-0.025	-0.01	0.676	0.955	-0.018	-0.027	0.961	0.936	0.679	0.704
N19	-0.012	0.51	0.679	-0.025	0.695	0.95	0.673	-0.012	0.934	0.678	-0.013	-0.012	0.678	0.704
N20	-0.041	0.51	0.965	-0.025	0.964	0.685	0.462	-0.037	0.667	0.678	-0.033	-0.035	0.47	0.704
N21	-0.041	0.51	0.966	-0.025	0.966	0.688	0.465	-0.037	0.67	0.678	-0.032	-0.033	0.471	0.704
N22	-0.04	0.51	0.967	-0.025	0.966	0.688	0.465	-0.036	0.669	0.678	-0.031	-0.033	0.472	0.704
N23	-0.011	0.51	0.68	-0.025	0.695	0.951	0.675	-0.009	0.932	0.677	-0.009	-0.012	0.679	0.704
N24	-0.013	0.51	0.68	-0.025	0.695	0.951	0.673	-0.012	0.934	0.678	-0.013	-0.012	0.677	0.682
N25	-0.01	0.51	0.68	-0.025	0.696	0.951	0.675	-0.008	0.932	0.678	-0.009	-0.011	0.68	0.685
N26	-0.04	0.51	0.966	-0.025	0.964	0.686	0.465	-0.036	0.668	0.975	-0.03	-0.031	0.472	0.472
N27	0.905	0.51	-0.036	-0.031	-0.031	-0.013	0.674	0.954	-0.021	-0.033	0.963	0.936	0.678	0.684
N28	0.905	0.51	-0.036	-0.031	-0.031	-0.013	0.674	0.954	-0.021	-0.033	0.963	0.936	0.678	0.684
N29	0.639	0.51	0.469	0.494	0.484	0.675	0.971	0.676	0.656	0.47	0.679	0.663	0.977	0.984
N30	0.505	-0.032	-0.036	-0.031	-0.031	-0.013	0.674	0.676	-0.021	-0.033	0.963	0.936	0.678	0.684
N31	0.905	-0.032	-0.034	-0.029	-0.03	-0.016	0.674	0.676	-0.022	-0.031	0.961	0.937	0.677	0.683
N32	0.507	-0.029	-0.03	-0.027	-0.025	-0.013	0.678	0.676	-0.021	-0.028	0.966	0.939	0.682	0.687
N33	0.636	0.514	0.47	0.496	0.485	0.677	0.972	0.672	0.658	0.471	0.677	0.659	0.977	0.984
N34	-0.013	0.739	0.68	0.712	0.696	0.677	0.673	-0.012	0.658	0.678	-0.013	-0.012	0.677	0.682
N35	-0.041	0.944	0.965	0.949	0.696	0.687	0.463	-0.038	0.658	0.975	-0.033	-0.035	0.47	0.471

N36	-0.011	0.739	0.682	0.713	0.699	0.687	0.679	-0.009	0.658	0.68	-0.011	-0.009	0.683	0.688
N37	0.637	0.513	0.47	0.494	0.484	0.679	0.973	0.673	0.658	0.47	0.678	0.661	0.978	0.986
N38	0.636	0.513	0.469	0.495	0.484	0.678	0.971	0.672	0.658	0.47	0.678	0.659	0.977	0.984
N39	0.639	0.513	0.469	0.495	0.484	0.675	0.971	0.676	0.657	0.47	0.679	0.663	0.977	0.984
N40	0.636	0.513	0.469	0.496	0.484	0.678	0.971	0.672	0.658	0.47	0.678	0.659	0.977	0.984
N41	0.408	-0.033	-0.034	-0.03	-0.03	-0.012	0.679	0.957	-0.02	-0.033	0.965	0.943	0.684	0.984
N42	0.507	-0.03	-0.03	-0.029	-0.03	-0.01	0.678	0.955	-0.019	-0.031	0.965	0.938	0.683	0.984
N43	0.505	-0.036	-0.039	-0.034	-0.034	-0.018	0.671	0.954	-0.025	-0.037	0.962	0.934	0.674	0.984
N44	0.639	0.512	0.469	0.495	0.484	0.675	0.971	0.676	0.656	0.47	0.679	0.663	0.977	0.984
N45	-0.012	0.738	0.68	0.712	0.695	0.953	0.674	-0.011	0.929	0.678	-0.011	-0.012	0.678	0.683
N46	-0.005	0.743	0.684	0.715	0.695	0.957	0.685	-0.003	0.934	0.682	-0.005	-0.002	0.686	0.704
N47	0.638	0.512	0.47	0.495	0.695	0.677	0.973	0.674	0.656	0.469	0.679	0.662	0.978	0.704
N48	-0.04	0.944	0.967	0.949	0.695	0.689	0.465	-0.036	0.667	0.975	-0.031	-0.033	0.472	0.704
N49	0.639	0.513	0.469	0.495	0.695	0.675	0.971	0.676	0.656	0.47	0.679	0.663	0.977	0.704
N50	-0.04	0.944	0.967	0.949	0.695	0.689	0.465	-0.036	0.667	0.975	-0.031	-0.033	0.472	0.704

The correlation table between different palms is shown in table 4.2 for template size 100 x 100 pixels.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
A1	1	0.552	0.558	-0.021	-0.052	0.558	0.556	0.003	0.554	0.975	0.981	0.558	-0.053	0.98
A2	1	0.552	0.558	-0.021	0.689	0.558	0.556	0.003	0.554	-0.019	-0.017	0.558	0.684	-0.009
A3	1	0.531	0.558	0.675	0.996	0.531	0.523	-0.043	0.532	-0.061	-0.061	0.529	0.684	-0.052
A4	0.558	0.531	0.558	0.787	0.531	0.531	0.523	-0.043	0.532	0.548	0.551	0.529	0.527	0.559
A5	0.787	0.531	0.558	0.787	0.687	0.531	0.523	0.007	0.532	-0.014	-0.012	0.529	0.681	-0.004
A6	0.787	0.531	0.558	0.789	0.533	0.531	0.523	0.563	0.532	0.548	0.551	0.529	0.529	0.559
A7	0.787	0.531	0.558	0.789	0.535	0.531	0.523	0.563	0.532	0.549	0.551	0.529	0.53	0.56
A8	0.787	0.531	0.558	0.978	0.685	0.531	0.523	0.007	0.532	-0.013	-0.011	0.803	0.679	-0.004

A9	0.787	0.531	0.558	0.787	0.531	0.531	0.989	0.564	0.532	0.547	0.551	0.993	0.527	0.559
A10	0.981	0.55	0.558	-0.023	-0.05	0.555	0.552	0.564	0.532	0.547	0.974	0.557	-0.049	0.559
A11	0.981	0.55	0.558	-0.023	0.684	0.801	0.552	0.002	0.532	-0.018	-0.016	0.557	0.678	-0.009
A12	0.981	0.554	0.558	-0.016	-0.043	0.56	0.557	0.002	0.532	-0.018	0.975	0.56	-0.042	0.979
A13	0.981	0.554	0.558	-0.016	0.686	0.56	0.557	0.008	0.532	-0.014	-0.011	0.56	0.68	-0.004
A14	0.981	0.554	0.558	-0.016	0.531	0.56	0.557	0.564	0.532	0.547	0.551	0.56	0.527	0.559
A15	0.981	0.554	0.558	-0.016	0.532	0.56	0.557	0.564	0.532	0.548	0.551	0.56	0.528	0.559
A16	0.981	0.554	0.558	-0.016	0.685	0.56	0.557	0.003	0.532	-0.017	-0.016	0.56	0.679	-0.008
A17	0.981	0.994	0.558	-0.016	0.532	0.56	0.557	0.566	0.532	0.551	0.553	0.56	0.528	0.561
A18	0.981	0.531	0.558	0.673	0.996	0.53	0.523	-0.044	0.532	-0.062	-0.061	0.529	0.528	-0.053
A19	0.981	0.531	0.558	0.673	0.531	0.994	0.989	0.564	0.991	0.547	0.551	0.529	0.527	0.559
A20	0.982	0.547	0.558	-0.026	-0.051	0.553	0.55	0.564	0.548	0.547	0.551	0.554	-0.05	0.559
A21	0.983	0.554	0.558	-0.019	-0.043	0.56	0.557	0.564	0.555	0.547	0.551	0.561	-0.042	0.559
A22	0.983	0.805	0.558	-0.019	0.686	0.8	0.797	-0.001	0.555	0.547	-0.02	0.561	0.68	-0.013
A23	0.981	0.546	0.551	-0.026	-0.053	0.552	0.549	-0.001	0.547	0.972	-0.02	0.553	-0.052	0.977
A24	0.981	0.994	0.992	0.787	0.531	0.552	0.549	0.564	0.547	0.547	0.551	0.553	0.527	0.559
A25	0.805	0.531	0.529	0.673	0.996	0.53	0.522	-0.045	0.532	-0.062	-0.062	0.529	0.527	-0.053
A26	0.805	0.551	0.557	-0.021	-0.049	0.557	0.554	-0.045	0.552	-0.062	-0.062	0.558	-0.048	0.978
A27	0.805	0.551	0.803	-0.021	0.686	0.804	0.554	0.006	0.552	-0.015	-0.012	0.804	0.68	-0.005
A28	0.805	0.809	0.803	-0.021	0.686	0.804	0.554	0.006	0.552	-0.015	-0.012	0.804	0.68	-0.005
A29	0.805	0.531	0.528	0.673	0.996	0.53	0.522	-0.043	0.532	-0.061	-0.06	0.529	0.68	-0.052
A30	0.805	0.531	0.802	0.98	0.687	0.803	0.522	0.006	0.803	-0.016	-0.014	0.803	0.681	-0.006
A31	0.805	0.531	0.557	-0.022	-0.049	0.557	0.554	0.006	0.552	0.974	-0.014	0.558	-0.049	-0.006
A32	0.805	0.531	0.529	0.674	0.996	0.531	0.523	-0.044	0.532	-0.061	-0.061	0.529	0.993	-0.006
A33	0.981	0.54	0.545	-0.033	-0.057	0.546	0.544	-0.044	0.541	-0.061	-0.061	0.547	-0.057	-0.006
A34	0.981	0.808	0.802	0.98	0.685	0.803	0.544	0.006	0.541	-0.061	-0.012	0.547	0.679	-0.005
A35	0.981	0.54	0.546	-0.033	-0.056	0.546	0.544	0.006	0.541	-0.061	-0.012	0.547	-0.056	-0.005

A36	0.986	0.549	0.555	-0.024	-0.05	0.556	0.553	0.006	0.552	-0.061	-0.012	0.557	-0.05	-0.005
A37	0.986	0.808	0.555	-0.024	0.686	0.803	0.553	0.004	0.803	-0.061	-0.015	0.557	0.68	-0.007
A38	0.986	0.531	0.555	0.675	0.996	0.531	0.523	-0.044	0.532	-0.061	-0.061	0.529	0.68	-0.052
A39	0.986	0.994	0.555	0.788	0.531	0.531	0.523	0.564	0.991	-0.061	0.551	0.994	0.527	0.559
A40	0.981	0.54	0.555	-0.033	-0.056	0.546	0.544	0.564	0.541	-0.061	0.551	0.547	-0.056	0.559
A41	0.988	0.548	0.555	-0.025	-0.055	0.554	0.552	0.564	0.55	-0.061	0.551	0.555	-0.055	0.559
A42	0.986	0.551	0.555	-0.022	-0.049	0.557	0.555	0.564	0.552	-0.061	0.551	0.558	-0.05	0.559
A43	0.981	0.54	0.555	-0.032	-0.056	0.546	0.545	0.564	0.542	-0.061	0.551	0.548	-0.056	0.559
A44	0.981	0.807	0.555	0.98	0.685	0.802	0.799	0.004	0.803	-0.061	-0.014	0.802	0.679	-0.007
A45	0.981	0.532	0.53	0.675	0.685	0.532	0.524	-0.042	0.533	-0.06	-0.06	0.529	0.679	-0.051
A46	-0.05	0.532	0.53	0.674	0.685	0.531	0.524	-0.043	0.533	-0.06	-0.061	0.529	0.679	-0.051
A47	-0.05	0.53	0.529	0.674	0.685	0.53	0.522	-0.044	0.531	-0.06	-0.061	0.528	0.679	-0.052
A48	0.982	0.542	0.548	-0.031	-0.053	0.548	0.546	0.971	0.543	0.975	0.976	0.55	-0.053	0.978
A49	0.701	0.807	0.801	-0.031	0.685	0.802	0.546	0.004	0.803	-0.017	-0.014	0.802	0.679	-0.007
A50	0.701	0.532	0.53	0.675	0.995	0.531	0.524	-0.042	0.533	-0.06	-0.06	0.53	0.679	-0.051
B1	0.552	1	0.993	0.796	0.53	0.995	0.991	0.561	0.533	0.543	0.548	0.994	0.525	0.555
B2	-0.018	0.802	0.796	0.978	0.68	0.796	0.794	-0.003	0.533	-0.023	-0.022	0.797	0.674	-0.014
B3	-0.054	0.802	0.526	0.676	0.992	0.526	0.519	-0.046	0.528	-0.064	-0.064	0.525	0.674	-0.056
B4	0.979	0.802	0.557	-0.023	-0.063	0.557	0.554	0.972	0.552	0.973	0.977	0.557	-0.062	-0.056
B5	0.979	0.802	0.554	-0.022	-0.051	0.554	0.551	0.972	0.549	0.973	0.976	0.554	-0.05	-0.056
B6	-0.019	0.802	0.796	0.979	0.68	0.796	0.794	-0.003	0.798	-0.024	-0.022	0.797	0.675	-0.014
B7	0.981	0.555	0.56	-0.017	-0.049	0.562	0.559	0.971	0.557	0.973	0.977	0.562	-0.048	0.98
B8	-0.023	0.799	0.792	0.982	0.68	0.793	0.79	-0.005	0.794	-0.028	-0.025	0.793	0.675	-0.018
B9	-0.024	0.798	0.791	0.982	0.679	0.792	0.789	-0.007	0.794	-0.03	-0.027	0.792	0.673	-0.02
B10	0.979	0.798	0.553	-0.027	-0.066	0.554	0.55	0.972	0.548	0.974	0.977	0.553	-0.066	0.977
B11	0.981	0.552	0.557	-0.021	-0.052	0.559	0.556	0.971	0.554	0.974	0.977	0.559	-0.051	0.98
B12	-0.018	0.802	0.796	0.979	0.683	0.797	0.795	-0.002	0.554	-0.023	-0.022	0.797	0.677	-0.013

