Rotation Invariant Copy Move Forgery Detection Using Fast Fourier Transformation Method

M.Tech. Dissertation

Submitted in the partial fulfillment of the requirements for the award of Degree of

MASTER OF TECHNOLOGY

in

SOFTWARE ENGINEERING

by

ANKITA VERMA

(Roll No. 801631003)

Under the supervision of

Dr. SANGITA ROY

THAPAR INSTITUTE
OF ENGINEERING & TECHNOLOGY
(Deemed to be University)

DEPARTMENT OF COMPUTER SCIENCE ENGINEERING

T.I.E.T, PATIALA, PUNJAB, INDIA

JUNE 2018

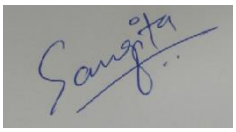
CERTIFICATE

I hereby certify that the work which is being presented in the thesis entitled, **"***Rotation invariant copy move forgery detection using fast fourier transformation method* **"**, in partial fulfilment of therequirements for the award of degree of Master of Engineering in *Software Engineering* submitted in Computer Science and Engineering Department of Thapar Institute of Engineering and Technology, Patiala, is an authentic record of my own work carried out under the supervision of *Dr. Sangita Roy* and refers other researcher's work which are duly listed in the reference section.

The matter presented in the thesis has not been submitted for award of any other degree of this or any other University.

Signature:
(Ankita Verma)

This is to certify that the above statement made by the candidate is correct and true to the best of my knowledge.



(Dr. Sangita Roy)

Assistant Professor

Declaration

I hereby declare that the work being presented in the dissertation report entitled "*rotation invariant copy move forgery detection using fast fourier transformation method*" in the partial fulfillment of the requirements for the award of degree of Master of Technology in Software Engineering from Thapar Institute of Engineering and Technology, Patiala, Punjab, is an authentic record of the work carried under the supervision of Dr.Sangita Roy, Assistant Professor, Department of Computer Science Engineering, Thapar Institute of Engineering and Technology, Patiala. The matter presented in this dissertation has not been submitted in any other University/Institute for the award of any degree / diploma.

Dated: 26-06-2018

Ankita Verma
(Roll No. 801631003)

ACKNOWLEDGEMENT

I express my gratitude towards the name of almighty GOD for all this grace and light, which gave me strength and encouragement and has always bless me with potential knowledge and success.

I am greatly honoured and thankful to my supervisor Dr. Sangita Roy Assistant Professor, Department of Computer Science and Engineering, for their guidance, cooperation, advise, motivation and support throughout the work.

I am thankful to Thapar Institute of Engineering and Technology, Patiala, which gives me the opportunity to learn and spread the light of education.

Words fail to express my feelings of thankfulness towards my parents and friends for their ever available cooperation, encouragement and love throughout this work.

Ankita Verma

ABSTRACT

Image processing is a framework which is used to enhance raw images which are gotten from cameras, sensors set on satellites and air make. Digital images are manipulated by applying forgeries such as image retouching, image splicing and copy-move forgery attacks. To detect such forgeries various techniques are proposed that includes active and passive approaches. There are numerous current strategies or methodologies used to identify the forgery in an image however this gives less precise outcomes. The proposed work here manages image forgery identification utilizing rotation invariant system with blur-invariant copy-move forgery detection. The proposed mechanism firstly rotates the inbuilt object of an image and after that partitions the picture into little squares. After dividing the image, fast fourier transformation is connected and afterward recognized. The simulations are performed in MATLAB device. The technique is more precise and gives accurate rate between 95% to 100%.

TABLE OF CONTENTS

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1Context

Alter an original picture in order to create fake image by means of any fraud or other reason is known to be image forgery. As per the process involved in fake image creation, image forgery scenarios can be divided into three groups. Image retouching, image splicing and copy-move attack are the best-known examples of image forgery processes. Numerous types of techniques of image forensics used to detect forgery. These types can be helpful in active and passive protection. There are many existing techniques or approaches used to detect the forgery in an image but provides less accurate results. The proposed work here deals with image forgery detection using rotation invariant technique with "blur-invariant copy-move forgery detection". The proposed mechanism firstly rotates the inbuilt object of an image and then divides the image into small blocks. After dividing the image into small size blocks fast Fourier transformation is applied and then detected. The simulations are performed in MATLAB tool. The method is more accurate and provide accuracy rate between 95-100%.

1.2Organization of Thesis

The research study here is composed of various chapters which are illustrated in detail as below-

Chapter 1 consists of context and flow of research study is also discussed.

Chapter 2 includes the detail description of digital image processing, its fundamentals, applications, challenges and also image forgery details with techniques.

Chapter 3 is composed of literature review. Existing literature is surveyed; its limitations and proposed techniques are evaluated.

Chapter 4 comprises of problem statement, motivation to proceed the research and various objectives of research study.

Chapter 5comprises of proposed work methodology. The chapter covers proposed work approach or technique and it also comprises of work flow of proposed study.

Chapter 6includes the results and discussions. The platform which is used for simulation processing is discussed in brief. Experimental results and performance of existing and proposed work is evaluated and analyzed.

Chapter 7lastly concludes the study. The chapter summarizes performance of existing and proposed approach. Various pros and cons are discussed in detail.

CHAPTER 2
INTRODUCTION TO DIGITAL IMAGE PROCESSING

2.1 Digital Image Processing

“Digital image processing” term is used to manipulate an image by means of getting some important details from it. DIP is concerned fundamentally with extracting supportive or vital data from pictures. Image is manipulated or some operation such as rotating, scaling is applied on it to extract hidden useful information. In a perfect world, it is done with the help of PC's with no human intervention. The principle objective of DIP is to build a pc framework that is capable of doing processing on an image. In this scenario, input/output is an image. A digital image is passed to pc as an input and the framework apply efficient image processing algorithm on it and gives a picture as output for useful information.

Image processing techniques might be set at three levels as per their role in processing in an image. Level 1 or most fundamental level deals with raw images; de-noising and edge detection of images. Middle level concerns with image segmentation and edge connections. At the most above level, appropriate techniques are applied on images to get meaningful data from output provided by the basic level.

Image processing is one of the rapidly growing zones of interest for the researchers in the field. Innovative advances boost up its development in almost every field due to its promising advantages. Fields which usually used straightforward imaging are transformed into computerized structures, for their versatility and sensibility. Basic cases are medical imaging, biometric, face or text detection, photography, remote detecting, and security analysis.

Digital image processing strategies are utilized as a part of nearly and each field to perform differenttasks for example, in human services field, for security applications, augmented reality etc. In medical application, image processing should be possible alongside color compensation method in LCD display with the goal that individuals experiencing Color Vision Deficiency can see the display gadgets as typical individuals do.Image processing methods are connected to biometrics in Security related applications, that is, measurements identified with one of a kind

human attributes and biometrics verifications are utilized as a type of ID and access control and subsequently give security to different applications.

In real-time applications, image enhancement stays one of the significant worries in this field. It manipulates an input image by means of extracting meaningful data and presents a quality image as output to user. For image enhancement histogram equalization (HE) as well as curve let transformationtechniques are utilized. Basically, HE equalization is used for picture upgrade and curve let transform perceive and isolate splendid regions of the picture. In augmented reality, image processing is mixed with augmented reality to center around the portable applications field, wherein there are numerous SDK's (Software Development Kits) accessible for the formation of these AR, for example, AR Toolkit, Argon and so on. The presentation of Image Processing and utilization of picture handling in reality issues, made it to wind up a quickly developing innovation today.

Basic Work Flow in DIP

- **Image Acquisition:** The main phase of any vision framework is the picture obtaining stage. On the off chances that the picture has been acquired or obtained agreeably only then the planned tasks can be achievable.It includes pre-processing such as scaling of image.
- **Image Enhancement:** For image enhancementmanipulations done on image to highlight certain features of qualitative information from the image for better outcome.
- **Image Restoration:** Image restoration is an objective strategy that is relative like image enhancement and figures out how to recoveroriginal image to rescue it from degradation. Image restoration is an inverse process keeping in mind the end goal to recover original image.
- **Color Image Processing:** Color image processing incorporates shading data of every pixel. A color image is usually stored in two-dimensional array. RGB color model is normally used to make pictures visually interactive and enhance quality.
- **Wavelets and Multi-Resolution Processing:**To represent pictures in different degree of determination, wavelets are established. Images split into tiny regions followed by data compression and for pyramid portrayal.

