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Forgery Detection of Computer Manipulated Digital Documents Using Image Processing

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Abstract*—The recent advancement in technology in the usage of image processing tools and applications has led to increased criminal activities in fraudulent and forging documents and digitally manipulating them. The use of tools like Adobe Photoshop, GNU Gimp to create manipulated fraud documents is a major concern for the government in this digital era. It is extremely crucial to detect image forgery and manipulation done by computer in these documents. This proposed system focusses on the use of image processing techniques and algorithms along with machine learning to detect the forgery and image manipulation done in a specific government document which is used nationally on a wide scale. A Convolutional Neural Network (CNN) is being adopted to extract the features from the image of the document to analyse it further and classify it. The image of the document extracts features like brightness of pixel and the font format and the resolution of image. These features provide us with details to analyse the similarity between the digital forged images and enable us to develop an algorithm to detect and manipulation in digital images and tampering in documents.*

Keywords—Convolutional Neural Network(CNN),digital,document,forgery,images.

I. INTRODUCTION

India is a developing country and most of the government and professional work is done by scanning and sending picture of the documents while filling a form or applying for jobs, loans, etc. The procedure usually requires the individual to scan or click picture of his/her document and send it to the organization or government or individual. The organization once receiving the image verifies the details with the naked eye and just confirms if there is no physical tampering done to the document whose image has been sent, they do not verify whether the image has been digitally manipulated or forged using any digital manipulation tools easily available to the common users on the Internet.

Due to this there is an increase in the field of image forgery and digitally manipulating the document or the image of the document which has been scanned or picture of the document clicked. People are using tools like Photoshop, GNU Gimp to forge and digitally manipulate the document before sending it or uploading it. The forgery or image manipulation that might be done on the document is not visible to the normal naked human eye. This leads to lot of loss of the organization as well as increases the criminal activity. By using image processing along with machine learning and deep learning it is possible to detect these forgeries or digital manipulation done on these documents and images.

II. LITERATURE SURVEY

Xintong Han, et. al. [1] has proposed a novel network using both RGB stream as well as noise stream for learning rich features of image manipulation detection. Extracting the noise features by an SRM filter layer adapted from steganalysis literatures which enables the model to capture noise inconsistency between tampered and authentic regions. Representation of rich features of the network enables it to distinguish between the different manipulation techniques. Changing the classes for manipulation classification to be splicing, removal and copy-move so as to learn distinct visual tampering artifacts and noise features for each class. The two streams featuring through a bilinear pooling layer and further incorporating spatial co-occurrence of these two

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modalities.Alsoit achieves better performance compared to other methods with robustness of resizing and compression. Distinguishing authentic images from the manipulated is difficult.

Daniel Oliveira Dantas, et. al. [2] has proposed an adaptation of the VisionGL library to support the GPU processing of two- and three-dimensional images by OpenCL shaders. The given libraries have automatic wrapper code generator which enhances and makes it easy to implement the new shaders for the coder. A new library that processes two- and three-dimensional images by OpenCL shaders with high performance. The library present has the ability to extend and then support the new shaders. Also, annual programming of wrapper code is a mechanical task that requires a great deal of effort. Due to elimination of these steps the programmer can further focus on the shader creation and automatic generation of the code also helps in library maintenance as the generated code has no need to be maintained or debugged.

Jing Hong Duan, et. al. [3] has proposed the technology which has been widely used in many fields, especially in printing industry for security documents. Though there are many anticounterfeiting methods, Data hiding method has become the mainstream method. This paper presents a computational inexpensive method. It can hide the message while the image is halftoned, and the message can be extracted easily. Halftoning is a traditional printing technique which converts the continuous toned image into a binary image so that the image can be displayed or printed with bi level devices such as digital inkjet printer and printing machine.

GururajMukarambi, et. al.[4] has proposed the trilingual script identification system in block wise for camera captured images. Local binary pattern features are used for Kannada, Hindi and English images for testing the performance of a proposed algorithm. Segmentation techniques are used to segment the image in blocks. This method is independent of thinning. Considereing only clean images with controlled manner capture of the image document. There is no standard database for camera based Indian document images. Hence,database is created with digital and mobile cameras to capture 600 neat sample images from fiction and non-fiction books and general magazines of Kannada, Hindi and English languages with variation of resolutions.