B13	-0.023	0.799	0.791	0.983	0.68	0.793	0.789	-0.005	0.554	-0.029	-0.022	0.792	0.675	-0.019
B14	-0.023	0.799	0.557	-0.023	-0.062	0.557	0.554	0.972	0.552	0.973	-0.022	0.557	-0.062	-0.019
B15	-0.023	0.799	0.551	-0.029	-0.068	0.551	0.548	0.972	0.546	0.973	-0.022	0.551	-0.068	-0.019
B16	-0.023	0.799	0.562	-0.017	-0.051	0.563	0.561	0.97	0.559	0.974	-0.022	0.564	-0.051	-0.019
B17	-0.023	0.554	0.56	-0.019	-0.047	0.56	0.559	0.971	0.556	0.975	-0.022	0.561	-0.047	-0.019
B18	-0.023	0.799	0.792	0.984	0.679	0.792	0.789	-0.006	0.793	-0.029	-0.025	0.792	0.673	-0.02
B19	0.979	0.55	0.557	-0.023	-0.062	0.557	0.554	0.972	0.552	0.973	0.977	0.557	-0.061	0.977
B20	-0.057	0.527	0.524	0.678	0.993	0.525	0.517	-0.05	0.527	-0.067	-0.068	0.523	-0.061	-0.061
B21	-0.022	0.799	0.524	0.98	0.682	0.794	0.792	-0.006	0.527	-0.028	-0.025	0.794	0.676	-0.018
B22	-0.022	0.801	0.524	0.983	0.682	0.795	0.791	-0.005	0.527	-0.027	-0.024	0.794	0.677	-0.018
B23	-0.022	0.8	0.524	0.983	0.68	0.793	0.79	-0.006	0.527	-0.028	-0.025	0.793	0.675	-0.019
B24	-0.057	0.8	0.523	0.676	0.993	0.524	0.516	-0.05	0.527	-0.068	-0.069	0.523	0.989	-0.061
B25	0.979	0.8	0.56	-0.016	-0.062	0.56	0.558	0.972	0.527	0.974	0.977	0.56	-0.06	0.978
B26	-0.024	0.798	0.56	0.982	0.679	0.792	0.789	-0.007	0.527	-0.03	-0.027	0.792	0.673	-0.02
B27	0.559	0.995	0.56	0.789	0.525	0.995	0.99	0.567	0.527	0.55	0.555	0.994	0.521	0.562
B28	0.559	0.995	0.56	0.789	0.525	0.995	0.99	0.567	0.527	0.55	0.555	0.994	0.521	0.562
B29	0.558	0.995	0.56	0.789	0.526	0.995	0.99	0.567	0.527	0.549	0.554	0.994	0.521	0.561
B30	0.98	0.995	0.56	-0.015	-0.06	0.56	0.558	0.972	0.527	0.974	0.976	0.56	-0.058	0.977
B31	-0.057	0.995	0.56	0.676	0.993	0.525	0.517	-0.05	0.527	-0.067	-0.069	0.523	-0.058	-0.06
B32	0.558	0.996	0.56	0.789	0.528	0.995	0.991	0.565	0.992	0.55	0.554	0.994	0.524	0.561
B33	-0.022	0.801	0.56	0.983	0.679	0.794	0.79	-0.006	0.794	-0.027	-0.024	0.793	0.673	-0.019
B34	-0.024	0.797	0.56	0.982	0.679	0.792	0.789	-0.007	0.794	-0.03	-0.027	0.792	0.673	-0.02
B35	-0.024	0.549	0.56	-0.02	-0.057	0.555	0.552	0.971	0.55	0.972	0.974	0.556	-0.056	0.976
B36	-0.057	0.996	0.524	0.679	0.993	0.525	0.518	-0.05	0.527	-0.067	-0.069	0.523	0.989	-0.06
B37	-0.057	0.996	0.524	0.677	0.993	0.525	0.518	-0.05	0.527	-0.067	-0.068	0.524	0.989	-0.06
B38	0.979	0.996	0.554	-0.021	-0.055	0.554	0.551	0.97	0.549	0.972	0.974	0.555	-0.054	0.976
B39	-0.024	0.996	0.791	0.982	0.679	0.792	0.789	-0.007	0.794	-0.03	-0.027	0.792	0.672	-0.02

B40	-0.056	0.996	0.525	0.677	0.992	0.525	0.518	-0.048	0.528	-0.067	-0.066	0.524	0.989	-0.059
B41	-0.056	0.996	0.559	-0.018	-0.056	0.56	0.557	0.976	0.556	0.974	0.98	0.56	-0.056	0.981
B42	-0.056	0.798	0.561	-0.015	-0.054	0.562	0.559	0.978	0.557	0.975	0.98	0.561	-0.054	0.979
B43	-0.016	0.804	0.796	0.981	0.681	0.797	0.793	-0.001	0.797	-0.021	-0.018	0.796	0.675	-0.013
B44	0.979	0.804	0.557	-0.023	-0.062	0.557	0.554	0.972	0.552	0.973	0.977	0.557	-0.061	0.977
B45	-0.057	0.527	0.524	0.677	0.992	0.525	0.517	-0.049	0.527	-0.068	-0.067	0.523	0.988	-0.06
B46	-0.021	0.804	0.794	0.985	0.678	0.795	0.792	-0.006	0.527	-0.026	-0.023	0.794	0.672	-0.017
B47	-0.056	0.996	0.525	0.675	0.993	0.526	0.519	-0.05	0.528	-0.066	-0.067	0.524	0.989	-0.058
B48	-0.018	0.996	0.525	0.982	0.68	0.796	0.793	-0.002	0.528	-0.022	-0.019	0.795	0.674	-0.014
B49	-0.018	0.996	0.525	-0.023	-0.062	0.557	0.554	0.972	0.552	0.973	0.977	0.557	-0.062	-0.014
B50	0.557	0.996	0.993	0.79	0.529	0.995	0.99	0.564	0.552	0.549	0.553	0.994	0.524	-0.014
C1	0.558	0.993	1	0.788	0.529	0.993	0.99	0.565	0.552	0.551	0.554	0.993	0.525	0.561
C2	-0.054	0.526	0.996	0.672	0.991	0.525	0.519	-0.046	0.528	-0.065	-0.064	0.523	0.988	-0.056
C3	-0.018	0.526	0.792	0.976	0.679	0.792	0.79	-0.001	0.793	-0.025	-0.02	0.791	0.674	-0.016
C4	-0.051	0.526	0.527	0.671	0.991	0.526	0.518	-0.045	0.527	-0.061	-0.062	0.524	0.988	-0.053
C5	-0.016	0.526	0.793	0.977	0.681	0.794	0.792	0.001	0.795	-0.022	-0.017	0.793	0.676	-0.014
C6	0.975	0.526	0.996	-0.02	-0.051	0.557	0.559	0.965	0.553	0.972	0.973	0.558	-0.051	0.974
C7	-0.018	0.526	0.796	0.977	0.682	0.795	0.792	-0.004	0.795	-0.022	-0.023	0.795	0.676	-0.016
C8	0.973	0.526	0.796	-0.017	-0.054	0.559	0.558	0.962	0.554	0.975	0.971	0.559	-0.055	-0.016
C9	0.974	0.526	0.796	-0.017	-0.054	0.56	0.559	0.962	0.555	0.975	0.971	0.56	-0.055	-0.016
C10	0.973	0.526	0.996	-0.017	-0.055	0.559	0.558	0.962	0.554	0.975	0.971	0.559	-0.055	-0.016
C11	-0.019	0.526	0.796	0.977	0.681	0.794	0.791	-0.005	0.554	-0.023	-0.023	0.794	0.675	-0.016
C12	0.559	0.526	0.994	0.786	0.528	0.994	0.991	0.566	0.554	0.553	0.554	0.994	0.523	0.562
C13	0.56	0.526	0.994	0.785	0.525	0.993	0.991	0.566	0.554	0.555	0.556	0.993	0.52	0.563
C14	0.56	0.526	0.994	-0.017	-0.055	0.559	0.559	0.962	0.555	0.975	0.971	0.559	-0.055	0.563
C15	0.56	0.526	0.994	-0.02	-0.056	0.557	0.557	0.962	0.552	0.975	0.971	0.558	-0.056	0.563
C16	-0.019	0.526	0.796	0.976	0.682	0.794	0.791	-0.003	0.794	-0.023	-0.022	0.793	0.677	-0.015

C17	-0.049	0.526	0.529	0.672	0.991	0.527	0.519	-0.043	0.528	-0.059	-0.06	0.525	0.988	-0.052
C18	-0.05	0.526	0.528	0.671	0.99	0.526	0.518	-0.043	0.527	-0.061	-0.061	0.524	0.987	-0.054
C19	0.974	0.526	0.56	-0.017	-0.055	0.559	0.559	0.962	0.555	0.975	0.971	0.559	-0.055	0.972
C20	0.56	0.526	0.994	0.785	0.524	0.993	0.991	0.566	0.555	0.555	0.556	0.993	0.52	0.563
C21	-0.024	0.526	0.792	0.975	0.686	0.79	0.788	-0.01	0.555	-0.028	-0.027	0.79	0.681	-0.02
C22	-0.022	0.526	0.793	0.976	0.682	0.792	0.789	-0.005	0.555	-0.027	-0.024	0.791	0.677	-0.019
C23	-0.02	0.526	0.792	0.973	0.68	0.79	0.788	-0.004	0.555	-0.026	-0.023	0.79	0.674	-0.019
C24	0.974	0.526	0.56	-0.017	-0.054	0.56	0.559	0.962	0.555	0.975	0.971	0.56	-0.055	0.972
C25	-0.021	0.526	0.792	0.974	0.682	0.79	0.788	-0.005	0.79	-0.026	-0.023	0.79	0.676	-0.019
C26	-0.021	0.526	0.56	-0.017	-0.054	0.56	0.559	0.962	0.555	0.975	0.971	0.56	-0.054	-0.019
C27	-0.022	0.526	0.791	0.973	0.68	0.789	0.786	-0.006	0.555	-0.027	-0.024	0.789	0.674	-0.02
C28	-0.022	0.526	0.791	0.973	0.68	0.789	0.786	-0.006	0.555	-0.027	-0.024	0.789	0.674	-0.02
C29	-0.018	0.526	0.795	0.973	0.684	0.793	0.791	-0.003	0.555	-0.021	-0.021	0.792	0.678	-0.014
C30	-0.018	0.526	0.557	-0.023	-0.054	0.553	0.553	0.962	0.548	0.975	0.969	0.556	-0.055	-0.014
C31	-0.018	0.526	0.995	0.786	0.529	0.994	0.991	0.567	0.991	0.555	0.557	0.994	0.524	0.564
C32	-0.018	0.526	0.995	-0.02	-0.056	0.557	0.556	0.965	0.552	0.976	0.973	0.558	-0.056	0.564
C33	-0.017	0.526	0.794	0.975	0.68	0.794	0.791	-0.001	0.552	-0.021	-0.018	0.793	0.674	-0.014
C34	-0.018	0.526	0.795	0.973	0.684	0.793	0.791	-0.004	0.552	-0.022	-0.021	0.792	0.678	-0.014
C35	-0.049	0.526	0.996	0.673	0.99	0.527	0.519	-0.042	0.529	-0.061	-0.059	0.525	0.987	-0.053
C36	-0.051	0.526	0.996	0.672	0.992	0.526	0.518	-0.044	0.527	-0.063	-0.062	0.523	0.988	-0.054
C37	-0.051	0.526	0.996	0.672	0.989	0.525	0.518	-0.041	0.527	-0.063	-0.059	0.523	0.986	-0.054
C38	0.972	0.526	0.563	-0.014	-0.05	0.559	0.559	0.961	0.554	0.975	0.968	0.562	-0.05	0.971
C39	-0.018	0.526	0.795	0.973	0.684	0.793	0.791	-0.004	0.792	-0.022	-0.022	0.792	0.678	-0.014
C40	0.972	0.526	0.795	-0.015	-0.05	0.558	0.558	0.961	0.553	0.975	0.968	0.561	-0.051	0.971
C41	-0.054	0.526	0.795	0.673	0.992	0.524	0.516	-0.047	0.526	-0.065	-0.065	0.522	0.988	-0.057
C42	-0.052	0.526	0.795	0.673	0.99	0.526	0.519	-0.043	0.528	-0.064	-0.06	0.524	0.987	-0.055
C43	-0.022	0.526	0.79	0.975	0.681	0.789	0.787	-0.006	0.528	-0.028	-0.024	0.789	0.675	-0.021