- **Compression:** Reduction in image size empowers system to store more data. This reduction of image size without hurting image quality is known as compression. It also results in saving the bandwidth to transmit image. Especially in the employments of web it is particularly important to compress data.
- **Morphological Processing:**Morphological preparing manages devices for separating picture segments that are helpful in the portrayal, also depiction of shape.
- **Segmentation:**This is segments a picture into its smaller parts. In general, itis a standout amongst the most troublesometasks in digital image processing. A tough division methodology takes the procedure far toward fruitful arrangement of imaging issues that expect items to be distinguished exclusively.
- **Representation and Description:**Output (raw pixel data) of segmentation step is utilized by representation and description stage. Representation changes crude information into a reasonable form for computer processing. Representation changes crude information into a reasonable form for computer processing. Description manages removing characteristics that outcome in some quantitative data or are fundamental for separating one class of items from another.
- **Object Recognition:** Recognition is the process to identify objects in images or videos.
- **Knowledge Base:** Knowledge base may be as clear as organizing regions of a photo where the important information is known to be found.

Fig. 1.1 describes the fundamental steps of “digital image processing” as discussed above.

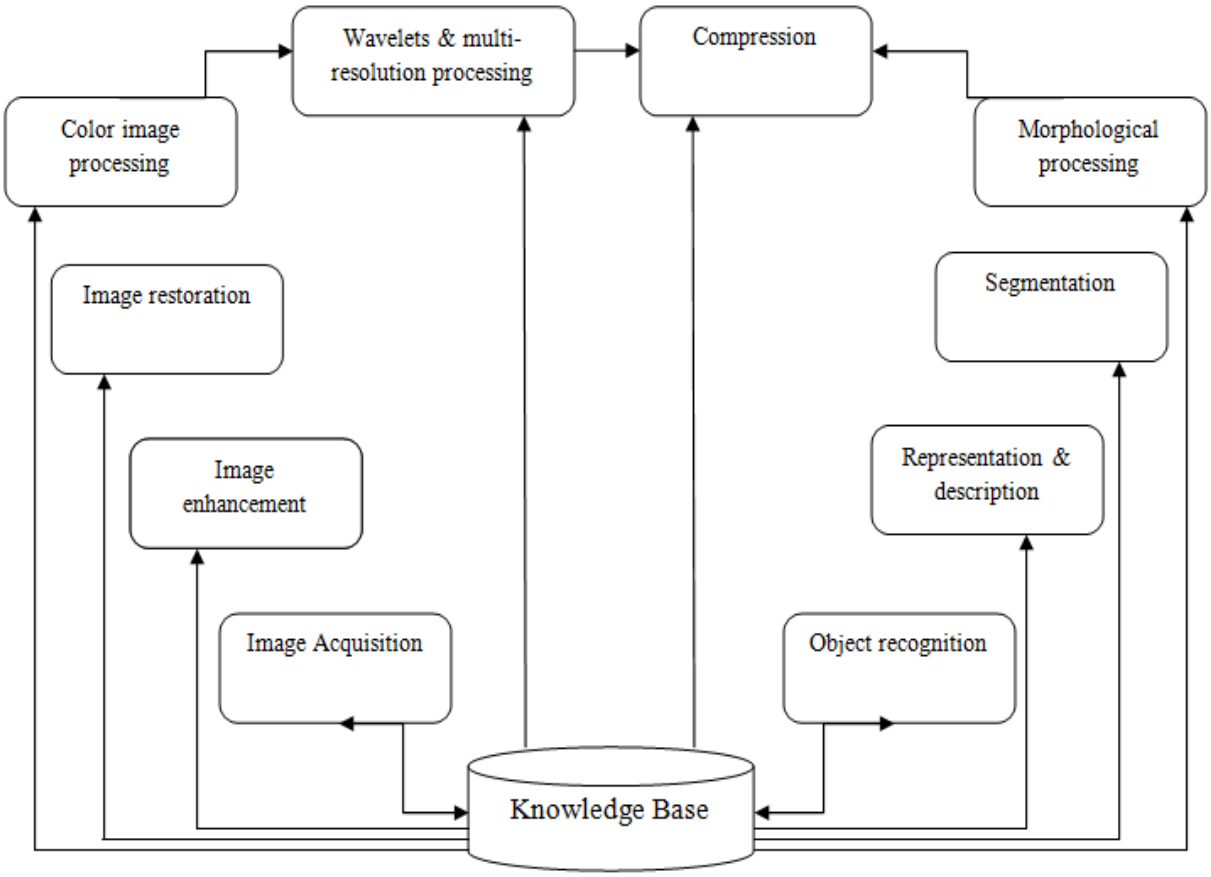


Fig. 1.1 Basic steps in DIP

2.2 Components of Digital Image Processing

Two components are required to achieve advanced picture. To begin with is the physical gadget that is touchy to the energy transmitted by the object, which is to be captured. And that changes or transforms output given by physical detecting devices into digital form is known as digitizer which is the second most required element of DIP.The Fig. 1.2 shows essential parts of DIP.

Picture sensor changes over optical picture into an electronic signal. Specialized digital image processing hardware comprises of digitizer and hardware that performs other crude tasks, let's say, an "Arithmetic Logic Unit (ALU) "that operate arithmetic and logical activities in parallel on whole pictures. Mass storage represents the capacity ability of the framework. An advanced PC may go from a PC to a super PC that is associated over a system to process the pictures by applying a few strategies on it.

Image processing software is a technique that keeps running on your equipment to accomplish particular outcomes. This technique can be your own particular outlined algorithm or you can be an end client (e.g. Utilizing Photoshop). Display gadget is an output device for introduction of data in visual. It can either be a TV or PC screen.

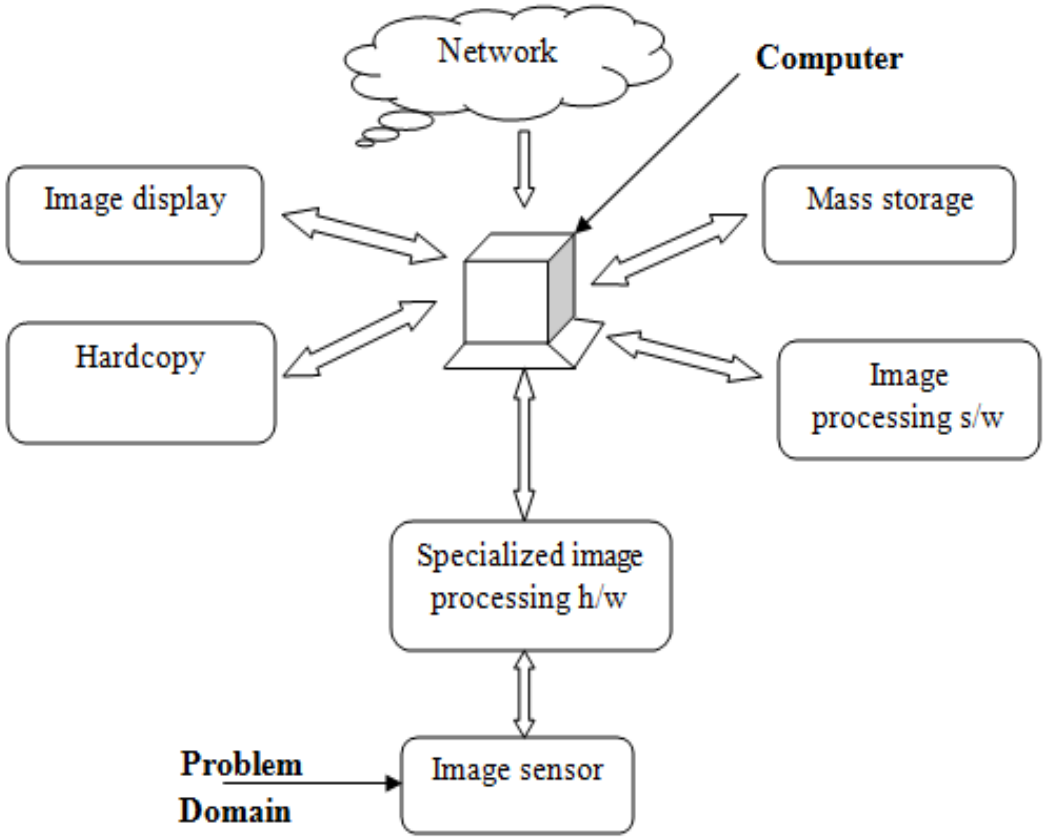


Fig. 1.2 Basic Components of DIP

2.3 Applications of Digital Image Processing

Because digital image processing takes up the priority to be used in or have application almost in every field and many particular fields are influenced by DIP, we will just discuss a segment of the critical employments of DIP:

- **Image Quality Enhancement:** After capturing a picture from advanced camera, manipulations will be done on it to improve it and to get wanted results. It incorporates

sharpening, blurring, zooming, shading changes, edge discovery of pictures and so forth by utilizing different picture preparing methods.