Wenjun Zhang, et. al. [5] has proposed a method which implements the three image model and back propagation neural network in which the image quality assessment has a crucial role for the image processing process and these components have various different visual impact. The shortage of VA model which is based on eye tracking experiments with images under the natural viewing conditions that the data of eye tracking experiment are just for source images of the database. The Image Quality Assessment method is very complicated and difficult for it to be implemented in the image processing process which contains variety of images. It is found that edge, smooth and texture regions have different visual impact.

Dong Hyun Kim, et. al.[6] has proposed that an image manipulation might be misused by the criminals of counterfeiters for the purpose of counterfeiting.The filter that us used for acquiring the hidden features is High pass. And, it becomes easily available to apply it to various multimedia as well as image. Digital Forensics will be needed to detect such illegal purposes. This paper can be used to check whether or not the image is manipulated or not and can be applied for detection of the manipulation techniques.

DamirDemirovic, et. al.[7] has proposed image processing algorithms which are capable to execute in parallel manner on several platforms such as CPU and GPU. Signal, image and Synthetic Aperture Radar imagery algorithms are used in a daily routine. Due to huge data and complexity their processing is almost impossible in a real time. Often image processing algorithms are inherently parallel in nature, so they fit nicely into parallel architectures multicore Central Processing Unit (CPU) and Graphics Processing Unit GPUs. Parallel processing has become most dominant for high performance computing. The amount of data in signal, image and Synthetic Aperture Radar imagery processing constantly rises. The computation on the smaller data set obtain lower speedups due to the fact how TensorFlow handling computation works.

Demetrios G. Sampson, et. al.[8] has proposed a method for low bit rate for the given spatial domain block coded images in the following paper. The shape is then adjusted according to the region.Smoothing operator is being implemented in detailed areas of

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the image where the adaptive Gaussian filters are being employed. Gaussian kernel shape is then adjusted in according to the local image region's characteristics. Technique such as vector quantisation is very much related to that of the orginal signal's characteristics.

ThumrongratAmornraksa, et. al.[9] describes that the text is in faxed document is exposed to be manipulated by any malicious person, the proposed process of text integrity verification for faxed document is proposed .There will always be some rotational and translational defects and distortions when a image is being clicked and this will definitely affect the accuracy of the text integrity verification. Pixel re-organizing techniques are used to reduce such distortions. The given following method is able to detect any change in the faxed document. The Results shows the success of the system. However, some distortions and noise from communication channel cannot be removed.

Matthias Kirchnera, et. al.[10] describes that the manipulations that are done at specific region does not usually harm the authentic value of image on performing image enhancing, it is still of high interest to learn as much as possible about what exactly has happened to an image and to make wise choice based on this knowledge. While this proliferates the ambiguities in the determination of the concrete preprocessing history, especially when the JPEG quality becomes lower, it might be argued that after strong enough compression it is sufficient to know that an image has been smoothed before because typical filter characteristics are suppressed by JPEG artifacts. The SPAM features are still able to detect median filtering reliably. In fact, a low pre-compression quality can even increase the detector's performance.

NikolaosMitianoudis, et. al.[11] describes an image depiction to perform accurate image binarization to color representations. ICA algorithm is used in performing background subtraction. Conventional binarization techniques of gray scale documents have proved to be efficient for simple gray scale images and are not at all suitable for the unclear andcomplex documents. One of the most efficient methods is proposed (GPP), where the document background is estimated by an adaptive threshold which labels each pixel as either text or background. The background is estimated from the single-channel or color image, which often results to inferior background estimates.

Daljeet Kaur Kalsi, et. al.[12] describes a system that detects a copy move forgery in the images. The forgery is introduced in images by copying a particular segment of the particular image and then to put it in the same image or in the other image. One of the common growing problems in the areas of crime is the digital image forgery. Detection of the given forged image is done using the AILBP method which includes the properties of wavelet decomposition; as the proposed approach targets to find the forged region with high accuracy. In the passive approach it there is no need of any prior knowledge and thus it mainly depends on the different preprocessing steps during the manipulation of the digital images.

S.PraylaShyry, et. al.[13] describes multiple types of picture forgery and detecting them techniques and methods have been elaborately explained. The picture and image manipulation by different means and methods have been discussed. At the beginning multiple types of attacks are categorized and the passive approach is been explained and discussed.

ZhuangXiong, et. al.[14] describes a non-local scheme which is related and based on the 3D convolutional neural network for the image and super resolution has been proposed. The method and techniques used is been built to sharpen the non-local patches. The analysis of the method indicate in results the higher reconstruction accuracy.