C44	-0.019	0.526	0.795	0.973	0.684	0.792	0.79	-0.005	0.528	-0.023	-0.022	0.791	0.678	-0.015
C45	0.56	0.526	0.993	0.786	0.527	0.993	0.99	0.567	0.528	0.555	0.556	0.993	0.522	0.562
C46	-0.054	0.526	0.993	0.673	0.991	0.525	0.517	-0.046	0.527	-0.064	-0.064	0.522	0.988	-0.056
C47	-0.054	0.526	0.993	-0.012	-0.048	0.563	0.56	0.968	0.557	0.973	-0.064	0.563	-0.049	0.975
C48	-0.054	0.526	0.993	-0.006	-0.047	0.564	0.563	0.96	0.559	0.975	-0.064	0.565	-0.047	0.97
C49	-0.019	0.526	0.993	0.973	0.684	0.792	0.79	-0.005	0.791	-0.023	-0.023	0.791	0.679	-0.015
C50	-0.05	0.526	0.993	0.674	0.99	0.528	0.52	-0.041	0.529	-0.062	-0.059	0.526	0.987	-0.053
D1	-0.021	0.526	0.788	1	0.675	0.788	0.784	-0.003	0.529	-0.026	-0.021	0.787	0.669	-0.016
D2	0.977	0.526	0.549	0.97	-0.061	0.551	0.548	0.968	0.548	0.971	-0.021	0.552	-0.063	-0.016
D3	-0.054	0.526	0.524	0.678	0.988	0.524	0.515	-0.047	0.525	-0.062	-0.064	0.521	0.985	-0.058
D4	-0.024	0.526	0.786	0.97	0.677	0.785	0.783	-0.01	0.787	-0.027	-0.026	0.787	0.671	-0.018
D5	-0.054	0.526	0.524	0.97	0.988	0.524	0.516	-0.047	0.525	-0.062	-0.065	0.522	0.985	-0.058
D6	0.557	0.526	0.991	0.787	0.524	0.993	0.99	0.566	0.992	0.549	0.553	0.993	0.521	0.561
D7	-0.023	0.526	0.788	0.972	0.677	0.79	0.787	-0.009	0.791	-0.027	-0.026	0.79	0.671	-0.016
D8	0.974	0.526	0.548	0.972	-0.063	0.549	0.55	0.963	0.546	0.971	0.968	0.551	-0.063	0.975
D9	-0.024	0.526	0.785	0.968	0.674	0.784	0.782	-0.011	0.546	-0.027	-0.027	0.786	0.669	-0.019
D10	-0.024	0.526	0.786	0.971	0.676	0.785	0.782	-0.01	0.546	-0.027	-0.026	0.787	0.671	-0.019
D11	-0.024	0.526	0.547	0.971	-0.067	0.549	0.549	0.967	0.546	0.967	0.972	0.55	-0.067	0.975
D12	0.557	0.526	0.991	0.786	0.523	0.994	0.99	0.566	0.546	0.549	0.553	0.993	0.519	0.562
D13	0.555	0.526	0.991	0.789	0.524	0.992	0.989	0.562	0.546	0.548	0.551	0.992	0.519	0.559
D14	-0.024	0.526	0.785	0.969	0.674	0.784	0.782	-0.011	0.546	-0.028	-0.027	0.786	0.669	-0.019
D15	0.555	0.526	0.991	0.789	0.524	0.992	0.989	0.562	0.546	0.548	0.551	0.992	0.519	0.559
D16	0.555	0.526	0.547	0.789	-0.066	0.549	0.549	0.966	0.546	0.968	0.551	0.551	-0.067	0.559
D17	0.555	0.526	0.549	0.789	-0.062	0.552	0.551	0.968	0.546	0.97	0.551	0.553	-0.062	0.559
D18	0.555	0.526	0.548	0.789	-0.062	0.55	0.551	0.963	0.546	0.971	0.551	0.551	-0.062	0.559
D19	-0.024	0.526	0.785	0.969	0.675	0.785	0.782	-0.011	0.546	-0.028	-0.027	0.786	0.669	-0.019
D20	-0.058	0.526	0.522	0.969	0.988	0.521	0.514	-0.052	0.524	-0.066	-0.069	0.521	0.986	-0.06

D21	-0.026	0.526	0.786	0.971	0.678	0.786	0.783	-0.012	0.788	-0.029	-0.029	0.788	0.672	-0.02
D22	0.556	0.526	0.992	0.79	0.524	0.993	0.99	0.564	0.991	0.549	0.552	0.993	0.519	0.56
D23	-0.059	0.526	0.523	0.676	0.988	0.522	0.514	-0.052	0.524	-0.067	-0.07	0.521	0.986	-0.061
D24	0.556	0.526	0.99	0.785	0.524	0.991	0.988	0.562	0.989	0.549	0.552	0.992	0.519	0.56
D25	-0.023	0.526	0.787	0.977	0.674	0.786	0.784	-0.007	0.787	-0.026	-0.025	0.786	0.669	-0.018
D26	0.973	0.526	0.549	0.977	-0.06	0.55	0.551	0.96	0.547	0.969	0.967	0.552	-0.061	0.974
D27	-0.059	0.526	0.523	0.977	0.988	0.522	0.514	-0.051	0.524	-0.067	-0.07	0.52	0.985	-0.062
D28	-0.059	0.526	0.523	0.977	0.988	0.522	0.514	-0.051	0.524	-0.067	-0.07	0.52	0.985	-0.062
D29	0.556	0.526	0.99	0.785	0.524	0.991	0.988	0.562	0.989	0.549	0.552	0.992	0.519	0.56
D30	0.975	0.526	0.547	0.785	-0.064	0.548	0.549	0.963	0.544	0.971	0.969	0.549	-0.063	0.975
D31	-0.056	0.526	0.524	0.672	0.99	0.523	0.516	-0.049	0.526	-0.065	-0.067	0.523	0.988	-0.058
D32	-0.019	0.526	0.79	0.984	0.676	0.79	0.787	-0.003	0.791	-0.023	-0.022	0.789	0.669	-0.016
D33	-0.057	0.526	0.523	0.984	0.988	0.523	0.514	-0.05	0.524	-0.066	-0.068	0.521	0.985	-0.061
D34	0.972	0.526	0.549	0.984	-0.06	0.55	0.551	0.96	0.547	0.969	0.967	0.552	-0.061	0.973
D35	0.554	0.526	0.991	0.791	0.525	0.992	0.989	0.561	0.989	0.547	0.549	0.991	0.52	0.557
D36	-0.054	0.526	0.524	0.791	0.99	0.524	0.516	-0.047	0.526	-0.063	-0.064	0.522	0.987	-0.057
D37	0.977	0.526	0.554	0.791	-0.053	0.554	0.554	0.965	0.55	0.976	0.973	0.555	-0.051	0.976
D38	-0.057	0.526	0.523	0.679	0.989	0.523	0.514	-0.05	0.525	-0.066	-0.068	0.52	0.986	-0.061
D39	-0.024	0.526	0.786	0.97	0.676	0.785	0.782	-0.011	0.787	-0.028	-0.027	0.787	0.671	-0.019
D40	0.554	0.526	0.992	0.791	0.525	0.992	0.989	0.561	0.99	0.548	0.55	0.991	0.521	0.557
D41	0.557	0.526	0.992	0.79	0.526	0.992	0.989	0.565	0.99	0.552	0.554	0.992	0.522	0.562
D42	0.555	0.526	0.991	0.791	0.527	0.992	0.989	0.562	0.99	0.548	0.551	0.991	0.522	0.557
D43	-0.056	0.526	0.524	0.791	0.988	0.523	0.515	-0.049	0.525	-0.064	-0.067	0.521	0.985	-0.06
D44	-0.024	0.526	0.786	0.97	0.676	0.785	0.782	-0.011	0.787	-0.028	-0.027	0.787	0.671	-0.019
D45	-0.058	0.526	0.523	0.679	0.988	0.523	0.514	-0.05	0.524	-0.066	-0.068	0.52	0.985	-0.062
D46	0.557	0.526	0.992	0.795	0.527	0.992	0.989	0.565	0.99	0.551	0.554	0.992	0.522	0.562
D47	0.557	0.526	0.552	0.795	-0.059	0.553	0.551	0.97	0.547	0.977	0.975	0.553	-0.059	0.562

D48	0.557	0.526	0.556	-0.02	-0.058	0.556	0.556	0.962	0.551	0.97	0.969	0.557	-0.058	0.562
D49	-0.024	0.526	0.786	0.97	0.676	0.785	0.782	-0.011	0.787	-0.028	-0.027	0.787	0.671	-0.019
D50	-0.056	0.526	0.523	0.97	0.988	0.523	0.515	-0.048	0.525	-0.064	-0.067	0.521	0.985	-0.06
E1	-0.052	0.526	0.529	0.675	1	0.53	0.521	-0.046	0.531	-0.063	-0.064	0.528	0.993	-0.054
E2	-0.055	0.526	0.528	0.677	0.995	0.528	0.521	-0.049	0.53	-0.067	-0.067	0.526	0.991	-0.058
E3	-0.049	0.526	0.531	0.676	0.995	0.533	0.526	-0.044	0.534	-0.06	-0.059	0.531	0.993	-0.05
E4	-0.049	0.526	0.561	-0.013	-0.05	0.564	0.561	0.973	0.559	0.974	0.98	0.563	-0.054	0.98
E5	-0.049	0.526	0.531	0.677	0.995	0.533	0.526	-0.044	0.534	-0.06	-0.059	0.531	0.993	-0.05
E6	-0.018	0.526	0.797	0.982	0.995	0.798	0.795	-0.001	0.798	-0.023	-0.021	0.797	0.68	-0.013
E7	-0.017	0.526	0.798	0.981	0.995	0.799	0.796	0	0.799	-0.021	-0.02	0.798	0.68	-0.012
E8	0.982	0.526	0.56	-0.014	0.995	0.562	0.56	0.973	0.558	0.974	0.98	0.561	-0.055	0.981
E9	-0.015	0.526	0.797	-0.014	0.689	0.799	0.796	0	0.8	-0.02	-0.018	0.798	0.684	-0.009
E10	-0.015	0.526	0.56	-0.014	-0.06	0.562	0.56	0.973	0.558	0.974	0.98	0.562	-0.055	0.981
E11	-0.049	0.526	0.53	-0.014	0.994	0.531	0.523	-0.041	0.533	-0.06	-0.06	0.529	0.991	-0.05
E12	-0.014	0.526	0.798	-0.014	0.689	0.8	0.797	0.003	0.801	-0.02	-0.017	0.8	0.683	-0.009
E13	-0.014	0.526	0.561	-0.014	-0.05	0.563	0.561	0.971	0.559	0.973	0.98	0.563	-0.054	0.981
E14	-0.047	0.526	0.532	-0.014	0.994	0.533	0.525	-0.04	0.535	-0.057	-0.057	0.531	0.992	-0.048
E15	0.98	0.526	0.561	-0.014	0.994	0.563	0.561	0.971	0.559	0.973	0.979	0.562	-0.054	0.98
E16	-0.046	0.526	0.531	-0.014	0.994	0.533	0.525	-0.038	0.535	-0.057	-0.057	0.531	0.992	-0.047
E17	0.56	0.526	0.531	-0.014	0.529	0.995	0.991	0.567	0.993	0.551	0.555	0.995	0.525	0.563
E18	0.98	0.526	0.531	-0.014	-0.06	0.561	0.559	0.971	0.557	0.973	0.979	0.561	-0.056	0.981
E19	-0.047	0.526	0.531	-0.014	0.994	0.533	0.525	-0.04	0.535	-0.057	-0.057	0.531	0.992	-0.048
E20	0.98	0.555	0.531	-0.014	-0.06	0.561	0.559	0.971	0.557	0.973	-0.057	0.561	-0.056	-0.048
E21	0.984	0.561	0.531	-0.014	-0.05	0.568	0.565	0.974	0.563	0.977	-0.057	0.567	-0.052	-0.048
E22	-0.047	0.534	0.531	-0.014	0.995	0.534	0.525	-0.041	0.535	-0.058	-0.058	0.531	0.992	-0.049
E23	0.98	0.553	0.531	-0.014	-0.06	0.559	0.558	0.971	0.555	0.973	0.979	0.559	-0.057	0.981
E24	-0.047	0.533	0.531	-0.014	0.994	0.533	0.525	-0.04	0.535	-0.057	-0.057	0.531	0.992	-0.048

E25	0.98	0.553	0.531	-0.014	-0.06	0.56	0.558	0.972	0.555	0.974	0.979	0.559	-0.057	0.981
E26	-0.015	0.553	0.531	-0.014	0.889	0.8	0.796	0	0.8	-0.02	-0.018	0.798	0.685	-0.009
E27	0.557	0.553	0.531	-0.014	0.889	0.995	0.991	0.565	0.992	0.549	0.553	0.994	0.526	0.562
E28	0.557	0.553	0.531	-0.014	0.889	0.995	0.991	0.565	0.992	0.549	0.553	0.994	0.526	0.562
E29	-0.015	0.553	0.531	-0.014	0.788	0.799	0.796	0	0.799	-0.02	-0.018	0.798	0.683	-0.009
E30	0.558	0.553	0.993	-0.014	0.788	0.995	0.991	0.565	0.992	0.549	0.553	0.994	0.526	0.562
E31	-0.048	0.533	0.531	-0.014	0.995	0.532	0.525	-0.042	0.534	-0.058	-0.058	0.53	0.993	-0.049
E32	-0.05	0.532	0.53	-0.014	0.996	0.531	0.524	-0.045	0.532	-0.061	-0.061	0.529	0.993	-0.052
E33	-0.016	0.532	0.798	-0.014	0.889	0.799	0.796	-0.003	0.799	-0.022	-0.02	0.798	0.685	-0.011
E34	-0.015	0.532	0.797	-0.014	0.889	0.799	0.796	0	0.8	-0.02	-0.018	0.798	0.683	-0.009
E35	0.98	0.551	0.556	-0.014	0.889	0.558	0.557	0.972	0.554	0.974	0.978	0.557	-0.057	0.981
E36	0.558	0.551	0.994	-0.014	0.533	0.995	0.992	0.565	0.993	0.55	0.553	0.995	0.529	0.561
E37	-0.048	0.533	0.532	-0.014	0.996	0.532	0.525	-0.043	0.534	-0.058	-0.059	0.531	0.994	-0.05
E38	0.558	0.533	0.993	-0.014	0.53	0.995	0.991	0.566	0.992	0.549	0.553	0.993	0.526	0.561
E39	0.558	0.557	0.561	-0.014	0.889	0.564	0.561	0.973	0.559	0.974	0.553	0.563	-0.054	0.98
E40	0.558	0.554	0.559	-0.014	0.889	0.56	0.559	0.972	0.555	0.974	0.553	0.559	-0.056	0.98
E41	-0.017	0.554	0.797	-0.014	0.889	0.798	0.796	-0.003	0.799	-0.023	-0.022	0.798	0.686	-0.013
E42	-0.013	0.554	0.801	-0.014	0.889	0.801	0.799	0.001	0.801	-0.019	-0.017	0.801	0.686	-0.009
E43	-0.013	0.554	0.557	-0.014	0.889	0.558	0.556	0.971	0.552	0.972	0.976	0.557	-0.059	0.978
E44	-0.013	0.554	0.561	-0.014	-0.05	0.564	0.561	0.973	0.559	0.974	0.98	0.563	-0.054	0.98
E45	0.558	0.554	0.993	-0.014	0.753	0.995	0.991	0.566	0.992	0.549	0.553	0.993	0.526	0.561
E46	-0.053	0.554	0.529	-0.014	0.997	0.529	0.521	-0.047	0.531	-0.064	-0.064	0.528	0.993	-0.055
E47	0.556	0.554	0.994	-0.014	0.997	0.995	0.992	0.563	0.993	0.549	0.552	0.994	0.527	0.561
E48	-0.049	0.554	0.531	-0.014	0.995	0.532	0.525	-0.045	0.534	-0.061	-0.061	0.53	0.993	-0.051
E49	0.982	0.554	0.561	-0.014	0.753	0.564	0.561	0.973	0.559	0.974	0.98	0.563	-0.054	0.98
E50	-0.013	0.554	0.799	-0.014	0.753	0.8	0.798	0	0.801	-0.02	-0.017	0.8	0.687	-0.008
F1	0.558	0.554	0.993	-0.014	0.53	1	0.991	0.566	0.993	0.551	0.556	0.995	0.526	0.562