- **Medical Field Applications:** Digital Image Processing assumes an essential part in medical field. Most basic illustrations are gamma-ray, X-ray imaging, MRI pictures, CT scans, UV imaging and so on.
- **Security Related Applications:** Very regular case of DIP applications is Biometric. Biometric identifiers are used to identify individuals. Biometric is utilized to recognize or verify clients for security reason.
- **Machine/Robot Vision:** DIP added to make robot ready to see things, distinguish them, and recognize the obstacles and so on. Obstacle recognition is one of the normal assignments that have been done through image processing by distinguishing distinctive sort of items in the picture and afterward ascertaining the distance amongst robot and obstacles.
- **Color Processing:**Color processing incorporates processing of hued pictures and distinctive shading spaces that are utilized. For instance,'RGB shading model','YCbCr', 'HSV'. It likewise includes considering transmission, storage, and encoding of these shading pictures.
- **Remote Sensing:** One specific use of advanced picture preparing in the field of 'remote detecting' is to identify infrastructure harms caused by an earthquake. The key advances incorporate into the examination are: the extraction of edges and the investigation and improvement of different kinds of edges.
- **Pattern Recognition:**Image processing is utilized for recognizing the items in a picture and thereafter machine learning is used to prepare the structure for the alteration in outline. Pattern recognition is utilized for text recognition, recognition of pictures and so forth.

2.4 Video Processing: A video simply is the continuous movement of pictures. The nature of the video depends upon the amount of pictures or framesevery single minuteand the nature of each edge being utilized. Video processing includes reduction of noise, detail upgrade, movement recognition, outline rate transformation, aspect ratio conversion, shading space transformation and so forth.

2.5 Challenges in Digital Image Processing

- **Dataset:** Development of vast medicinal imaging information is very challenging as it requires broad time from therapeutic specialists. Then again, well portrayal of the

information is incomprehensible because of inaccessibility of qualified aptitude. Another real issue is unbalancing of information that is exceptionally regular in health area i.e. uncommon infections, by uprightness of being uncommon, are underrepresented in the informational indexes.

- **Privacy and Legal Issues:**It is substantially more complex and hard to share the restorative information when contrasted with real-world pictures. Information security is successfully both sociological and in addition specialized issue, which must be tended to mutually from the two points of view.
- **Image Quality Maintenance:** For picture transmission and reclamation reduction of picture size or compression is fundamental to diminish storage space which emerge difficulties to pack information without serious misfortune in the picture quality. A picture might be of low quality since its contrast is low, or it is noisy or blurred, and so on. Numerous techniques have been contrived to evacuate these corruptions. The troublesome issue is the manner by which to remove degradation without harming the signal. Efficient algorithms are required to keep up the quality of the picture information.
- **Visualization:**Basically, virtualization is considered as a major aspect of computer graphics. The fundamental assignment is to produce pictures or picture arrangements in view of three-dimensional object and scene models. Testing issue is the means by which to demonstrate dynamic scenes containing non-inflexible objects. The models must be sensible, but the calculation cost must be reasonable.
- **Recognition:** Recognition of input patterns is also becoming a challenge if there is large no. of classes or if all the member of the same class looks differently. E.g. how can we construct a system to recognize ‘chair’.

2.6 Image Forgery

Digital image forgery does not vary especially in nature when contrasted withconventional image forgery. Rather than utilizing photo picture forgery manages digital pictures. The procedure making duplicate picture has been massively straightforward with the presentation of ground-breaking PC designs altering programming, for example, ‘adobe Photoshop’, ’GIMP’, ‘Corel paint shop’ and some of other which are accessible free. There are numerous instances of digital

‘image forgery’. These cases are classified into three noteworthy gatherings, in view of the procedure in making the duplicate picture. The gatherings are Image modifying, Image splicing and Copy-Move assault.

Image retouching: Image retouching is responsible for changes in image that either improves or lessens confident highlights of a picture. This method is prominent among magazine photograph editor.

- Image splicing- It is a method that includes a composite of at least two pictures which are consolidated to make a duplicate picture.
- Copy-Move attack- Where two or more operations applied on an image with the goal to alter certain regions of the image with another picture, it sounds to have copy-move attack. However, instead of having an external picture as the source, copy-move assault utilizes some portion or region of the base picture as its source. In copy-move assault, some portion of the source picture is replicated moved to a desired area and pasted over there. This is normally done so as to cover certain parts of the picture.

2.6.1 Image Forgery Detection Techniques

The ‘image forgery techniques’can be ordered with two methodologies i.e. Dynamic and Passive approach.

2.6.1.1 Dynamic/active Approach-

The dynamic approach depends on extra data inserted in the computerized picture for altering recognition, for example, advanced watermarks and advanced marks. Such data can be utilized to evaluate the innovation of a picture. But this requires extra data to be inserted in the picture during the image catching procedure otherwise at later stage by approved staff. In the event that data about the base picture is unfamiliar (like pictures on the web), at that point the dynamic approach is unimaginable or insufficient.

2.6.1.2 Passive Approach-

The passive approach is fit for recognizing picture control without extra data. The inactive approach recognizes the control by extricating inborn highlights inside the picture in light of altering recognition and source gadget ID. Such strategies can be additionally ordered into dependent and autonomous forgery. The dependent forgery is an activity of reordering the

picture areas either inside a similar picture (duplicate passage) otherwise from another picture (joining). Other computerized manipulation or general altering, for example, compression, re-sampling and irregularities, are sorted as autonomous forgery. Conversely, the source gadget distinguishing proof is a procedure to decide the birthplace gadget of the advanced picture in view of optical and sensor regularities.

2.7 Copy Move Forgery Detection (CMFD)-

'Copy-move forgery' comes under submissive approach for forgery uncovering wherein at least one area has been reordered inside a similar picture.Commonplace inspirations of such forgery incorporate concealing a component in the picture (e.g. 'Steganography') or stressing a specific object. 'Copy-move forgery' is anything that is to perform and can be moderately successful in picture handling, especially when both source and target locales are from an indistinguishable picture from properties, for example, shading temperature, light conditions and noise will for the most part be very much coordinated between the altered area and the picture. Subsequently, it can be imperceptible by exposed eyes.

2.7.1 Workflow of the CMFD-

- Pre-Processing
- Feature Extraction
- Matching
- Visualization

2.7.2 CMFD Techniques

'CMFD' techniques are organized into two approaches as discussed below-

- **Block Based Approach-** The Square based approach parts a picture into square block for examination amid the pre-processing stage. These squares may overlap with each other. At that point, the highlights are separated from these squares and contrasted against each other with decide likeness between hinders inside the picture. Once the coordinated squares are identified, these squares represent the manipulation of copy-move forgery

performed in the picture. In CMFD, the square based is the most well-known approach embraced by scientists as of late, maybe because of its similarity with different component extraction methods and expanded coordinating execution.

- **Key- Based Approach- '**Key point-based' methodologies are non-square based, as the square partition is disposed of in preprocessing. The key point highlights extricate the unmistakable nearby highlights, for example, corners, blobs, and edge from the picture. Each component is given an arrangement of descriptor delivered inside a locale around the highlights. The descriptor expands the dependability of the highlights to the relative change. At that point, the two highlights and descriptors in the picture are grouped and coordinated to each other to discover the copied areas in the copy-move forgery. Highlight extraction-based strategies in key based approach are delineated beneath as-
- **Scale Invariant Feature Transform (SIFT)**- SIFT has a high computational complexity because of the high number of highlight vectors acquired from the picture. Therefore, the coordinating strategies will be computationally costly, if certainly feasible, especially for a high resolution picture. Filter cannot recognize the copied regions in flat areas or minimal visual structure because of the confinement of dependable points. This constraint can be limited by joining SIFT and Zernike moments. In any case, this mix will expand the preparing time as the two methods should be connected on the picture.

Drawbacks-

- High computational complexity.
- Cannot recognize duplication regions in level areas.
- Difficult to distinguish a shape area.
- Cannot separate purposefully embedded duplicated locale or normally comparable area.

Harris Corner Detector and Speed Up Robust-The indicator separates corners and edges from the areas in light of the nearby auto-connection function. It has been demonstrated that Harris highlights result in textures in common imagery. In CMFD, the Harris detector has been considered and investigated to enhance SIFT-based procedures. As the Harris detector just creates feature points, good potential descriptor systems are joined with the highlights. Besides,

the Harris highlights are upgraded to build the points unwavering quality in distinguishing the forgery. Such systems are by and large observed to be vigorous to turn, scale, compress, and noisiness and blurring.