TianmeiGuo, et. al.[15]describes a basic and simple model of convolutional neural network has been used to perform the image classicfication. The datset of minst and cifar-10 have been used to perform the image processing in this paper, In this paper based on the neural network the different techniques and methods of the learning rate set have been analysed. The different optimization algorithm and optimal parameters have been studied.

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III. ANALYSIS

TABLE 1:ANALYSISOF IMAGE PROCESSING

Sr. No.	Title of paper	Techniques/Technologies used	Datasets used	Advantages
1.	Learning Rich Features for Image Manipulation Detection.[1]	Two-Stream Faster R-CNN	Ground-Truth Tampering mask, Spliced and Copy moved images.	The method can recognize the difference in different tampering methods.
2.	Fast 2D and 3D Image Processing with OPENCL [2]	OpenCL, OpenGL	Two- and Three-Dimensional Images of One, Three (RGB) and Four (RGBA) channels	The performance of three-dimensional image processing is better than CImg and ITK libraries
3.	An Anti- Counterfeiting Method for Printed Image by Digital Halftoning Method [3]	Digital Halftoning Technique	Image sets of Monkey and Ship	This paper presented a simple and inexpensive method, which can hide the message while the image is halftoned.
4.	Script Identification from Camera Based Tri-Lingual Document [4]	K nearest neighbor (KNN),	Datasets of nearly 6000 neat block images are used	Accuracy of 96.6%, 98.00% for 128x128 block, 98.71%, 98.07% for 256x256and 94.9%, 99.01% for 1024x1024 by using KNN and SVM respectively
5.	Full-Reference Image Quality Assessment via Region-Based Analysis [5]	Back Propagation (BP) Neural Network	Dataset contains 29 original images and 779 images that are distorted.	Performance of RBPSNR/RBSSIM is better than WPSNR/WSSIM
6.	Image Manipulation Detection using Convolutional Neural Network [6]	Convolutional Neural Network (CNN)	Nearly 200,000 images including the original images are used.	95 % accuracy was achieved
	Performance of some	TensorFlow	Implementation of two	It is observed that for the smaller

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7.	image processing algorithms in TensorFlow [7]		input data sets for all algorithms, smaller and bigger were used.	data size CPU outperforms GPU .For bigger input data, GPU gave better performance
8.	Post Processing of Block Coded Images at Low Bitrates [8]	Fully Adaptive Gaussian type filter	The training set consists from five ISO/ITU-T test images.	High image detail regions, which include edges and texture
9.	Text Integrity Verification for Faxed Document Using Pixel Reorganizing Technique [9]	Support Vector Machine (SVM)	Faxed Document Images	The proposed method can detect any change in the faxed document.
10.	On Detection of Median Filtering in Digital Images [10]	Median Filtering Technique (MFT)	Database of near around 6500 never-compressed RGB images.	Detection for false positive rates was achieved as low as 1.8 %
11.	Multi-Spectral Document Image Binarization using Image Fusion and Background Subtraction techniques [11]	Spatial Kernel K-Harmonic Means clustering (SKKHM)	Dataset contains the 10 multispectral pictures byHediam and Cheriet.	Previous system scores an average of 63% while the proposed system scores 79%
12.	A Copy-Move Forgery Detection System Using Approximation Image Local Binary Pattern [12]	AILBP (Approximatio n image local binary pattern)	Using adobe photoshop 7.0, the dataset of Mountain, Monkey,	High and precise accuracy including the properties of wavelet decomposition is achieved
13.	Digital Image Forgery Detection[13]	SVM	Dataset consisting of multiple images.	Machine learning yields better results.
14.	SINGLE IMAGE SUPER-RESOLUTION USING A NON-LOCAL 3D CONVOLUTIONAL NEURAL NETWORK[14]	3D convolutional neural network (3DCNN)	Dataset of 91 images from and 200 images from Berkeley Segmentation Dataset	Model has achieved superior performance especially for the images with rich textures.
15.	Simple Convolutional	Convolutional	The MNIST dataset consists of 60000	The CNN network also has a

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	Neural Network on Image Classification[15]	neural network(CNN)	28x28 Grayscale images	relatively good recognition effect.

IV. CONCLUSIONS

In this project the Image processing technique using Convolutional Neural Network (CNN) is used for determining whether the input digital image of the document is forged or not. The algorithm used along with feature extraction techniques will be able to extract the features from the document image. These features are used by the convolutional layers to process the image and give a binary classified output as whether the input image is forged or not. The system will use the features to process and will detect and classify whether the image is forged or not. However, the system cannot detect if there is any tampering done on the physical document which was scanned, or picture clicked and uploaded to the system.

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