F2	0.982	0.548	0.554	-0.014	-0.059	0.555	0.553	0.973	0.55	0.977	0.981	0.555	-0.057	0.984
F3	-0.017	0.548	0.797	-0.014	0.683	0.799	0.794	-0.002	0.799	-0.022	-0.018	0.798	0.678	-0.012
F4	-0.053	0.529	0.526	-0.014	0.993	0.799	0.519	-0.044	0.531	-0.063	-0.063	0.526	0.99	-0.055
F5	-0.016	0.529	0.797	-0.014	0.682	0.799	0.795	-0.001	0.531	-0.021	-0.017	0.798	0.677	-0.011
F6	-0.016	0.552	0.559	-0.014	-0.056	0.799	0.559	0.97	0.531	0.978	0.979	0.56	-0.056	0.981
F7	-0.016	0.556	0.563	-0.014	-0.053	0.799	0.563	0.971	0.531	0.979	0.98	0.564	-0.053	0.981
F8	0.555	0.556	0.993	-0.014	0.529	0.995	0.99	0.563	0.531	0.549	0.553	0.993	0.525	0.559
F9	0.555	0.556	0.993	-0.014	0.528	0.995	0.991	0.564	0.531	0.548	0.553	0.993	0.524	0.558
F10	0.555	0.556	0.993	-0.014	0.528	0.995	0.99	0.563	0.531	0.549	0.553	0.993	0.525	0.559
F11	0.558	0.556	0.993	-0.014	0.528	0.995	0.991	0.565	0.531	0.552	0.555	0.994	0.524	0.561
F12	-0.05	0.556	0.527	-0.014	0.994	0.529	0.52	-0.041	0.531	-0.06	-0.06	0.527	0.991	-0.053
F13	-0.01	0.556	0.799	-0.014	0.685	0.801	0.796	0.007	0.531	-0.015	-0.011	0.527	0.679	-0.006
F14	0.555	0.556	0.993	-0.014	0.528	0.995	0.991	0.564	0.531	0.548	0.553	0.527	0.524	0.558
F15	-0.01	0.556	0.799	-0.014	0.685	0.801	0.796	0.007	0.531	-0.015	-0.011	0.527	0.679	-0.006
F16	-0.052	0.556	0.527	-0.014	0.993	0.801	0.52	-0.043	0.531	-0.062	-0.061	0.527	0.99	-0.055
F17	0.559	0.556	0.527	-0.014	0.527	0.996	0.991	0.567	0.531	0.552	0.555	0.527	0.524	0.562
F18	0.559	0.556	0.527	-0.014	-0.047	0.996	0.564	0.969	0.531	0.976	0.555	0.527	-0.046	0.978
F19	0.559	0.551	0.527	-0.014	-0.06	0.996	0.556	0.971	0.531	0.977	0.555	0.527	-0.059	0.979
F20	0.559	0.557	0.527	-0.014	-0.047	0.996	0.563	0.969	0.531	0.976	0.555	0.565	-0.046	0.978
F21	-0.053	0.529	0.527	-0.014	0.994	0.996	0.52	-0.044	0.531	-0.063	-0.063	0.526	0.99	-0.055
F22	0.984	0.56	0.527	-0.014	-0.044	0.996	0.566	0.973	0.531	0.978	0.982	0.567	-0.044	0.983
F23	-0.051	0.529	0.527	-0.014	-0.044	0.529	0.52	-0.043	0.531	-0.061	-0.06	0.526	0.99	-0.053
F24	0.981	0.551	0.527	-0.014	-0.044	0.559	0.556	0.971	0.554	0.977	0.98	0.557	-0.059	0.979
F25	-0.01	0.551	0.527	-0.014	-0.044	0.801	0.797	0.006	0.801	-0.016	-0.011	0.8	0.678	-0.006
F26	0.555	0.551	0.527	-0.014	-0.044	0.995	0.991	0.564	0.993	0.548	0.553	0.993	0.524	0.558
F27	-0.01	0.551	0.527	-0.014	-0.044	0.802	0.798	0.007	0.802	-0.016	-0.011	0.8	0.677	-0.005
F28	-0.01	0.551	0.527	-0.014	-0.044	0.802	0.798	0.007	0.802	-0.016	-0.011	0.8	0.677	-0.005

F29	0.555	0.551	0.527	-0.014	-0.044	0.995	0.991	0.564	0.993	0.548	0.553	0.993	0.524	0.558
F30	-0.052	0.529	0.527	-0.014	-0.044	0.995	0.519	-0.044	0.53	-0.062	-0.061	0.526	0.99	-0.053
F31	-0.052	0.557	0.527	-0.014	-0.044	0.566	0.562	0.974	0.561	0.978	0.983	0.565	-0.049	0.981
F32	-0.017	0.804	0.527	-0.014	-0.044	0.799	0.795	-0.001	0.799	-0.022	-0.018	0.565	0.678	-0.011
F33	-0.054	0.528	0.527	-0.014	-0.044	0.527	0.519	-0.046	0.529	-0.064	-0.063	0.565	0.99	-0.055
F34	0.555	0.528	0.527	-0.014	-0.044	0.995	0.991	0.564	0.529	0.548	0.553	0.565	0.524	0.558
F35	0.556	0.528	0.527	-0.014	-0.044	0.995	0.99	0.563	0.529	0.549	0.553	0.565	0.526	0.56
F36	0.553	0.528	0.527	0.793	-0.044	0.996	0.991	0.562	0.529	0.546	0.551	0.565	0.528	0.557
F37	0.558	0.528	0.527	0.788	-0.044	0.996	0.991	0.565	0.529	0.55	0.554	0.565	0.526	0.562
F38	-0.011	0.528	0.527	0.979	-0.044	0.802	0.797	0.005	0.529	-0.016	-0.011	0.565	0.677	-0.006
F39	0.555	0.528	0.527	0.792	-0.044	0.995	0.991	0.564	0.529	0.549	0.553	0.565	0.524	0.558
F40	0.556	0.528	0.527	0.789	-0.044	0.995	0.99	0.563	0.529	0.549	0.553	0.565	0.525	0.56
F41	0.554	0.528	0.527	0.792	-0.044	0.997	0.991	0.562	0.529	0.547	0.551	0.565	0.529	0.558
F42	-0.05	0.528	0.527	0.672	-0.044	0.53	0.522	-0.044	0.532	-0.06	-0.06	0.565	0.991	-0.051
F43	-0.015	0.528	0.527	0.979	-0.044	0.8	0.795	0	0.8	-0.02	-0.016	0.565	0.677	-0.01
F44	-0.053	0.528	0.527	0.677	-0.044	0.8	0.519	-0.044	0.531	-0.063	-0.063	0.526	0.99	-0.055
F45	0.557	0.528	0.527	0.788	-0.044	0.995	0.99	0.563	0.992	0.549	0.553	0.994	0.526	0.561
F46	0.983	0.528	0.527	-0.01	-0.044	0.57	0.565	0.973	0.563	0.978	0.981	0.567	-0.044	0.982
F47	0.558	0.528	0.527	0.788	-0.044	0.995	0.991	0.566	0.992	0.551	0.555	0.994	0.524	0.563
F48	-0.057	0.528	0.527	0.673	-0.044	0.995	0.516	-0.049	0.527	-0.067	-0.066	0.523	0.991	-0.058
F49	-0.053	0.528	0.527	0.677	0.993	0.995	0.519	-0.044	0.531	-0.063	-0.063	0.526	0.99	-0.055
F50	0.981	0.556	0.527	-0.011	-0.046	0.995	0.561	0.97	0.559	0.975	0.979	0.526	-0.045	0.982
G1	0.556	0.991	0.527	0.784	0.521	0.991	1	0.564	0.989	0.551	0.553	0.526	0.518	0.562
G2	0.557	0.991	0.527	0.785	0.526	0.991	0.991	0.564	0.99	0.55	0.553	0.526	0.523	0.561
G3	-0.051	0.531	0.527	0.676	0.992	0.529	0.991	-0.045	0.532	-0.062	-0.062	0.526	0.988	-0.053
G4	-0.053	0.528	0.527	0.673	0.991	0.527	0.991	-0.047	0.529	-0.065	-0.064	0.526	0.988	-0.055
G5	-0.05	0.531	0.527	0.676	0.992	0.529	0.991	-0.044	0.532	-0.062	-0.062	0.526	0.988	-0.052

G6	-0.022	0.799	0.527	0.979	0.687	0.529	0.791	-0.007	0.795	-0.028	-0.026	0.526	0.682	-0.018
G7	0.558	0.991	0.527	0.784	0.523	0.529	0.989	0.566	0.99	0.553	0.554	0.526	0.518	0.56
G8	0.558	0.523	0.527	-0.042	-0.082	0.529	0.989	0.957	0.523	0.956	0.965	0.526	-0.082	0.959
G9	0.558	0.525	0.527	-0.039	-0.081	0.529	0.989	0.957	0.525	0.954	0.965	0.526	-0.08	0.959
G10	-0.052	0.529	0.527	0.674	0.991	0.529	0.989	-0.045	0.53	-0.063	-0.062	0.526	0.988	-0.054
G11	-0.056	0.526	0.527	0.674	0.993	0.529	0.518	-0.05	0.526	-0.069	-0.067	0.526	0.99	-0.058
G12	-0.021	0.526	0.527	0.674	0.69	0.529	0.792	-0.004	0.797	-0.027	-0.024	0.526	0.685	-0.017
G13	0.559	0.526	0.527	0.674	0.52	0.529	0.99	0.567	0.988	0.549	0.556	0.526	0.515	0.561
G14	0.559	0.526	0.527	0.674	0.519	0.529	0.99	0.568	0.988	0.549	0.555	0.526	0.515	0.56
G15	0.963	0.526	0.527	0.674	-0.082	0.529	0.532	0.957	0.523	0.954	0.965	0.526	-0.082	0.958
G16	-0.018	0.526	0.527	0.674	-0.082	0.529	0.794	-0.002	0.798	-0.025	-0.023	0.526	0.684	-0.015
G17	0.97	0.534	0.527	0.674	-0.082	0.529	0.794	0.961	0.536	0.965	0.969	0.526	-0.07	0.965
G18	0.559	0.991	0.527	0.782	-0.082	0.529	0.989	0.567	0.988	0.549	0.556	0.526	0.515	0.561
G19	-0.019	0.798	0.527	0.975	-0.082	0.529	0.793	-0.004	0.794	-0.026	-0.024	0.526	0.69	-0.017
G20	-0.019	0.524	0.527	-0.04	-0.081	0.529	0.793	0.957	0.525	0.954	0.965	0.526	-0.082	0.959
G21	-0.019	0.529	0.527	-0.037	-0.075	0.533	0.793	0.96	0.53	0.962	0.968	0.526	-0.075	0.963
G22	-0.052	0.53	0.527	0.674	-0.075	0.528	0.522	-0.045	0.53	-0.064	-0.063	0.526	0.99	-0.054
G23	-0.052	0.528	0.527	-0.036	-0.078	0.533	0.537	0.957	0.528	0.953	0.965	0.526	-0.079	0.96
G24	0.559	0.991	0.527	0.783	0.52	0.99	0.99	0.568	0.988	0.549	0.556	0.526	0.515	0.56
G25	0.558	0.991	0.527	0.782	0.521	0.99	0.99	0.567	0.988	0.549	0.555	0.526	0.516	0.561
G26	0.558	0.525	0.527	-0.039	-0.081	0.53	0.535	0.956	0.525	0.954	0.965	0.526	-0.081	0.959
G27	0.558	0.991	0.527	0.782	0.52	0.99	0.99	0.567	0.525	0.549	0.556	0.526	0.516	0.562
G28	0.558	0.991	0.527	0.782	0.52	0.99	0.99	0.567	0.525	0.549	0.556	0.526	0.516	0.562
G29	0.559	0.991	0.527	0.783	0.52	0.99	0.99	0.568	0.525	0.549	0.556	0.526	0.515	0.56
G30	0.558	0.991	0.527	0.782	0.521	0.99	0.99	0.567	0.525	0.549	0.556	0.526	0.516	0.562
G31	0.559	0.992	0.527	0.784	0.522	0.992	0.991	0.569	0.525	0.55	0.556	0.526	0.518	0.562
G32	0.969	0.536	0.527	-0.03	-0.072	0.542	0.991	0.963	0.525	0.958	0.97	0.526	-0.074	0.966

G33	0.963	0.53	0.527	-0.033	-0.076	0.536	0.991	0.957	0.531	0.952	0.965	0.536	-0.078	0.961
G34	0.559	0.991	0.527	-0.033	-0.076	0.99	0.99	0.568	0.988	0.549	0.556	0.99	0.516	0.56
G35	-0.053	0.529	0.527	-0.033	-0.076	0.528	0.99	-0.046	0.53	-0.063	-0.064	0.527	0.989	-0.054
G36	-0.053	0.529	0.527	-0.033	-0.076	0.534	0.99	0.963	0.53	0.961	0.97	0.535	-0.073	0.966
G37	-0.053	0.542	0.527	-0.033	-0.076	0.548	0.549	0.961	0.542	0.959	0.969	0.548	-0.062	0.967
G38	-0.053	0.529	0.527	-0.033	0.991	0.528	0.521	-0.046	0.53	-0.063	-0.064	0.527	0.988	-0.054
G39	0.559	0.529	0.527	-0.033	0.52	0.528	0.99	0.568	0.988	0.549	0.555	0.99	0.516	0.56
G40	0.557	0.529	0.527	-0.033	0.521	0.528	0.989	0.567	0.988	0.548	0.555	0.99	0.517	0.561
G41	0.558	0.529	0.527	-0.033	0.523	0.528	0.994	0.566	0.989	0.55	0.554	0.992	0.519	0.562
G42	0.558	0.529	0.527	0.785	0.526	0.528	0.992	0.564	0.991	0.55	0.554	0.993	0.522	0.561
G43	0.558	0.529	0.527	0.785	0.521	0.99	0.989	0.567	0.989	0.548	0.555	0.99	0.516	0.561
G44	0.559	0.529	0.527	0.783	0.521	0.99	0.99	0.568	0.988	0.549	0.555	0.99	0.516	0.561
G45	0.559	0.53	0.527	-0.033	-0.077	0.536	0.99	0.957	0.531	0.951	0.965	0.536	-0.079	0.961
G46	0.559	0.992	0.527	0.784	0.522	0.992	0.999	0.565	0.99	0.552	0.554	0.992	0.519	0.562
G47	-0.062	0.524	0.527	0.676	0.993	0.523	0.516	-0.055	0.525	-0.07	-0.074	0.522	0.99	-0.064
G48	0.963	0.529	0.527	-0.034	-0.078	0.534	0.537	0.958	0.53	0.952	0.965	0.534	-0.079	0.961
G49	-0.019	0.797	0.792	-0.034	0.696	0.793	0.793	-0.004	0.794	-0.026	-0.024	0.534	0.69	-0.016
G50	-0.053	0.53	0.528	-0.034	0.991	0.528	0.793	-0.047	0.53	-0.064	-0.065	0.534	0.988	-0.055
H1	-0.053	0.561	0.565	-0.034	-0.046	0.566	0.564	1	0.563	0.965	0.974	0.534	-0.045	0.972
H2	-0.053	0.553	0.559	-0.034	-0.051	0.561	0.563	0.961	0.556	0.968	0.969	0.534	-0.052	0.972
H3	-0.053	0.529	0.527	-0.034	-0.051	0.528	0.519	0.961	0.531	-0.062	-0.06	0.534	0.986	-0.054
H4	-0.052	0.526	0.522	-0.034	-0.051	0.525	0.516	0.961	0.527	-0.066	-0.062	0.534	0.985	-0.056
H5	-0.017	0.526	0.79	-0.034	-0.051	0.525	0.516	0.961	0.793	-0.026	-0.022	0.534	0.679	-0.016
H6	0.558	0.526	0.992	-0.034	0.526	0.525	0.516	0.961	0.991	0.55	0.554	0.534	0.522	0.561
H7	0.558	0.526	0.992	-0.034	0.525	0.525	0.516	0.961	0.991	0.55	0.554	0.534	0.522	0.561
H8	0.554	0.526	0.989	0.786	0.521	0.525	0.516	0.961	0.989	0.548	0.552	0.534	0.517	0.558
H9	-0.016	0.526	0.79	0.974	0.681	0.525	0.516	0.002	0.793	-0.024	-0.017	0.534	0.675	-0.013