Features (SURF)-The SURF highlights decrease the handling time and furthermore include measurement. 'SURF' can decrease the incorrect match particularly for high firmness pictures, while strong to certain change and post preparing activities. But this procedure cannot distinguish a little replicated area in the picture. It was later demonstrated that the SURF-based system lessens the precision in spite of the fact that it enhances the handling time in duplicate move location.

2.8Types of Copied Regions in Copy-Move Forgery

There are some regions in copy-move forgery which are listed as follows-

- Background- Scene, Nature, Texture, Color
- Object- Architecture, Art, Shape, Plant, Line
- Creature- Animal, Human
- Letter- Word, Text

CHAPTER 3

LITERATURE SURVEY

The chapter reviews the various techniques, methods and algorithms discussed in the existing study of image processing for Copy-Move forgery detection which are illustrated as below-

Zhang Ye and Qu Hongsong, in the paper titled, "*Rotation invariant feature lines transform for image matching*" **[1]** proposed a technique in view of using highlight lines to accomplish more powerful picture coordinating, which incorporates include line discovery, highlight vector portrayal and coordinating, and the contrived rotation invariant element line change. Rotating and scaling invariance are the properties of feature vector. Trial comes about exhibit the viability and effectiveness of the proposed strategy. Contrasted and the celebrated intense calculation scale invariant component change, the proposed strategy is more insensitive to noise, and then chose unmistakable areas of highlights are more scatter. For a specific arrangement of pictures, which contain solid lines, the proposed technique is more productive. Utilizing the component lines got by the technique, it is conceivable to coordinate two scene pictures with various turn points, scales, and light twisting, and the means of coordinating are easier. Yet at the same time there is have to improve the line descriptor computation work for accelerate, joining highlight points and include lines for more powerful picture coordinating, and emulating HVS.

Vivek Kumar Singh and R. C. Tripathi, in the paper titled, "*Fast Rotation Invariant Detection of Region Duplication Attacks Even on Uniform Background Containing Digital Images*" **[2]** propose a quick duplicate—rotate-paste image forgery recognition strategy utilizing rotation invariant property of Zernike moments (ZM). The paper center around those pictures where number of items because of forgery, gets expanded. Connected component investigation is performed before square coordinating to diminish time complexity and for more dependable outcomes. The fraudster endeavors to show up more like unique. Replicated part can be scaled, rotated or hued before pasting it. To defeat these issues ZM is utilized. The outcome is fast and

exact other than existing techniques. The approach is additionally robust to noise, smoothening and misfortune compression up to a degree.

XiuLi Bi, Chi-Man Pun, et al., in the paper titled, "*Multi-scale feature extraction and adaptive matching for copy-move forgery detection*" **[3]** proposed a scheme for copy-move forgery discovery by utilizing multi-scale feature extraction and versatile coordinating. To start with, the host picture is portioned into the non covering patches of irregular shape in various scales. At that point, Scale Invariant Feature Transform is connected to extricate highlight points from all patches, to produce the multi-scale highlights. An Adaptive Patch Matching algorithm is in this manner proposed for finding the coordinates that show the suspicious forged areas in each scale. At last, the suspicious locales in all scales are converged to create the recognized forged areas in the proposed Matched keypointsmerging algorithm. Yet at the same time there is further need to center around applying multi-scale way to deal with other sort of forgery, for example, splicing or other sort of media, for example, video and sound forgery.

Er. MaltiPuri and Dr. Vinay Chopra., in the paper titled, "*A Survey: Copy-Move Forgery Detection Methods*" **[4]** surveyed copy-move forgery detection methods. Copy-Move detection techniques are that includes Block-based methods and Keypoint based method are discussed thoroughly. Both block –based and key-point based methods have own merits and demerits. However, in terms of about accuracy then block based method stands out. The survey provides various future directions for hybrid mechanism in copy-move forgery.

Khurshid Asghar, Zulfiqar Habibet al.,in the paper titled,"*Copy-move and splicing image forgery detection and localization techniques: a review*"**[5]**exhibited a broad writing audit of the best in class systems on copy-move and splicing forgeries, featuring their restrictions, and furthermore shows the future research headings. As cutting edge easy to use tools have made it simple to manipulate picture content keeping in mind the end goal to increase illegal advantage or to make false propaganda, and advanced pictures and recordings are not satisfactory in official courtrooms as proof without solid scientific examination. And research had been done so as to address the issue and numerous methods exist that distinguish and confine copy-move and splicing forgeries. In any case, it is critical to know whether these strategies are vigorous, legitimately demonstrating the basic changes that have happened in pictures because of copy-

move as well as splicing forgery, and can dependably group a digital picture as an authentic or adjusted picture. So the paper surveys the current disadvantages to beat this issue.

Xiang-Yang Wang, Shuo Li et al., in the paper titled, "*A new keypoint-based copy-move forgery detection for small smooth regions*" **[6]** propose another keypoint-based copy-move forgery detection for little smooth areas. Right off the bat, the original altered picture is portioned into non-overlapping and irregular super-pixels, and the super-pixels are grouped into smooth, surface and solid surface in view of nearby data entropy. Also, the steady picture keypoints are extricated from each super-pixel, including smooth, surface and solid surface ones, by using the super-pixel content based versatile feature point indicator. Thirdly, the nearby visual highlights, in particular exponent moments magnitudes, are developed for each picture keypoint, and the best container first and turned around summed up 2 closest neighbor calculation are used to discover quickly the coordinating picture keypoints. At last, the dishonestly coordinated picture keypoints are expelled by modifying the irregular example agreement, and the copied areas are restricted by utilizing zero mean standardized cross-connection measure. The limitation of the proposed copy-move forgery detection is its inefficiency to be utilized successfully. There is further need to center around taking out these disadvantages. Additionally, explore the utilization of approach in distinguishing areas which have experienced non-affine changes.

AtefehShahroudnejad and Mohammad Rahmati, in the paper titled, *"Copy-Move Forgery Detection in Digital Images Using Affine-SIFT*" **[7]** another duplicate move recognition technique in light of affine scale invariant feature transform (ASIFT) is proposed, which is completely relative invariant and robust to changes and twisting of copy-move areas. The strategy begins by finding coordinated ASIFT keypoints and after that gauges all pixels inside the copied districts by utilizing super-pixel division and morphological tasks. The technique is robust to some post-preparing tasks, for example, blurring and Gaussian noise addition.

Charmil Nitin Bharti and PurviTandel, in the paper titled, "*A Survey of Image Forgery Detection Techniques*" **[8]** examined about image forgery discovery, diverse sorts of picture forgery that happen and the assaults that happen because of forgery. The essential stream of how manufactured area is distinguished is appeared. The diagram of various systems that encourages

us to identify forgeries and correlation of various procedures in view of various parameters with its benefits and bad marks are given.

Nor Bakiah Abd Warif ,Ainuddin Wahid Abdul Wahab et al., in the paper titled, "*Copy-Move Forgery Detection: Survey, Challenges and Future Directions*" **[9]** overview the ongoing advancements in CMFD, and depict the whole CMFD process included. Portray the normal CMFD work process of feature extraction and coordinating procedure utilizing square or keypoint-based methodologies. Rather than posting the datasets and approvals utilized as a part of the writing, they classify the sorts of duplicated areas. A layout of future research bearings is additionally thoroughly portrayed in the paper.

Fan Yang, Jingwei Li et al., in the paper titled, "*Copy-move forgery detection based on hybrid features*" **[10]** a novel duplicate move imitation identification technique is proposed in view of hybrid features. A powerful intrigue point locator KAZE is acquainted and joined with SIFT with extricate more feature points. Keeping in mind the end goal to manage different forgeries, an enhanced matching algorithm is utilized which can discover the n-best coordinated highlights. At that point a powerful separating step in light of picture division is executed to filter out false matches. In addition, an iteration procedure is produced to appraise transformation matrices and decide the presence of forgery. In light of these matrices, the forged areas can be situated at pixel level. The outcomes exhibited that the proposed strategy can exactly recognize copied areas even after distortions, for example, rotation, scaling, compression and including noise.

Navpreet Kaur Gill, Ruhi Garg et al., in the paper titled, "*A Review Paper on Digital Image Forgery Detection Techniques*" **[11]**introduced a portion of the passive procedures and furthermore think about them as far as exactness of their outcomes. The prime downside of the current strategies is Automation that is the appropriate responses can be interpreted with the mediation of human as it were. Second downside is that in the event that we discuss copy-move forgery, at that point the utilization of these strategies is computationally costly. Thirdly as these strategies are connected to pictures no one but, we can expand the exploration on sounds and recordings. Fourthly at present, there is no system which can distinguish between the malignant fraud and simply the correcting like artistic manipulation. The most difficult task is to build up a brought together techniques having ability to distinguish any sort of forgery.

Rahul Dixit1 ,RuchiraNaskar, et al., in the paper titled*, "Blur-invariant copy-move forgery detection technique with improved detection accuracy utilising SWT-SVD"* **[12]**exhibited an approach for recognition of copy-move forgery. The approach is move invariant, and aides in finding the likenesses, i.e. matches and dissimilarities, i.e. commotion, between the squares of a picture, caused because of blurring.Stationary wavelet transform (SWT) was utilized in the approach.The squares are spoken to by highlights extricated utilizing singular value decomposition (SVD) of a picture. The idea of shading based division is utilized which accomplishes obscure invariance. The further work should be possible on the examination of different types of picture locale changes, for example, turn, rescale and reflection, in duplicate move fraud.

CHAPTER 4

PROBLEM STATEMENT

4.1Problem Formulation

To process images by means of scaling, rotating etc. is known as image processing. Image processing is done in order to extracting useful information by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame. After image processing a picture or an arrangement of objects and features associated with the picture delivered as an output.Image security is an essential need to protect the digital images from any kind of misuse. There are many ways to protect the image from various types of attacks such as image splicing, copy-move attack etc. Existing studies surveyed provides different types of techniques to detect copy-move image forgery but still addresses some limitations. To overcome such limitations that involves investigation of image region transformation such as rotation, rescale and reflection in copy-move forgery. The study here proposes to detect the copy-move image forgery using rotation invariant with block-based copy-move forgery detection method for digital images.

4.2 Motivation

Advanced Forensics includes the utilization of logical strategies for the examination, investigation and interpretation of confirmations got from computerized sources to facilitate the reproduction of events, thus helping to anticipate illegitimate exercises. Computerized picture crime scene investigation manages examination of picture substance for examination and recognition of forgeries to a picture. As there are many kinds of attacks and duplication images that needs to be detected as soon as possible. So, the work is an initiative towards the detection of attacks in digital image forgeries.

4.3 Objectives

- Analyze the existing literature related to ‘Copy-Move Image Forgery’.
- Implementing the rotation invariant in ‘copy-move forgery’ to investigate image region transformation that includes rotation, rescale and reflection.
- Compare the results of rotation invariant with the block-based copy-move forgery detection method of existing study.

CHAPTER 5

RESEARCH METHDOLOGY

5.1 Simulation Tool

To perform mathematical calculations MATLAB takes the priority for being utilized in wide spread areas of research. It empowers clients to effortlessly utilize MATLAB in light of the fact that it incorporates inbuilt tool kit and drag and drop based GUI.MATLAB is utilized to execute algorithms, plotting charts and outline UI. Following is the detailed description about MATLAB-

- MATLAB is an intuitive framework whose essential information component is an array that does not require dimensioning. This enables you to take care of numerous specialized processing issues, particularly those with matrix and vector details, in a small amount of the time it would take to compose a program in a scalar non-interactive dialect, for example, C or FORTRAN.
- MATLAB has intense realistic tools and can create decent pictures in both 2D and 3D. It is likewise a programming dialect and is one of the simplest programming dialects for composing numerical projects. MATLAB likewise has some tool kits valuable for signal preparing, picture handling, improvement, and so forth.
- MATLAB bolsters creating applications with graphical UI (GUI) highlights. MATLAB incorporates GUIDE (GUI improvement condition) for graphically outlining GUIs. It likewise has firmly incorporated diagram plotting highlights.

5.2 Proposed Technique

The proposed technique is composed of rotation invariant with blur invariant‘copy-move forgery detection’. With the help of rotation invariant technique, the object in image is rotated and then the forgery is detected.

Proposed Hybrid Method-

Following is the pseudo code of proposed method to detect the forgery in an image.

Inputs : 1. Input an image (in_img) with M×N size, Block size b, Thresholds T1 ad T2

Procedure:

2. Convert in_img to Gray scale image g_img.

3. Divide image into 1 pixel B overlapping blocks of block size b.

Loop i=1:1:M-b

Loop j=1:1:N-b

%Store blocks

Blk = g_img(i:i+b-1, j:j+b-1)

End

End

4. Convert Blk to polar system pol_Blk.

For each colum in pol_Blk compute FFT and save at pol_Blk_dct

Radix sort the column of pol_Blk_dct

Reshape pol_Blk_dctas one vector by raster scan

Store n coefficients in feature matrix A of size B×n

6. Radix sort all rows and save in As.

6. Compute correlation corr between each two adjacent rows in As.

If *corr> T1*

Flag both bocks as similar

7. Compute spatial distance *dis* for similar blocks (*Bi,Bj*)

If *dis> T2*

Mark both blocks in red

Connection between each match of columns in the arranged component framework is figured. Expect sparing the arranged grid in As, at that point each column Asj is contrasted with the following line As(j+1). Relationship between each neighboring column in the arranged squares is ascertained.

$$corr = \frac{\sum_{i=1}^{n}(Bx_i - \overline{Bx}).(By_i - \overline{By})}{\sqrt{\sum_{i=1}^{n}(Bx_i - \overline{Bx})^2.\sum_{i=1}^{n}(By_i - \overline{By})^2}}$$

Where (Bx,By), are the blocks FT coefficients, ($\overline{Bx}$,$\overline{By}$) are the mean of Bx and By respectively also, is the quantity of coefficients in the square. In the event that the relationship is more prominent than a threshold T1, the two squares should be comparative.

5.3 Flow chart of proposed study

The following flow chart depicts the flow of proposed study.

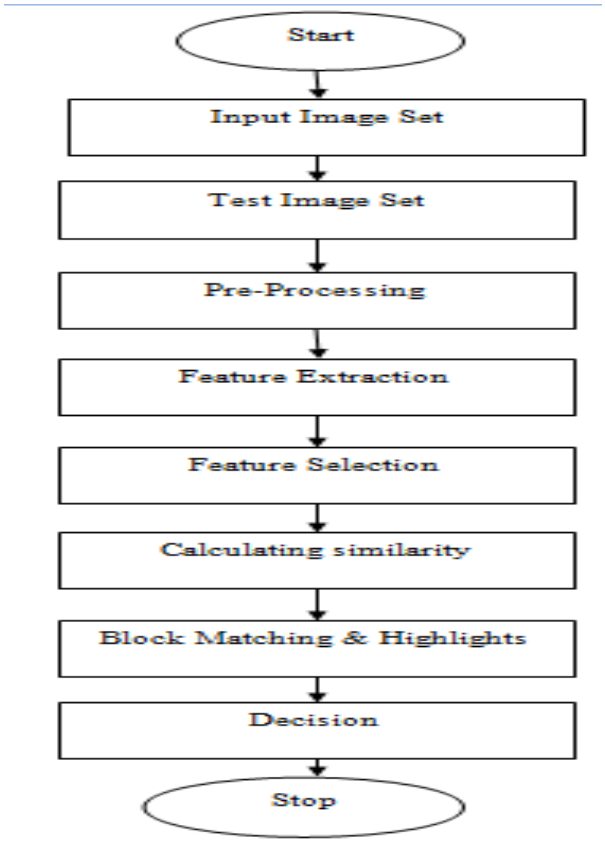


Fig. 5.1 Flowchart of Proposed work

CHAPTER 6

RESULTS AND DISCUSSION

The chapter describes the implementation of proposed research methodology. The chapter covers the objectives that are discussed in Chapter 3 and are also illustrated as below-

6.1 Analyze the existing literature related to Copy-Move Image Forgery-

Existing study is analyzed that includes the image forgery uncovering using' Blur Invariant Copy-Move Forgery detection' technique. Simulation is performed in MATLAB using one original image. For detecting the forgery attack, the original image was manipulated and then using'Blur Invariant copy move forgery detection' technique the manipulated or forged region is detected.

- Fig. 6.1 describes the input file uploaded in editor window of MATLAB. The input is an image of flowers. Statistics dimensions and cumulative block values are also defined.