H10	0.554	0.526	0.989	0.786	0.521	0.525	0.516	0.961	0.989	0.548	0.552	0.534	0.517	0.558
H11	0.558	0.526	0.991	0.785	0.525	0.525	0.516	0.961	0.991	0.551	0.554	0.534	0.521	0.561
H12	-0.015	0.526	0.795	0.976	0.679	0.525	0.516	0.961	0.797	-0.021	-0.016	0.534	0.674	-0.011
H13	-0.053	0.526	0.522	0.673	0.987	0.525	0.516	0.961	0.527	-0.066	-0.063	0.534	0.984	-0.057
H14	-0.016	0.798	0.79	0.974	0.68	0.525	0.516	0.961	0.792	-0.024	-0.017	0.791	0.675	-0.013
H15	-0.053	0.526	0.522	0.673	0.987	0.525	0.516	0.961	0.527	-0.066	-0.063	0.523	0.984	-0.057
H16	0.558	0.993	0.991	0.785	0.524	0.525	0.989	0.961	0.991	0.551	0.555	0.993	0.52	0.562
H17	-0.049	0.53	0.527	0.673	0.989	0.525	0.52	-0.04	0.531	-0.06	-0.059	0.527	0.986	-0.053
H18	0.965	0.543	0.548	-0.018	-0.059	0.551	0.548	0.969	0.545	0.967	0.964	0.55	-0.057	0.966
H19	-0.052	0.527	0.523	0.673	0.988	0.525	0.516	0.969	0.527	-0.066	-0.062	0.523	0.984	-0.056
H20	-0.053	0.527	0.523	0.673	0.987	0.525	0.517	0.969	0.527	-0.067	-0.063	0.523	0.985	-0.057
H21	0.972	0.549	0.556	-0.016	-0.052	0.556	0.554	0.967	0.551	0.971	0.968	0.557	-0.051	0.971
H22	0.557	0.992	0.99	-0.016	0.523	0.992	0.988	0.567	0.99	0.55	0.553	0.992	0.52	0.56
H23	-0.053	0.527	0.524	-0.016	0.523	0.526	0.517	0.744	0.528	-0.066	-0.062	0.524	0.984	-0.057
H24	-0.052	0.526	0.523	-0.016	0.523	0.525	0.516	0.744	0.527	-0.066	-0.062	0.523	0.984	-0.056
H25	-0.053	0.527	0.524	-0.016	0.523	0.526	0.517	0.744	0.528	-0.066	-0.062	0.524	0.985	-0.057
H26	-0.052	0.527	0.523	-0.016	0.523	0.525	0.517	0.744	0.527	-0.065	-0.062	0.523	0.985	-0.056
H27	-0.053	0.526	0.523	-0.016	0.523	0.526	0.517	0.744	0.528	-0.067	-0.062	0.524	0.984	-0.057
H28	-0.053	0.526	0.523	-0.016	0.523	0.526	0.517	0.969	0.528	-0.067	-0.062	0.524	0.984	-0.057
H29	-0.052	0.526	0.522	-0.016	0.988	0.525	0.516	0.969	0.527	-0.066	-0.062	0.523	0.984	-0.056
H30	0.965	0.55	0.555	-0.01	-0.051	0.557	0.556	0.969	0.552	0.965	0.965	0.557	-0.049	0.966
H31	-0.053	0.527	0.523	0.673	0.989	0.525	0.517	-0.04	0.527	-0.066	-0.062	0.523	0.986	-0.057
H32	-0.055	0.526	0.523	0.673	0.989	0.525	0.517	0.748	0.527	-0.069	-0.065	0.523	0.987	-0.06
H33	0.969	0.526	0.555	-0.012	-0.049	0.557	0.555	0.748	0.552	0.969	0.967	0.557	-0.048	0.968
H34	-0.053	0.526	0.522	0.673	0.988	0.525	0.516	0.748	0.527	-0.066	-0.062	0.523	0.984	-0.056
H35	-0.053	0.526	0.555	-0.012	-0.049	0.557	0.555	0.748	0.552	0.969	0.967	0.557	-0.048	0.968
H36	-0.05	0.526	0.525	0.674	0.989	0.528	0.52	0.748	0.529	-0.063	-0.06	0.525	0.986	-0.054

H37	-0.02	0.526	0.788	0.973	0.678	0.79	0.786	0.748	0.79	-0.029	-0.023	0.789	0.672	-0.018
H38	0.559	0.526	0.989	0.784	0.521	0.992	0.987	0.566	0.989	0.552	0.553	0.991	0.518	0.561
H39	0.97	0.526	0.558	-0.009	-0.051	0.559	0.556	0.972	0.553	0.969	0.968	0.559	-0.05	0.97
H40	-0.018	0.526	0.788	0.974	0.678	0.79	0.786	-0	0.792	-0.026	-0.022	0.559	0.674	-0.017
H41	0.975	0.526	0.56	-0.009	-0.046	0.561	0.559	0.982	0.556	0.969	0.971	0.559	-0.046	0.972
H42	-0.019	0.526	0.791	-0.009	0.684	0.793	0.559	0.982	0.793	-0.028	-0.024	0.559	0.679	-0.017
H43	0.56	0.526	0.989	-0.009	0.522	0.992	0.559	0.982	0.99	0.552	0.554	0.559	0.518	0.562
H44	0.56	0.526	0.558	-0.009	-0.051	0.558	0.556	0.972	0.553	0.969	0.968	0.559	-0.05	0.97
H45	0.971	0.526	0.556	-0.009	-0.048	0.558	0.555	0.966	0.553	0.968	0.967	0.559	-0.048	0.968
H46	0.974	0.526	0.563	-0.009	-0.049	0.565	0.561	0.992	0.56	0.965	0.972	0.564	-0.048	0.97
H47	0.971	0.526	0.559	-0.009	-0.041	0.562	0.558	0.971	0.557	0.967	0.972	0.562	-0.04	0.971
H48	0.561	0.526	0.989	-0.009	0.523	0.992	0.558	0.971	0.99	0.552	0.555	0.562	0.519	0.562
H49	-0.052	0.526	0.522	0.673	0.523	0.525	0.516	0.971	0.527	-0.066	-0.062	0.523	0.985	-0.056
H50	0.972	0.526	0.555	-0.015	0.523	0.557	0.554	0.967	0.552	0.968	0.967	0.558	-0.047	0.969
I1	0.554	0.526	0.991	-0.015	0.531	0.557	0.554	0.563	1	0.545	0.55	0.992	0.527	0.558
I2	-0.017	0.526	0.794	-0.015	0.685	0.557	0.554	0	0.795	-0.021	-0.019	0.794	0.678	-0.013
I3	-0.015	0.526	0.794	-0.015	0.687	0.557	0.554	0.003	0.796	-0.02	-0.017	0.793	0.682	-0.012
I4	-0.05	0.526	0.529	-0.015	0.99	0.529	0.521	-0.041	0.796	-0.061	-0.058	0.528	0.987	-0.052
I5	-0.016	0.526	0.529	-0.015	0.685	0.529	0.521	0.001	0.797	-0.021	-0.017	0.794	0.68	-0.012
I6	-0.018	0.526	0.529	-0.015	0.688	0.529	0.521	-0.001	0.797	-0.02	-0.02	0.796	0.683	-0.012
I7	-0.018	0.526	0.529	-0.015	-0.067	0.549	0.548	0.962	0.545	0.972	0.969	0.551	-0.069	0.973
I8	0.967	0.526	0.529	-0.015	-0.071	0.549	0.546	0.961	0.992	0.964	0.968	0.549	-0.071	0.969
I9	0.967	0.526	0.529	-0.015	-0.071	0.548	0.546	0.961	0.992	0.964	0.968	0.548	-0.071	0.969
I10	0.967	0.526	0.529	-0.024	-0.071	0.549	0.546	0.961	0.545	0.964	0.968	0.548	-0.071	0.969
I11	0.556	0.526	0.529	0.789	0.527	0.994	0.546	0.564	0.992	0.551	0.552	0.993	0.522	0.56
I12	-0.054	0.526	0.528	0.676	0.527	0.528	0.521	-0.046	0.992	-0.061	-0.063	0.527	0.988	-0.054
I13	0.552	0.526	0.991	0.789	0.523	0.993	0.521	0.56	0.992	0.547	0.55	0.992	0.519	0.556

I14	-0.05	0.526	0.529	0.675	0.99	0.529	0.521	-0.041	0.532	-0.061	-0.058	0.528	0.987	-0.052
I15	0.552	0.526	0.991	0.789	0.523	0.993	0.989	0.56	0.992	0.547	0.55	0.992	0.519	0.556
I16	0.555	0.526	0.993	0.789	0.525	0.994	0.991	0.564	0.993	0.55	0.553	0.993	0.521	0.56
I17	-0.051	0.526	0.528	0.675	0.992	0.529	0.522	-0.042	0.993	-0.061	-0.06	0.528	0.988	-0.053
I18	-0.052	0.526	0.527	0.675	0.991	0.527	0.52	-0.043	0.993	-0.063	-0.06	0.526	0.988	-0.054
I19	0.553	0.526	0.991	0.79	0.524	0.527	0.989	0.562	0.992	0.547	0.55	0.992	0.521	0.558
I20	-0.018	0.526	0.793	0.978	0.682	0.527	0.79	0	0.797	-0.023	-0.019	0.794	0.677	-0.014
I21	-0.021	0.526	0.794	0.978	0.684	0.527	0.791	-0.004	0.796	-0.024	-0.022	0.793	0.679	-0.015
I22	-0.021	0.526	0.792	0.979	0.685	0.527	0.789	-0.004	0.795	-0.025	-0.022	0.793	0.679	-0.016
I23	-0.051	0.526	0.527	0.676	0.991	0.527	0.52	-0.042	0.795	-0.062	-0.059	0.526	0.988	-0.053
I24	0.967	0.526	0.546	-0.025	-0.072	0.547	0.545	0.96	0.543	0.964	0.968	0.547	-0.072	0.969
I25	-0.017	0.526	0.793	0.978	0.681	0.794	0.545	0.001	0.797	-0.022	-0.018	0.794	0.676	-0.013
I26	0.967	0.526	0.546	-0.025	-0.071	0.548	0.545	0.961	0.797	0.964	0.968	0.548	-0.071	0.969
I27	0.554	0.526	0.99	0.789	0.522	0.993	0.545	0.562	0.991	0.547	0.551	0.992	0.518	0.557
I28	0.554	0.526	0.99	0.789	0.522	0.993	0.545	0.562	0.991	0.547	0.551	0.992	0.518	0.557
I29	-0.019	0.526	0.793	0.977	0.682	0.793	0.545	-0.002	0.796	-0.023	-0.019	0.793	0.677	-0.014
I30	-0.017	0.526	0.792	0.977	0.682	0.793	0.545	0.001	0.796	-0.021	-0.018	0.793	0.677	-0.013
I31	-0.05	0.526	0.529	0.675	0.991	0.53	0.545	-0.041	0.796	-0.06	-0.058	0.528	0.988	-0.051
I32	-0.053	0.526	0.526	0.678	0.992	0.527	0.545	-0.044	0.796	-0.064	-0.061	0.525	0.989	-0.055
I33	0.969	0.526	0.546	-0.027	-0.072	0.546	0.545	0.96	0.543	0.967	0.969	0.547	-0.072	0.972
I34	0.553	0.526	0.991	0.79	0.524	0.993	0.545	0.562	0.992	0.547	0.55	0.992	0.521	0.558
I35	0.969	0.526	0.545	-0.027	-0.073	0.546	0.545	0.961	0.992	0.968	0.969	0.546	-0.072	0.972
I36	-0.049	0.526	0.529	0.676	0.991	0.53	0.522	-0.042	0.992	-0.06	-0.058	0.528	0.988	-0.051
I37	0.976	0.526	0.545	-0.027	-0.074	0.547	0.545	0.967	0.992	0.97	0.974	0.546	-0.074	0.976
I38	0.97	0.526	0.545	-0.027	-0.075	0.546	0.545	0.961	0.992	0.969	0.969	0.547	-0.074	0.973
I39	-0.05	0.526	0.529	0.675	0.99	0.529	0.521	-0.041	0.992	-0.061	-0.058	0.528	0.987	-0.052
I40	0.97	0.526	0.546	-0.026	-0.074	0.547	0.545	0.961	0.992	0.969	0.969	0.547	-0.073	0.973