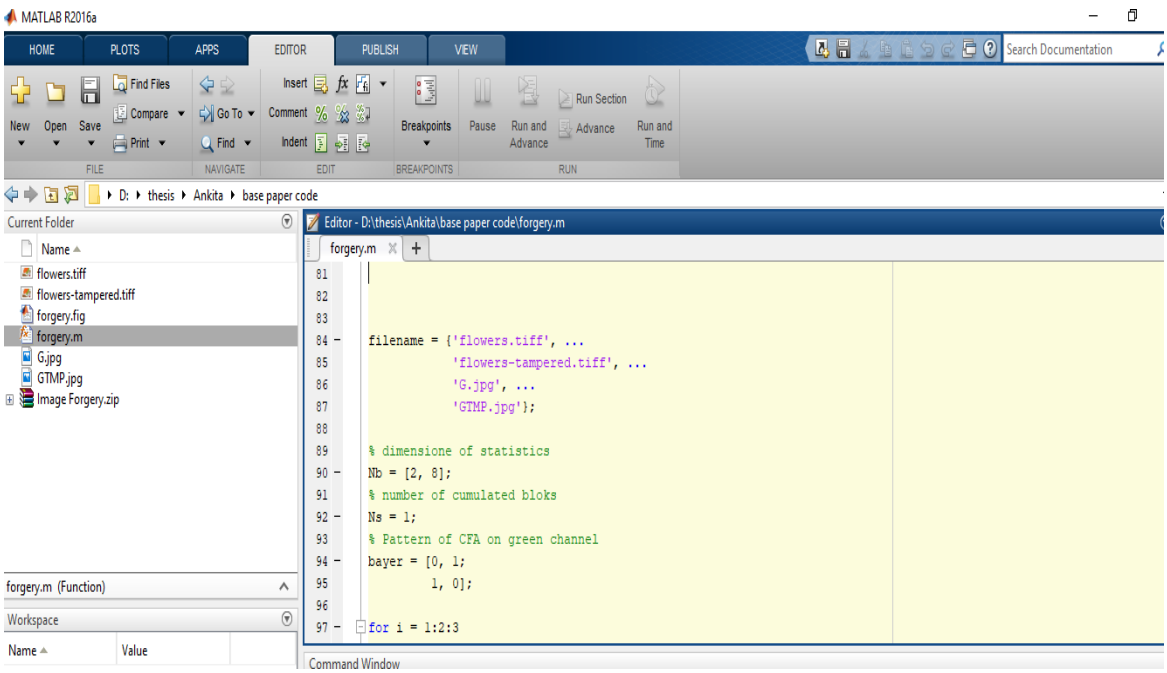


Fig. 6.1 Input (Image) uploaded in MATLAB

- When the image is uploaded, it is manipulated using forgery attack. Using Blur invariant detection technique the manipulated image is analyzed and probability map defines the forged region of manipulated image. The Fig. 6.2 also describes the histogram of blur invariant technique for detecting forged areas of an image.

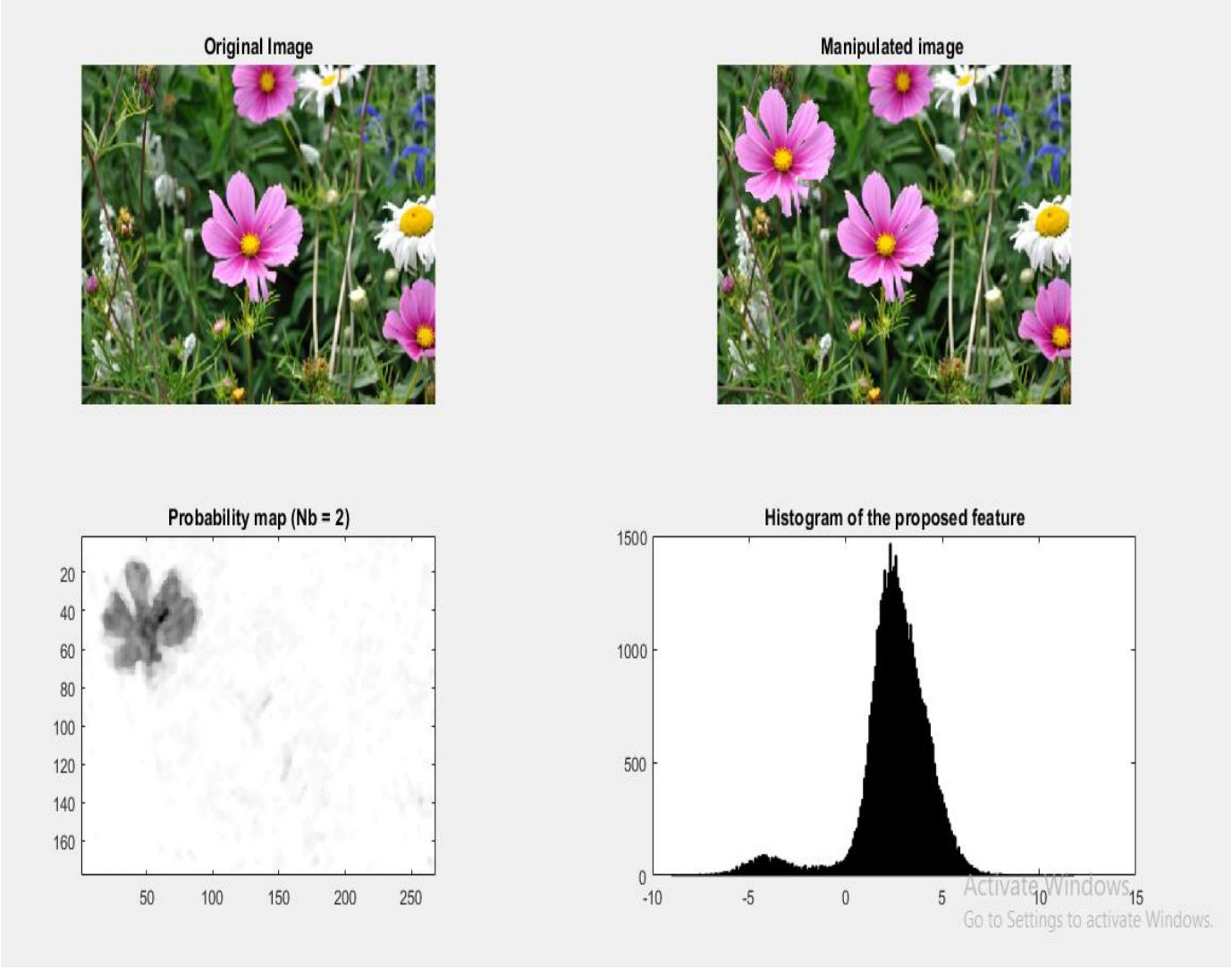


Fig. 6.2 Blur Invariant 'Copy-Move Forgery Detection' Technique

- Compare the ‘Blur invariant copy-move forgery detection’ method with existing method as far as detection accuracy as illustrated in Fig. 6.3 and is also defined as under-

  Detection accuracy=

$$\frac{\text{Number of correctly detected copy – moved pixels}}{\text{Number of pixels actually copy – moved}} \times 100\%$$

  Keeping in mind the end goal to assess the execution of the proposed technique without blurring, unit detection block size is varied.

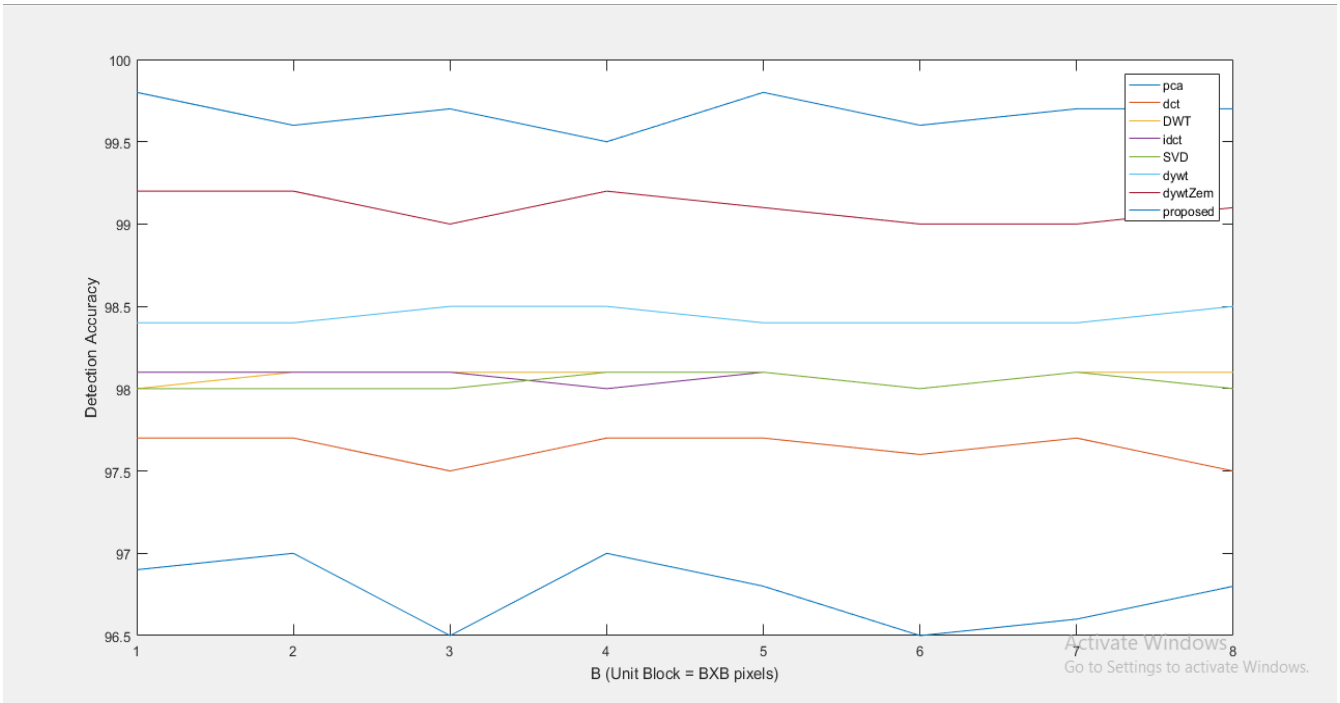


Fig. 6.3 Detection Accuracy versus Block size

6.2 Implementing the rotation invariant in copy-move forgery to investigate image region transformation that includes rotation, rescale and reflection-

The proposed research here deals with the implementation of rotation invariant technique in copy-move forgery to detect the image region transformations which include rotation, rescale and reflection.The rotation invariant approach detects the forged regions of an image more accurately.

- Fig. 6.4 shows GUI design whichdemonstrates to uploadtampered image.

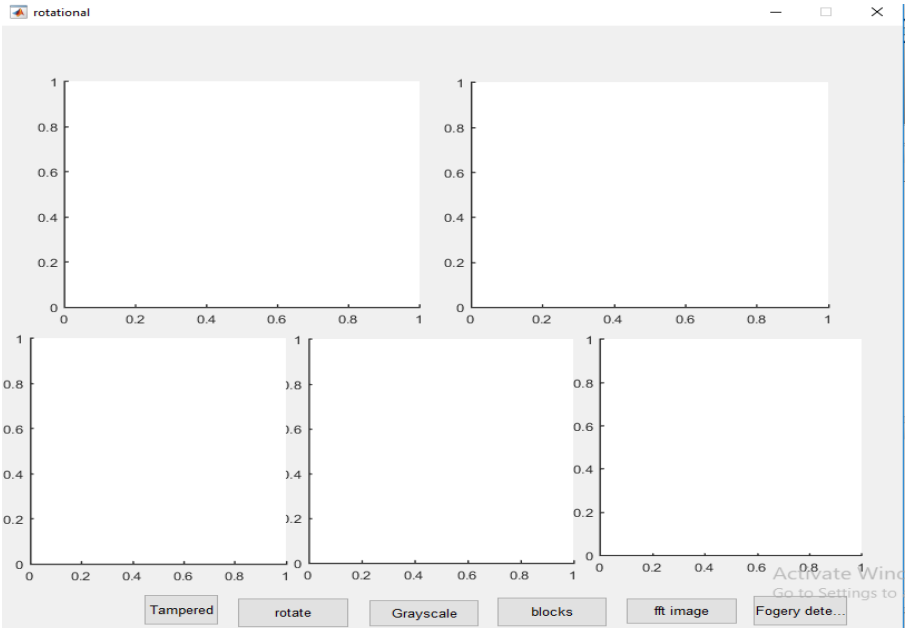


Fig. 6.4 GUI for Implementing Rotational Invariant Technique

- After uploading the tampered image,the object in the image rotated using rotation invariant method and a grayscale image is produced while clicking on grayscale button. When the image gets converted into grayscale it is signified into blocks and a Fast Fourier Transformation (FFT) is applied. The Fourier transform is a portrayal of a picture as a whole of complex exponentials of fluctuating extents, frequencies, and stages. The Fourier transform assumes a basic part in an expansive scope of picture handling applications, including improvement, investigation, rebuilding, and pressure.
- Fig. 6.5 illustrates the processing mechanism of rotation invariant method using blur invariant copy-move forgery detection.

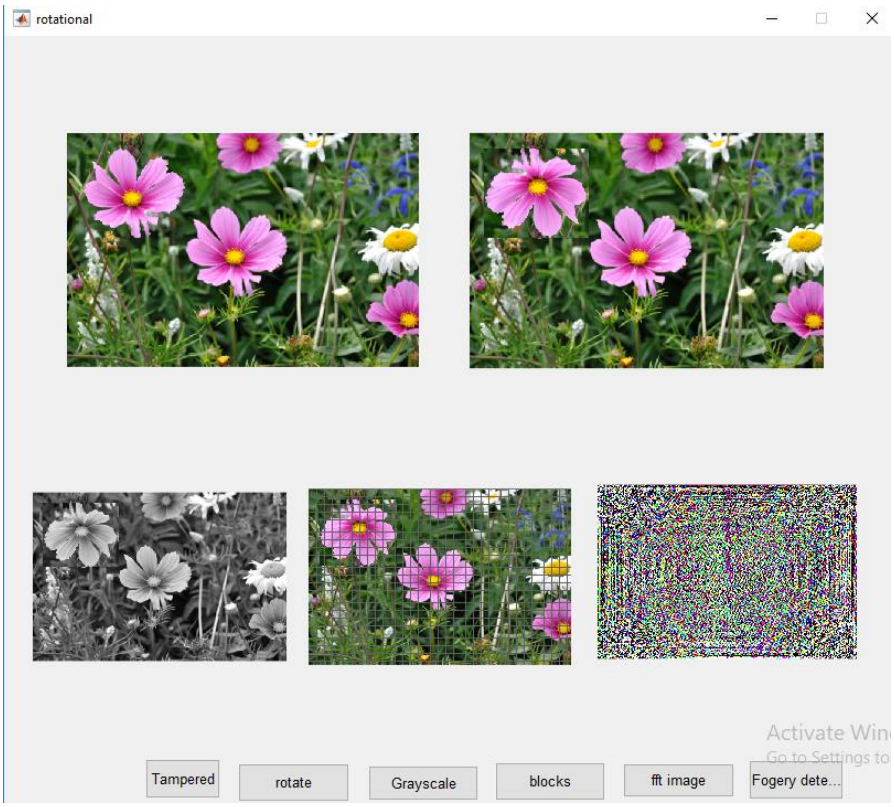


Fig. 6.5 Processing Mechanism of Proposed Technique

- When FFT is applied on the forged image it gets partitioned into small blocks. With the help of partitioning the image into blocks it becomes easier to detect the forged blocks.
- On click, forgery detection a new GUI window will open as shown in Fig. 6.6.

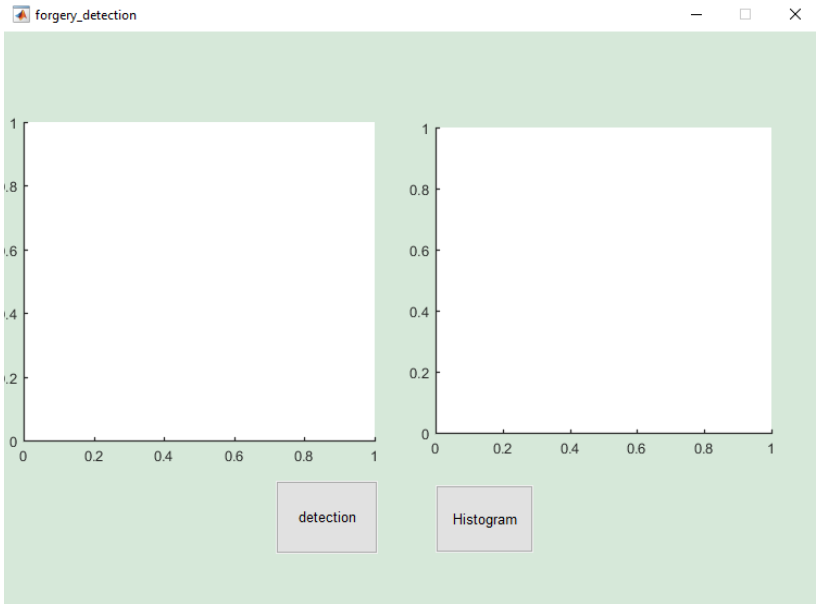


Fig. 6.6 Forgery Detection GUI

- On click detection, the proposed algorithm will detect the forged regions of an image which are represented in yellow and red color regions as depicted in Fig. 6.7. The histogram of proposed detection scheme is also shown in Fig. 6.7.