I41	0.973	0.526	0.55	-0.023	-0.056	0.547	0.549	0.966	0.549	0.966	0.973	0.551	-0.055	0.972
I42	-0.021	0.526	0.793	-0.023	0.683	0.547	0.79	-0.003	0.796	-0.025	-0.021	0.792	0.678	-0.016
I43	0.556	0.526	0.991	-0.023	0.523	0.547	0.989	0.564	0.991	0.549	0.552	0.992	0.519	0.561
I44	-0.05	0.526	0.529	-0.023	0.523	0.547	0.521	-0.042	0.991	-0.061	-0.058	0.528	0.987	-0.052
I45	-0.049	0.526	0.529	-0.023	0.523	0.529	0.521	-0.04	0.991	-0.06	-0.058	0.528	0.988	-0.052
I46	-0.051	0.526	0.528	-0.023	0.523	0.529	0.522	-0.044	0.535	-0.061	-0.059	0.527	0.988	-0.052
I47	-0.052	0.526	0.528	-0.023	0.523	0.53	0.522	-0.045	0.992	-0.062	-0.06	0.527	0.989	-0.054
I48	-0.048	0.526	0.53	-0.023	0.991	0.53	0.522	-0.039	0.534	-0.06	-0.057	0.528	0.988	-0.052
I49	0.553	0.526	0.991	-0.023	0.525	0.993	0.522	0.562	0.992	0.547	0.55	0.992	0.521	0.558
I50	-0.02	0.526	0.792	-0.023	0.682	0.793	0.522	-0.003	0.795	-0.025	-0.022	0.791	0.676	-0.016
J1	0.975	0.526	0.551	-0.023	-0.063	0.551	0.551	0.965	0.545	1	0.974	0.552	-0.062	0.977
J2	-0.019	0.526	0.798	-0.023	0.689	0.551	0.551	-0.002	0.8	0.924	-0.021	0.798	0.684	-0.013
J3	0.556	0.526	0.992	-0.023	0.526	0.551	0.551	0.565	0.991	0.924	0.552	0.992	0.521	0.56
J4	-0.056	0.526	0.525	0.674	0.992	0.524	0.518	-0.05	0.527	0.924	-0.065	0.524	0.99	-0.058
J5	-0.055	0.526	0.525	0.672	0.992	0.525	0.519	-0.048	0.527	0.924	-0.065	0.524	0.99	-0.057
J6	-0.052	0.526	0.528	0.674	0.994	0.529	0.523	-0.044	0.531	0.924	-0.061	0.527	0.991	-0.054
J7	-0.05	0.526	0.529	0.675	0.994	0.53	0.524	-0.042	0.532	0.924	-0.06	0.528	0.991	-0.053
J8	0.97	0.526	0.549	-0.022	-0.063	0.551	0.553	0.966	0.547	0.924	0.971	0.551	-0.063	0.973
J9	0.554	0.526	0.549	0.789	0.528	0.551	0.991	0.563	0.991	0.547	0.551	0.992	0.524	0.559
J10	-0.056	0.526	0.549	0.674	0.992	0.524	0.518	-0.05	0.527	0.992	-0.065	0.524	0.99	-0.058
J11	-0.018	0.526	0.549	0.981	0.687	0.8	0.798	0	0.801	0.992	-0.021	0.799	0.682	-0.013
J12	0.973	0.526	0.549	-0.024	-0.066	0.55	0.55	0.965	0.546	0.964	0.972	0.55	-0.064	0.974
J13	0.97	0.526	0.549	-0.022	-0.063	0.551	0.553	0.966	0.547	0.967	0.971	0.55	-0.062	0.972
J14	0.554	0.526	0.549	0.789	0.528	0.551	0.991	0.563	0.991	0.967	0.551	0.992	0.524	0.559
J15	0.97	0.526	0.549	-0.022	-0.063	0.551	0.553	0.966	0.547	0.967	0.971	0.551	-0.062	0.972
J16	0.976	0.526	0.551	-0.023	-0.062	0.553	0.553	0.97	0.549	0.97	0.975	0.552	-0.062	0.978
J17	-0.015	0.526	0.801	-0.023	0.687	0.553	0.799	0.001	0.549	0.97	-0.018	0.801	0.683	-0.011

J18	0.554	0.526	0.992	-0.023	0.528	0.553	0.991	0.564	0.549	0.97	0.551	0.992	0.524	0.558
J19	-0.011	0.526	0.802	-0.023	0.686	0.553	0.8	0.004	0.549	0.97	-0.014	0.802	0.683	-0.007
J20	0.554	0.526	0.992	-0.023	0.528	0.553	0.991	0.563	0.549	0.97	0.551	0.992	0.524	0.558
J21	0.556	0.526	0.992	-0.023	0.528	0.553	0.991	0.565	0.549	0.97	0.552	0.993	0.524	0.56
J22	0.973	0.526	0.555	-0.023	-0.057	0.556	0.558	0.968	0.549	0.97	0.974	0.556	-0.057	0.975
J23	-0.056	0.526	0.525	-0.023	0.992	0.525	0.518	-0.05	0.549	0.762	-0.065	0.524	0.99	-0.057
J24	0.554	0.526	0.992	-0.023	0.528	0.525	0.991	0.563	0.549	0.762	0.551	0.992	0.524	0.559
J25	0.97	0.526	0.55	-0.023	-0.062	0.551	0.553	0.967	0.547	0.968	0.971	0.551	-0.061	0.972
J26	0.554	0.526	0.992	-0.023	0.528	0.551	0.991	0.563	0.991	0.547	0.551	0.992	0.524	0.559
J27	-0.011	0.526	0.802	0.981	0.687	0.551	0.799	0.004	0.803	0.762	-0.014	0.802	0.682	-0.008
J28	-0.011	0.526	0.802	0.981	0.687	0.551	0.799	0.004	0.803	0.762	-0.014	0.802	0.682	-0.008
J29	-0.056	0.526	0.525	0.674	0.992	0.524	0.517	-0.05	0.527	0.762	-0.066	0.524	0.99	-0.058
J30	-0.056	0.526	0.525	0.674	0.992	0.525	0.518	-0.049	0.527	0.762	-0.065	0.524	0.989	-0.057
J31	0.973	0.544	0.549	-0.026	-0.056	0.551	0.551	0.966	0.547	0.97	0.973	0.55	-0.056	0.975
J32	-0.014	0.806	0.801	0.981	0.689	0.551	0.799	0.001	0.802	0.97	-0.017	0.801	0.683	-0.01
J33	0.554	0.993	0.992	0.789	0.526	0.551	0.991	0.563	0.991	0.97	0.55	0.992	0.522	0.558
J34	-0.057	0.525	0.524	0.674	0.992	0.524	0.517	-0.051	0.526	0.97	-0.066	0.523	0.99	-0.059
J35	-0.057	0.546	0.551	-0.02	-0.064	0.552	0.555	0.965	0.548	0.967	0.97	0.552	-0.063	0.97
J36	-0.057	0.544	0.55	-0.027	-0.054	0.551	0.552	0.967	0.548	0.973	0.975	0.551	-0.054	0.976
J37	-0.057	0.547	0.552	-0.02	-0.055	0.553	0.554	0.965	0.549	0.972	0.972	0.553	-0.054	0.974
J38	-0.011	0.808	0.803	0.981	0.687	0.553	0.8	0.004	0.803	0.972	-0.015	0.802	0.682	-0.008
J39	-0.057	0.525	0.524	0.674	0.687	0.524	0.517	-0.051	0.526	0.972	-0.066	0.523	0.99	-0.059
J40	-0.057	0.525	0.524	0.673	0.687	0.523	0.516	-0.051	0.526	0.972	-0.066	0.523	0.989	-0.059
J41	-0.017	0.805	0.8	0.981	0.688	0.523	0.797	-0.002	0.8	-0.02	-0.019	0.799	0.684	-0.013
J42	0.976	0.546	0.55	-0.023	-0.057	0.551	0.552	0.966	0.548	0.973	0.973	0.552	-0.057	0.975
J43	0.969	0.543	0.547	-0.023	-0.067	0.548	0.552	0.964	0.545	0.965	0.968	0.549	-0.067	0.968
J44	-0.056	0.525	0.525	0.674	0.992	0.524	0.517	-0.051	0.526	-0.06	-0.066	0.524	0.99	-0.059

J45	-0.057	0.525	0.524	0.673	0.992	0.523	0.517	-0.051	0.526	-0.06	-0.067	0.523	0.989	-0.059
J46	0.556	0.525	0.524	0.673	0.532	0.523	0.517	0.562	0.991	0.556	0.552	0.994	0.527	0.56
J47	0.976	0.544	0.524	0.673	-0.059	0.55	0.551	0.963	0.546	0.976	0.972	0.55	-0.06	0.974
J48	0.555	0.544	0.524	0.673	0.525	0.55	0.551	0.565	0.991	0.976	0.551	0.992	0.52	0.559
J49	-0.056	0.526	0.524	0.673	0.992	0.524	0.518	-0.05	0.527	0.976	-0.066	0.524	0.99	-0.058
J50	0.556	0.526	0.524	0.673	0.525	0.992	0.518	0.565	0.991	0.976	0.551	0.992	0.52	0.559
K1	0.556	0.548	0.524	0.673	-0.064	0.556	0.553	0.974	0.55	0.974	1	0.554	-0.063	0.981
K2	0.556	0.549	0.524	0.673	-0.061	0.555	0.556	0.969	0.55	0.974	0.979	0.554	-0.061	0.98
K3	-0.055	0.526	0.524	0.673	0.993	0.526	0.519	-0.047	0.527	-0.065	0.979	0.524	0.99	-0.057
K4	-0.059	0.524	0.522	0.673	0.993	0.523	0.515	-0.05	0.526	-0.069	0.979	0.521	0.99	-0.061
K5	-0.055	0.526	0.525	0.673	0.993	0.526	0.519	-0.048	0.527	-0.065	-0.07	0.525	0.991	-0.057
K6	0.98	0.55	0.557	0.673	-0.061	0.558	0.557	0.971	0.553	0.974	0.978	0.559	-0.062	0.978
K7	-0.021	0.55	0.793	0.98	0.681	0.794	0.557	-0.004	0.796	-0.027	0.978	0.794	0.676	-0.017
K8	0.56	0.55	0.991	0.784	0.523	0.993	0.557	0.567	0.991	0.553	0.978	0.992	0.518	0.562
K9	-0.058	0.524	0.522	0.674	0.993	0.524	0.557	-0.05	0.526	-0.069	0.978	0.522	0.99	-0.061
K10	0.56	0.524	0.991	0.784	0.523	0.993	0.99	0.567	0.991	0.553	0.978	0.992	0.518	0.563
K11	0.981	0.549	0.556	-0.023	-0.064	0.557	0.557	0.971	0.552	0.975	0.979	0.558	-0.065	0.979
K12	-0.02	0.549	0.795	0.98	0.686	0.796	0.792	-0.003	0.797	-0.026	0.722	0.795	0.68	-0.016
K13	-0.059	0.524	0.522	0.673	0.992	0.523	0.515	-0.05	0.526	-0.07	0.722	0.521	0.99	-0.062
K14	-0.059	0.524	0.522	0.674	0.993	0.524	0.516	-0.05	0.526	-0.069	0.722	0.522	0.99	-0.061
K15	-0.024	0.524	0.789	0.975	0.681	0.791	0.788	-0.007	0.793	-0.03	0.722	0.79	0.676	-0.02
K16	0.559	0.524	0.992	0.787	0.524	0.994	0.991	0.567	0.992	0.551	0.722	0.994	0.52	0.562
K17	-0.02	0.524	0.794	0.979	0.682	0.795	0.792	-0.004	0.797	-0.026	0.782	0.795	0.676	-0.016
K18	-0.025	0.524	0.789	0.976	0.682	0.79	0.788	-0.009	0.792	-0.031	0.722	0.79	0.676	-0.021
K19	-0.025	0.524	0.789	0.977	0.68	0.791	0.788	-0.009	0.792	-0.031	0.722	0.79	0.674	-0.021
K20	-0.059	0.525	0.523	0.674	0.993	0.524	0.516	-0.051	0.526	-0.07	-0.07	0.522	0.99	-0.062
K21	0.559	0.994	0.992	0.787	0.527	0.994	0.991	0.566	0.992	0.551	0.556	0.994	0.522	0.562

K22	0.981	0.546	0.552	-0.024	-0.063	0.552	0.552	0.97	0.548	0.551	0.979	0.553	-0.065	0.979
K23	-0.025	0.796	0.788	0.975	0.681	0.789	0.788	-0.009	0.791	-0.031	0.979	0.79	0.675	-0.021
K24	-0.059	0.524	0.522	0.674	0.993	0.524	0.516	-0.05	0.526	-0.069	0.979	0.521	0.99	-0.061
K25	-0.06	0.525	0.522	0.674	0.993	0.524	0.516	-0.052	0.526	-0.071	0.979	0.522	0.99	-0.062
K26	-0.058	0.525	0.522	0.674	0.993	0.524	0.516	-0.049	0.526	-0.069	-0.07	0.522	0.99	-0.061
K27	0.559	0.525	0.991	0.786	0.523	0.992	0.516	0.565	0.99	0.552	0.875	0.993	0.518	0.561
K28	0.559	0.525	0.991	0.786	0.523	0.992	0.516	0.565	0.99	0.552	0.875	0.993	0.518	0.561
K29	-0.059	0.524	0.522	0.674	0.993	0.524	0.516	-0.05	0.526	-0.069	0.875	0.522	0.99	-0.061
K30	0.559	0.524	0.522	0.786	0.523	0.992	0.516	0.565	0.99	0.552	0.875	0.993	0.519	0.561
K31	0.56	0.524	0.522	0.784	0.526	0.993	0.516	0.567	0.991	0.553	0.875	0.993	0.522	0.563
K32	-0.058	0.525	0.522	0.674	0.994	0.524	0.516	-0.051	0.526	-0.07	0.875	0.523	0.991	-0.061
K33	0.559	0.993	0.522	0.786	0.524	0.992	0.516	0.566	0.99	0.552	0.875	0.993	0.519	0.562
K34	-0.059	0.524	0.522	0.674	0.993	0.524	0.516	-0.05	0.526	-0.069	0.875	0.521	0.99	-0.061
K35	-0.025	0.796	0.522	0.977	0.684	0.79	0.789	-0.008	0.792	-0.031	-0.03	0.791	0.678	-0.021
K36	0.98	0.544	0.522	-0.024	-0.061	0.552	0.551	0.97	0.546	0.978	0.982	0.552	-0.061	0.979
K37	-0.023	0.797	0.522	0.977	0.682	0.792	0.551	-0.007	0.793	-0.028	0.982	0.793	0.677	-0.019
K38	0.559	0.993	0.992	0.786	0.523	0.992	0.551	0.565	0.99	0.552	0.982	0.993	0.518	0.562
K39	-0.025	0.796	0.789	0.977	0.68	0.791	0.551	-0.01	0.792	-0.032	0.982	0.79	0.674	-0.022
K40	-0.06	0.524	0.522	0.674	0.993	0.523	0.551	-0.053	0.526	-0.071	0.982	0.522	0.99	-0.062
K41	-0.022	0.799	0.792	0.977	0.684	0.794	0.551	-0.006	0.795	-0.028	0.982	0.794	0.679	-0.018
K42	-0.058	0.526	0.524	0.675	0.993	0.525	0.551	-0.051	0.526	-0.07	0.982	0.523	0.991	-0.061
K43	-0.021	0.798	0.792	0.976	0.682	0.792	0.551	-0.005	0.793	-0.026	0.982	0.793	0.676	-0.017
K44	-0.026	0.796	0.789	0.977	0.68	0.791	0.551	-0.01	0.792	-0.032	-0.03	0.79	0.674	-0.022
K45	0.978	0.541	0.547	-0.028	-0.069	0.546	0.547	0.966	0.542	-0.032	0.977	0.549	-0.07	0.976
K46	-0.054	0.527	0.526	0.673	0.994	0.527	0.519	-0.048	0.529	-0.066	0.977	0.525	0.991	-0.056
K47	-0.057	0.526	0.525	0.674	0.994	0.526	0.519	-0.05	0.527	-0.068	0.977	0.524	0.992	-0.059
K48	-0.02	0.799	0.793	0.977	0.683	0.794	0.792	-0.004	0.795	-0.025	0.724	0.794	0.677	-0.016