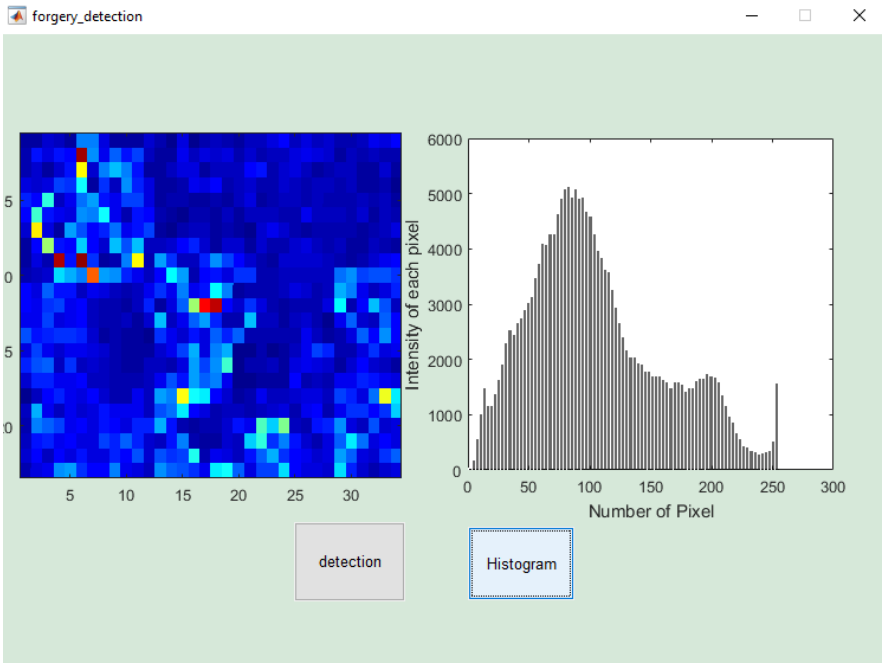


Fig. 6.7 Forgery Detection

6.3Comparing the results of proposed technique with existing block-based copy-move forgery detection method-

- Fig. 6.8 depicts the comparison between proposed forgery detection technique and existing forgery techniques.
- The comparison illustrates that the proposed technique outperforms better and has good results between 96% to 100% accuracy rates.

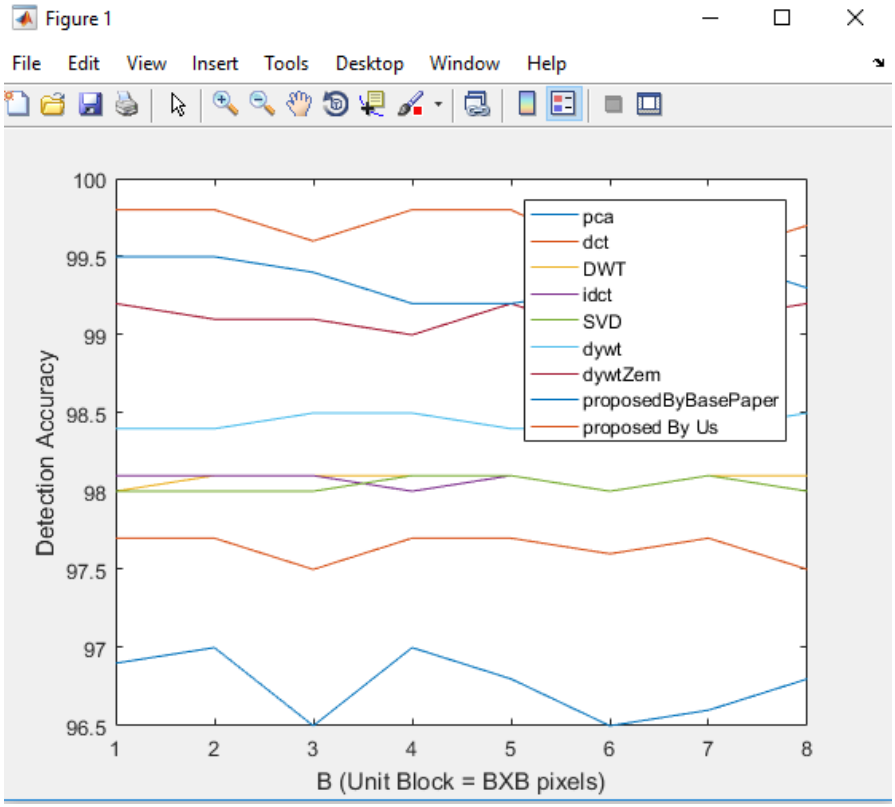


Fig. 6.8 Comparison of proposed technique with existing techniques

CHAPTER 7
CONCULSION

7.1 Conclusion

Digital image processing is the processing of images and is a framework which is used to enhance raw images which are gotten from cameras, sensors set on satellites and air make. Various techniques are discussed to protect the digital images from image forgery attacks. Surveyed studies provide different types of techniques to detect copy-move image forgery. The analyzation of the studies still suffers from some drawbacks. There is need to investigate image region transformation so that copy-move attacks can be easily detected. The proposed study focuses on the detection of copy-move attack on digital images. The image region transformation includes rotation, rescale and reflection in copy-move forgery. The rotation invariant with block-based copy-move forgery detection method is used which shows better results as compared to blur invariant copy-move forgery detection and provides accuracy rates between 96% to 100%.

REFERENCES

[1] Ye, Z. and Qu, H., 2014. Rotation invariant feature lines transform for image matching. *Journal of Electronic Imaging*, *23*(6), p.063002.

[2] Singh, V.K. and Tripathi, R.C., 2016. Fast Rotation Invariant Detection of Region Duplication Attacks Even on Uniform Background Containing Digital Images. *Procedia Computer Science*, *64*, pp.772-780.

[3] Bi, X., Pun, C.M. and Yuan, X.C., 2018. Multi-scale feature extraction and adaptive matching for copy-move forgery detection. *Multimedia Tools and Applications*, *77*(1), pp.363-386.

[4] Puri, M. and Chopra, V., 2016. A survey: Copy-Move forgery detection methods. *International journal of computer systems*, *3*.

[5] Asghar, K., Habib, Z. and Hussain, M., 2017. Copy-move and splicing image forgery detection and localization techniques: a review. *Australian Journal of Forensic Sciences*, *49*(3), pp.281-307.

[6] Wang, X.Y., Li, S., Liu, Y.N., Niu, Y., Yang, H.Y. and Zhou, Z.L., 2017. A new keypoint-based copy-move forgery detection for small smooth regions. *Multimedia Tools and Applications*, *76*(22), pp.23363-23382.

[7] Shahroudnejad, A. and Rahmati, M., 2016, December. Copy-move forgery detection in digital images using affine-SIFT. In *Signal Processing and Intelligent Systems (ICSPIS), International Conference of* (pp. 1-6). IEEE.

[8] Bharti, C.N. and Tandel, P., 2016, March. A survey of image forgery detection techniques. In *Wireless Communications, Signal Processing and Networking (WiSPNET), International Conference on* (pp. 877-881). IEEE.

[9] Warif, N.B.A., Wahab, A.W.A., Idris, M.Y.I., Ramli, R., Salleh, R., Shamshirband, S. and Choo, K.K.R., 2016. Copy-move forgery detection: Survey, challenges and future directions. *Journal of Network and Computer Applications*, *76*, pp.269-278.

[10] Yang, F., Li, J., Lu, W. and Weng, J., 2017. Copy-move forgery detection based on hybrid features. *Engineering Applications of Artificial Intelligence*, *69*, pp.73-83.

[11] Gill, N.K., Garg, R. and Doegar, E.A., 2017, July. A review paper on digital image forgery detection techniques. In *Computing, Communication and Networking Technologies (ICCCNT), 2017 8th International Conference on* (pp. 1-7). IEEE.

[12] Dixit, R., Naskar, R. and Mishra, S., 2017. Blur-invariant copy-move forgery detection technique with improved detection accuracy utilising SWT-SVD. *IET Image Processing*, *11*(6), pp.301-309