K49	-0.059	0.524	0.522	0.674	0.993	0.523	0.515	-0.05	0.526	-0.07	0.724	0.521	0.99	-0.062
K50	-0.021	0.798	0.793	0.977	0.685	0.793	0.515	-0.005	0.794	-0.027	0.724	0.794	0.679	-0.017
L1	0.558	0.994	0.993	0.787	0.528	0.995	0.515	0.566	0.992	0.552	0.554	1	0.524	0.562
L2	-0.022	0.798	0.793	0.98	0.682	0.792	0.515	-0.006	0.793	-0.027	-0.025	0.791	0.677	-0.019
L3	0.977	0.541	0.547	-0.029	-0.052	0.547	0.515	0.963	0.544	0.968	0.971	0.791	-0.052	0.975
L4	-0.056	0.526	0.524	0.673	0.992	0.524	0.515	-0.051	0.527	-0.065	-0.067	0.791	0.989	-0.058
L5	0.558	0.994	0.992	0.787	0.531	0.993	0.515	0.565	0.992	0.551	0.554	0.994	0.526	0.562
L6	0.558	0.995	0.992	0.788	0.529	0.994	0.515	0.568	0.992	0.551	0.555	0.994	0.524	0.562
L7	-0.054	0.526	0.524	0.673	0.992	0.525	0.515	-0.049	0.526	-0.064	-0.065	0.994	0.989	-0.057
L8	0.975	0.543	0.548	-0.027	-0.062	0.55	0.515	0.965	0.546	0.97	0.973	0.552	-0.062	0.976
L9	0.559	0.994	0.992	0.787	0.527	0.55	0.515	0.567	0.992	0.552	0.555	0.994	0.522	0.563
L10	-0.056	0.526	0.524	0.673	0.992	0.524	0.515	-0.05	0.527	-0.065	-0.066	0.524	0.989	-0.058
L11	0.559	0.994	0.992	0.788	0.528	0.524	0.515	0.567	0.992	0.551	0.555	0.994	0.524	0.563
L12	0.976	0.545	0.548	-0.027	-0.056	0.55	0.515	0.967	0.548	0.551	0.975	0.994	-0.056	0.975
L13	0.976	0.545	0.55	-0.026	-0.061	0.551	0.515	0.965	0.548	0.551	0.973	0.994	-0.061	0.975
L14	-0.02	0.798	0.793	0.976	0.684	0.793	0.515	-0.005	0.794	0.551	-0.023	0.794	0.679	-0.015
L15	-0.056	0.526	0.525	0.674	0.992	0.525	0.515	-0.05	0.527	0.551	-0.067	0.794	0.989	-0.058
L16	-0.057	0.526	0.524	0.674	0.992	0.524	0.515	-0.051	0.526	0.551	-0.068	0.794	0.989	-0.059
L17	-0.056	0.526	0.524	0.674	0.992	0.524	0.515	-0.05	0.526	0.551	-0.067	0.794	0.989	-0.058
L18	-0.056	0.527	0.526	0.675	0.992	0.526	0.515	-0.05	0.528	0.551	-0.067	0.525	0.989	-0.058
L19	-0.02	0.798	0.793	0.976	0.684	0.793	0.515	-0.005	0.794	0.551	-0.023	0.794	0.679	-0.015
L20	-0.02	0.544	0.549	-0.026	-0.061	0.551	0.55	0.964	0.547	0.551	0.972	0.794	-0.062	0.975
L21	-0.02	0.54	0.545	-0.026	-0.064	0.547	0.545	0.967	0.543	0.971	0.974	0.548	-0.064	0.976
L22	-0.021	0.8	0.795	-0.026	0.683	0.795	0.793	-0.005	0.795	-0.024	-0.024	0.795	0.677	-0.016
L23	0.975	0.545	0.549	-0.026	-0.062	0.551	0.55	0.964	0.548	-0.024	0.972	0.795	-0.062	0.975
L24	-0.021	0.798	0.792	-0.026	0.685	0.792	0.79	-0.006	0.794	-0.024	-0.023	0.794	0.68	-0.016
L25	-0.056	0.527	0.526	-0.026	0.992	0.526	0.519	-0.05	0.528	-0.065	-0.067	0.925	0.989	-0.058

L26	-0.056	0.526	0.524	-0.026	0.992	0.524	0.517	-0.05	0.527	-0.065	-0.066	0.925	0.989	-0.058
L27	-0.056	0.542	0.547	-0.026	-0.059	0.549	0.548	0.965	0.546	-0.065	0.973	0.925	-0.06	0.976
L28	-0.056	0.542	0.547	-0.026	-0.059	0.549	0.548	0.965	0.546	-0.065	0.973	0.925	-0.06	0.976
L29	-0.056	0.542	0.547	-0.026	-0.063	0.549	0.548	0.966	0.544	-0.065	0.973	0.925	-0.062	0.975
L30	-0.056	0.528	0.527	0.676	0.992	0.527	0.52	-0.05	0.528	-0.065	-0.067	0.925	0.989	-0.058
L31	-0.054	0.528	0.527	0.674	0.993	0.527	0.52	-0.049	0.529	-0.065	-0.065	0.925	0.99	-0.056
L32	0.978	0.543	0.548	-0.031	-0.063	0.549	0.549	0.968	0.546	-0.065	0.974	0.793	-0.063	0.979
L33	-0.056	0.528	0.527	0.676	0.992	0.527	0.52	-0.049	0.528	-0.065	-0.066	0.793	0.988	-0.058
L34	0.975	0.542	0.547	-0.028	-0.063	0.549	0.548	0.966	0.545	-0.065	0.973	0.793	-0.062	0.976
L35	0.557	0.994	0.992	0.788	0.529	0.993	0.991	0.566	0.992	-0.065	0.553	0.994	0.524	0.561
L36	-0.054	0.529	0.528	0.675	0.993	0.528	0.521	-0.047	0.53	-0.063	-0.064	0.994	0.99	-0.055
L37	-0.022	0.799	0.794	0.98	0.682	0.793	0.79	-0.006	0.793	-0.026	-0.024	0.793	0.677	-0.018
L38	0.976	0.54	0.544	-0.032	-0.056	0.545	0.545	0.964	0.543	0.969	0.972	0.548	-0.057	0.976
L39	0.976	0.542	0.547	-0.028	-0.063	0.549	0.548	0.966	0.545	0.97	0.973	0.551	-0.063	0.976
L40	0.975	0.539	0.543	-0.033	-0.057	0.544	0.544	0.964	0.542	0.969	0.971	0.547	-0.058	0.975
L41	-0.02	0.8	0.795	0.977	0.683	0.794	0.544	-0.005	0.795	-0.024	-0.022	0.798	0.677	-0.015
L42	0.979	0.544	0.549	-0.029	-0.059	0.551	0.544	0.967	0.548	-0.024	0.975	0.553	-0.06	0.979
L43	0.558	0.994	0.992	0.787	0.531	0.993	0.544	0.566	0.992	-0.024	0.553	0.994	0.526	0.562
L44	0.558	0.994	0.992	0.786	0.526	0.993	0.544	0.567	0.992	-0.024	0.555	0.994	0.522	0.563
L45	0.558	0.994	0.992	0.787	0.53	0.993	0.544	0.566	0.992	-0.024	0.553	0.994	0.525	0.562
L46	-0.054	0.529	0.528	0.675	0.992	0.528	0.544	-0.047	0.53	-0.024	-0.064	0.53	0.99	-0.055
L47	-0.055	0.528	0.526	0.676	0.992	0.526	0.544	-0.048	0.528	-0.024	-0.066	0.524	0.99	-0.058
L48	0.558	0.994	0.992	0.787	0.527	0.993	0.544	0.565	0.991	-0.024	0.554	0.993	0.522	0.562
L49	-0.057	0.526	0.524	0.673	0.992	0.524	0.544	-0.051	0.527	-0.024	-0.067	0.993	0.989	-0.058
L50	-0.055	0.528	0.527	0.676	0.992	0.527	0.544	-0.048	0.528	-0.024	-0.064	0.993	0.988	-0.057
M1	-0.053	0.525	0.525	0.669	0.993	0.526	0.544	-0.045	0.527	-0.024	-0.063	0.524	1	-0.055
M2	0.96	0.56	0.565	0.669	-0.047	0.566	0.544	0.952	0.562	-0.024	0.957	0.524	0.945	0.96

M3	0.967	0.544	0.55	0.669	-0.064	0.55	0.544	0.952	0.546	-0.024	0.965	0.524	0.945	0.967
M4	-0.021	0.798	0.794	0.669	0.685	0.795	0.544	-0.005	0.795	-0.024	-0.024	0.524	0.945	-0.016
M5	-0.061	0.521	0.521	0.669	0.993	0.52	0.544	-0.054	0.523	-0.024	-0.07	0.524	0.99	-0.062
M6	0.56	0.992	0.991	0.669	0.522	0.993	0.544	0.567	0.99	-0.024	0.555	0.524	0.99	0.563
M7	-0.022	0.799	0.794	0.669	0.682	0.795	0.544	-0.006	0.796	-0.024	-0.025	0.524	0.677	-0.016
M8	-0.055	0.526	0.525	0.669	0.992	0.525	0.544	-0.048	0.527	-0.024	-0.066	0.524	0.99	-0.055
M9	-0.023	0.797	0.792	0.669	0.685	0.793	0.544	-0.008	0.793	-0.024	-0.026	0.524	0.99	-0.018
M10	-0.024	0.796	0.792	0.669	0.685	0.792	0.544	-0.009	0.793	-0.024	-0.028	0.524	0.99	-0.019
M11	0.559	0.992	0.991	0.669	0.523	0.993	0.544	0.566	0.99	0.551	0.555	0.524	0.99	0.563
M12	0.975	0.549	0.556	0.669	-0.061	0.555	0.544	0.964	0.55	0.971	0.972	0.524	0.99	0.974
M13	0.561	0.991	0.991	0.781	0.521	0.992	0.544	0.566	0.989	0.555	0.556	0.524	0.99	0.565
M14	0.559	0.991	0.991	0.783	0.522	0.992	0.544	0.565	0.989	0.554	0.555	0.524	0.99	0.564
M15	-0.022	0.798	0.793	0.975	0.686	0.793	0.544	-0.007	0.794	-0.027	-0.026	0.524	0.682	-0.017
M16	-0.059	0.522	0.522	0.67	0.993	0.522	0.544	-0.053	0.524	-0.068	-0.07	0.524	0.99	-0.06
M17	-0.02	0.8	0.795	0.977	0.685	0.795	0.544	-0.006	0.796	-0.025	-0.025	0.524	0.99	-0.016
M18	0.97	0.554	0.562	-0.009	-0.054	0.562	0.544	0.956	0.555	0.967	0.967	0.562	0.993	0.971
M19	-0.023	0.797	0.793	0.976	0.684	0.793	0.544	-0.007	0.794	-0.028	-0.025	0.793	0.68	-0.018
M20	0.561	0.991	0.991	0.781	0.522	0.992	0.989	0.566	0.989	0.555	0.556	0.992	0.718	0.566
M21	0.561	0.546	0.554	-0.02	-0.057	0.553	0.553	0.959	0.547	0.972	0.971	0.554	0.718	0.973
M22	0.561	0.548	0.556	-0.017	-0.054	0.555	0.555	0.956	0.549	0.972	0.969	0.556	0.718	0.974
M23	-0.022	0.797	0.792	0.974	0.685	0.793	0.791	-0.006	0.794	-0.027	-0.025	0.793	0.718	-0.016
M24	-0.022	0.548	0.555	-0.016	-0.06	0.554	0.554	0.956	0.548	0.968	0.968	0.555	0.718	0.97
M25	0.559	0.991	0.991	0.782	0.525	0.992	0.989	0.564	0.989	0.553	0.555	0.555	0.718	0.564
M26	-0.023	0.797	0.792	0.976	0.685	0.793	0.79	-0.008	0.793	-0.028	-0.026	0.555	0.718	-0.018
M27	-0.023	0.55	0.558	-0.013	-0.052	0.557	0.556	0.953	0.55	-0.028	0.964	0.557	0.718	0.97
M28	-0.023	0.55	0.558	-0.013	-0.052	0.557	0.556	0.953	0.55	-0.028	0.964	0.557	0.718	0.97
M29	-0.023	0.548	0.555	-0.016	-0.06	0.555	0.554	0.956	0.548	-0.028	0.968	0.555	0.718	0.97

M30	-0.023	0.549	0.557	-0.014	-0.052	0.556	0.555	0.952	0.549	-0.028	0.964	0.557	-0.05	0.97
M31	-0.023	0.554	0.561	-0.011	-0.056	0.562	0.56	0.962	0.555	-0.028	0.972	0.561	-0.06	0.973
M32	-0.061	0.522	0.521	0.67	0.993	0.521	0.514	-0.053	0.523	-0.071	-0.071	0.52	0.991	-0.061
M33	0.97	0.546	0.554	-0.019	-0.056	0.553	0.553	0.954	0.547	0.969	0.967	0.554	0.991	0.972
M34	-0.022	0.798	0.793	0.976	0.684	0.794	0.553	-0.006	0.794	-0.027	-0.025	0.793	0.991	-0.017
M35	0.97	0.545	0.552	-0.021	-0.057	0.552	0.553	0.954	0.546	0.969	0.967	0.553	0.991	0.972
M36	-0.02	0.801	0.796	0.976	0.688	0.796	0.553	-0.003	0.797	-0.024	-0.022	0.553	0.684	-0.013
M37	0.56	0.992	0.992	0.783	0.525	0.992	0.553	0.565	0.99	0.553	0.555	0.553	0.521	0.565
M38	-0.021	0.798	0.793	0.975	0.686	0.793	0.553	-0.006	0.794	-0.027	-0.025	0.553	0.681	-0.015
M39	-0.054	0.526	0.525	0.671	0.992	0.526	0.553	-0.047	0.528	-0.065	-0.065	0.524	0.99	-0.055
M40	-0.059	0.522	0.521	0.669	0.992	0.521	0.553	-0.052	0.523	-0.069	-0.07	0.52	0.99	-0.06
M41	-0.05	0.528	0.526	0.669	0.993	0.527	0.553	-0.045	0.529	-0.061	-0.061	0.526	0.993	-0.05
M42	-0.059	0.523	0.522	0.669	0.993	0.523	0.553	-0.052	0.525	-0.068	-0.068	0.521	0.992	-0.059
M43	-0.059	0.522	0.521	0.67	0.992	0.521	0.553	-0.052	0.523	-0.069	-0.069	0.52	0.99	-0.06
M44	0.559	0.991	0.991	0.783	0.522	0.992	0.989	0.565	0.989	0.554	0.555	0.992	0.99	0.564
M45	0.97	0.541	0.548	-0.026	-0.064	0.548	0.548	0.955	0.543	0.554	0.968	0.549	0.99	0.971
M46	0.97	0.55	0.556	-0.016	-0.057	0.559	0.556	0.962	0.554	0.554	0.973	0.557	-0.06	0.977
M47	-0.063	0.518	0.518	0.668	0.991	0.518	0.511	-0.056	0.521	-0.072	-0.073	0.516	0.99	-0.063
M48	-0.061	0.522	0.521	0.67	0.992	0.521	0.514	-0.054	0.523	-0.07	-0.07	0.52	0.99	-0.062
M49	0.559	0.991	0.991	0.783	0.522	0.992	0.989	0.565	0.989	0.554	0.555	0.52	0.993	0.564
M50	-0.023	0.798	0.792	0.977	0.689	0.793	0.79	-0.009	0.793	-0.029	-0.026	0.52	0.993	-0.018
N1	0.98	0.555	0.561	-0.016	-0.054	0.562	0.562	0.972	0.558	0.977	0.981	0.562	-0.055	1
N2	0.558	0.995	0.994	0.789	0.532	0.995	0.992	0.567	0.993	0.549	0.554	0.995	0.528	0.962
N3	-0.048	0.531	0.529	0.673	0.994	0.53	0.522	-0.04	0.532	-0.058	-0.057	0.528	0.991	0.962
N4	-0.048	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.058	-0.057	0.528	0.99	0.962
N5	0.559	0.994	0.994	0.786	0.528	0.995	0.991	0.568	0.992	0.553	0.555	0.528	0.524	0.962
N6	-0.05	0.529	0.528	0.673	0.994	0.528	0.52	-0.044	0.53	-0.057	-0.062	0.528	0.991	0.962

N7	-0.051	0.529	0.527	0.673	0.994	0.528	0.52	-0.045	0.53	-0.058	-0.062	0.528	0.991	0.962
N8	-0.017	0.803	0.797	0.978	0.686	0.798	0.796	0	0.798	-0.022	-0.019	0.528	0.68	0.962
N9	-0.049	0.53	0.529	0.672	0.993	0.53	0.522	-0.04	0.531	-0.059	-0.057	0.528	0.99	0.962
N10	-0.018	0.803	0.797	0.978	0.686	0.798	0.795	0	0.798	-0.022	-0.019	0.528	0.68	-0.01
N11	0.56	0.995	0.994	0.786	0.531	0.995	0.991	0.567	0.993	0.553	0.555	0.528	0.527	0.564
N12	-0.048	0.531	0.53	0.673	0.994	0.53	0.523	-0.04	0.532	-0.056	-0.057	0.528	0.991	-0.05
N13	-0.047	0.531	0.529	0.672	0.993	0.53	0.522	-0.037	0.532	-0.057	-0.056	0.528	0.989	-0.05
N14	0.982	0.552	0.558	-0.019	-0.053	0.559	0.557	0.972	0.555	-0.057	0.978	0.528	-0.053	0.982
N15	0.98	0.549	0.556	-0.022	-0.058	0.557	0.555	0.971	0.552	-0.057	0.976	0.528	-0.057	0.98
N16	0.561	0.995	0.994	0.786	0.531	0.995	0.992	0.568	0.993	-0.057	0.556	0.528	0.527	0.98
N17	0.561	0.995	0.994	0.786	0.53	0.995	0.992	0.568	0.993	-0.057	0.556	0.528	0.526	0.98
N18	0.56	0.994	0.993	0.785	0.529	0.995	0.991	0.568	0.992	-0.057	0.556	0.528	0.524	0.98
N19	0.982	0.552	0.558	-0.019	-0.053	0.559	0.558	0.972	0.555	-0.057	0.978	0.559	-0.053	0.98
N20	-0.048	0.53	0.529	0.672	0.993	0.529	0.521	-0.039	0.531	-0.057	-0.057	0.527	0.989	0.98
N21	-0.048	0.531	0.529	0.672	0.994	0.531	0.523	-0.039	0.532	-0.057	-0.057	0.529	0.99	-0.05
N22	0.56	0.995	0.994	0.786	0.53	0.995	0.991	0.568	0.993	0.553	0.556	0.995	0.526	0.565
N23	0.559	0.994	0.994	0.786	0.53	0.995	0.991	0.568	0.993	0.553	0.556	0.994	0.526	0.564
N24	-0.048	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.059	-0.057	0.528	0.99	0.749
N25	0.98	0.548	0.555	-0.024	-0.057	0.555	0.554	0.97	0.551	0.976	0.977	0.556	-0.058	0.98
N26	-0.048	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.058	-0.057	0.528	0.99	0.749
N27	-0.015	0.804	0.799	0.978	0.687	0.8	0.522	0.004	0.801	-0.019	-0.017	0.528	0.681	0.749
N28	-0.015	0.804	0.799	0.978	0.687	0.8	0.522	0.004	0.801	-0.019	-0.017	0.528	0.681	0.749
N29	-0.048	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.058	-0.057	0.528	0.99	0.749
N30	-0.014	0.805	0.8	0.978	0.687	0.8	0.522	0.004	0.801	-0.018	-0.016	0.528	0.681	0.749
N31	0.981	0.558	0.564	-0.012	-0.047	0.565	0.522	0.974	0.561	0.974	0.977	0.564	-0.048	0.749
N32	-0.049	0.529	0.528	0.672	0.994	0.529	0.521	-0.042	0.531	-0.06	-0.059	0.564	0.991	0.749
N33	-0.017	0.803	0.798	0.978	0.686	0.798	0.795	0	0.799	-0.021	-0.019	0.797	0.681	0.749

N34	-0.049	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.059	-0.057	0.528	0.99	-0.05
N35	-0.017	0.803	0.797	0.978	0.686	0.798	0.795	0	0.799	-0.022	-0.02	0.797	0.681	-0.01
N36	0.983	0.557	0.563	-0.015	-0.051	0.564	0.562	0.974	0.56	-0.022	0.979	0.564	-0.052	0.987
N37	0.559	0.995	0.994	0.787	0.531	0.996	0.992	0.567	0.993	-0.022	0.555	0.995	0.527	0.987
N38	0.56	0.994	0.994	0.786	0.529	0.995	0.991	0.568	0.993	-0.022	0.555	0.994	0.525	0.987
N39	-0.049	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.059	-0.057	0.528	0.99	0.987
N40	-0.048	0.53	0.529	0.672	0.994	0.53	0.522	-0.04	0.532	-0.058	-0.058	0.528	0.99	0.987
N41	0.559	0.995	0.994	0.788	0.529	0.995	0.992	0.566	0.993	0.552	0.554	0.995	0.525	0.565
N42	0.981	0.555	0.56	-0.017	-0.055	0.562	0.559	0.973	0.556	0.978	0.978	0.561	-0.055	0.984
N43	0.56	0.994	0.994	0.786	0.528	0.995	0.991	0.569	0.993	0.553	0.556	0.994	0.524	0.764
N44	-0.048	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.058	-0.057	0.528	0.99	-0.05
N45	0.56	0.994	0.994	0.786	0.528	0.995	0.991	0.568	0.993	0.553	0.556	0.994	0.524	0.964
N46	0.981	0.555	0.561	-0.018	-0.056	0.562	0.56	0.973	0.558	0.977	0.98	0.562	-0.058	0.994
N47	-0.053	0.528	0.526	0.673	0.994	0.527	0.52	-0.047	0.528	-0.063	-0.063	0.525	0.994	0.994
N48	0.56	0.994	0.994	0.785	0.528	0.995	0.991	0.568	0.993	0.554	0.556	0.994	0.524	0.994
N49	-0.048	0.531	0.529	0.672	0.993	0.53	0.522	-0.04	0.532	-0.059	-0.057	0.528	0.99	0.994
N50	0.98	0.554	0.561	-0.016	-0.055	0.56	0.56	0.972	0.557	0.976	0.977	0.561	-0.056	0.98

Table 4.2: Correlation table for template size 100 x 100 pixels.

Two performance measures, namely false rejection rate (FRR) and false acceptance rate (FAR) were calculated for different images for comparison of results with different thresholds and window sizes. Experiments were performed by considering template size of 100 x 100 and 200 x 200 pixels extracted from the centre of the image. Figure 4.6 shows the extracted images of template size 100 x 100 and 200 x 200 pixels respectively,

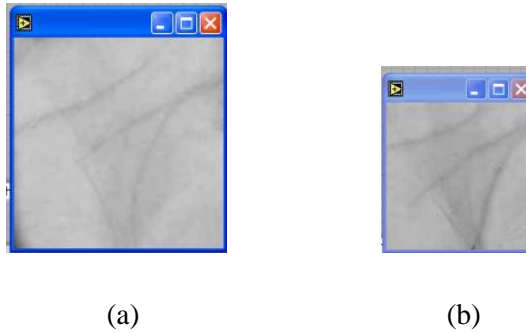


Figure 4.6: Template size of (a) 200 x 200 pixels, (b) 100 x 100 pixels

4.6 False rejection rate (FRR)

For the images which were only translated from the original image, no false rejection was found for any reference template size at any threshold value. However, when the images were rotated or translated plus rotated, the following results were obtained for different template learning images. Table 4.3 show % false rejections for 200 x 200 image size and table 4.4 shows % false rejection for 100 x 100.

Table 4.3; 200 x 200 pixels FRR

threshold	Image number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.9	36%	38%	24%	50%	32%	34%	24%	30%	56%	34%	34%	54%	40%	54%
0.8	34%	10%	18%	50%	32%	34%	24%	30%	56%	34%	34%	20%	40%	54%
0.7	12%	10%	18%	18%	12%	10%	16%	16%	10%	26%	24%	14%	16%	24%

Table 4.4: 100 x 100 pixels FRR

threshold	Image number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.9	36%	68%	60%	52%	60%	46%	36%	34%	50%	24%	50%	54%	38%	42%
0.8	20%	38%	60%	52%	38%	28%	36%	34%	50%	24%	34%	54%	38%	42%
0.7	6%	14%	16%	12%	28%	16%	18%	12%	16%	12%	12%	20%	18%	22%

4.7 False acceptance rate (FAR)

No false acceptance was found for the learning image sizes of 100 x 100 and 200 x 200 pixels up to threshold of 0.7. For the learning image size of 200 x 200 pixels the following results were observed in table 4.5. Table 4.6 represents % false acceptance at various thresholds for the learning image size of 100 x 100 pixels.

Table 4.5: 200 x 200 pixels FAR

threshold	Image number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.9	9%	15%	16%	11%	14%	13%	15%	18%	10%	5%	18%	18%	12%	13%
0.8	18%	15%	20%	23%	23%	22%	23%	29%	16%	15%	28%	24%	23%	18%
0.7	19%	28%	35%	34%	38%	28%	35%	33%	24%	25%	30%	30%	32%	28%

Table 4.6: 100 x 100 pixels FAR

threshold	Image number													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.9	16%	17%	18%	21%	10%	21%	19%	14%	20%	16%	12%	20%	14%	17%
0.8	32%	25%	20%	21%	30%	26%	20%	24%	23%	26%	32%	26%	24%	27%
0.7	32%	32%	40%	41%	30%	45%	42%	36%	40%	28%	32%	44%	34%	28%

From the above results for FFR and FAR, it is observed that as the threshold value increases, so does the % false rejection, although for the smaller learning images (100 x 100 pixels) the % false rejection is less in comparison to that for the larger learning images (200 x 200 pixels). However, no false acceptance was observed (down to threshold of 0.7) for the learning image sizes of 100 x 100 and 200 x 200 pixels. The above results are expected as smaller images contain less information in comparison to larger images, and thus the probability of more than one image having the same little information is greater.

Chapter 5

Conclusion and Future Scope

5.1 Conclusion

In this thesis, a novel approach is presented to authenticate individuals by using their palm-print features. The hand images are captured from a HP C7716 scanner without any fixed peg. This mechanism is very suitable and comfortable for all users. The proposed system is reliable and user friendly as satisfactory recognition result is provided and convenient acquiring process is offered. The Palm print recognition system has been implemented using LabVIEW version 6i. The position and scaling of the palmprint is critical to the success of palmprint template-based approach, and the alignment of the training images is determinant. It has been stressed that the good performance of the palmprint verification method depends on alignment of the palmprint image. The image is first preprocessed (histogram equalized, resized, and thresholded) and Gauss and Sobel filters are used to extract the palm feature like principle lines, ridges, edges etc. so make fit to given to developed algorithm. In the template-matching method, the linear correlation function is adopted as the metric measurement. Using this method, nearly 80% accuracy rate has been achieved. Self made database has been used in the present work and the experiments conducted shows the False accept rate of 20% and False reject rate of 18%.

5.2 Future Scope

A palm print recognition system using LabVIEW has been developed. Although a lot of effort has been made for the development of the system, still following points may be considered for the improvement of the system in future.

- i). The present work has been implemented with the palm images only it can be extended with the hand geometry measurement as well to enhance the security.
- ii). The algorithm can be extended to recognize colored images.
- iii). The accuracy of the system can be improved by using the high resolution scanner.

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