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CRIMINAL FACIAL DETECTION AND OCCURRENCE PREDICTION USING DEEP LEARNING

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ABSTRACT:

Various recent advancements in deep learning models have greatly boosted the performance of semantic pattern recognition using images. Various state estimation of an individual like emotional state and other certain character features or traits can be estimated from the facial images. With this motivation, in this work we are attempting to infer criminal tendency or (crime prediction/detection) from facial images by using the learning capabilities of various deep learning architectures. More precisely two type of deep learning models we have used in this study: standard convolutional neural network(CNN) architecture and pre-trained CNN architectures, namely VGG-16, VGG-19, and InceptionV3. We have done a performance comparative analysis among these models for efficiently capturing criminal traits from a human face. The efficacy of the above deep learning models was evaluated on a public database, National Institute of Standards and Technology (NIST). To avoid any discrepancies, we have only used male images in this work. It was found that VGG CNN models are best performing models, especially in a limited data scenario producing the classification accuracy of 99.5% in identifying criminal faces.

Index Terms—Image Classification, Facial images, Semantic pattern Recognition, Personality Traits, Deep Learning, Image Processing.

INTRODUCTION

Biometrics is a technology that uses the unique patterns of physical or behavioural traits of human for authentication or identification. The advancement in biometric technology is bringing in the biometric scanners onto smartphones and other affordable devices. There is also an increasing number of services and applications that require high security and smooth customer experience. Biometric technology is replacing traditional authentication methods. One of the advanced methods of biometric is facial recognition.

For identifying a person face is the decisive part of the human body. Face distinguishes a person. Facial recognition is a challenging problem that finds application for authentication in banking services, security systems, searching, identifying personal among others. A human can easily recognize the face, for the computer it requires an entirely different process. Face acknowledgement is an errand that people perform routinely and easily in their day to day lives. The wide accessibility of amazing and minimal effort - work area and inserted registering frameworks has made a tremendous enthusiasm for programmers to prepare computerized pictures and recordings in various applications, including biometric confirmation, observation, human-PC association, and sight and sound administration. Innovative work in programmed face acknowledgement pursues normally. A face recognition system is expected to identify faces present in images and videos automatically. It can operate in either or both of two modes: face verification (or authentication), face identification (or recognition).Face check includes a coordinated match from grayscale image (black and white) against a format face (datasets) picture whose feature is being extracted. Face recognizable proof includes one-to-numerous matches that think about an inquiry face picture or video against all the format pictures in the database to decide if it matches. Another face acknowledgement situation includes a watch-list check, where an inquiry

face is coordinated to a rundown of suspects (one-to-few matches). The research in facial recognition is motivated by enormous real-time applications that can make the traditional identification system smooth and easy. The face recognition motivates the researcher by throwing the fundamental challenges for recognizing the faces.

The simple and easy approach to identification has made facial recognition as the primary biometric technology. The importance of the technique owed to easily accessible digital cameras and increased demand for security. The advantage of facial recognition over other biometric technologies is that it is natural, nonintrusive and easy to use .

This study may be considered as a new kind of department that can be called as cyber-forensic for dealing the crime by predicting the behavior of criminals and detecting the nature of crime to be done by criminals. This study may be considered as a new kind of department that can be called as cyber-forensic for dealing the crime by predicting the behavior of criminals and detecting the nature of crime to be done by criminals.

The disclaimer of this work is that it is limited to technical and analytical aspects and not questioning social aspects as it requires a high level of caution and supervision. This work can be further improved with the availability of a large and variety of available data-set. Large corpus will also help in the disclaimer of this work is that it is limited to technical and analytical aspects and not questioning social aspects as it requires a high level of caution and supervision. This work can be further improved with the availability of a large and variety of available data-sets.

LITERATURESURVEY

Character recognition is not a new problem but its roots can be traced back to systems before the inventions of computers. The earliest OCR systems were not computers but mechanical devices that were able to recognize characters, but very slow speed and low accuracy. In 1951, M. Sheppard invented a reading and robot GISMO that can be considered as the earliest work on modern OCR [1]. GISMO can read musical notations as well as words on a printed page one by one. However, it can only recognize 23 characters. The machine also has the capability to could copy a typewritten page. J. Rainbow, in 1954, devised a machine that can read uppercase typewritten English characters, one per minute. The early OCR systems were criticized due to errors and slow recognition

speed. Hence, not much research efforts were put on the topic during 60's and 70's. The only developments were done on government agencies and large corporations like banks, newspapers and airlines etc.

Because of the complexities associated with recognition, it was felt that three should be standardized OCR fonts for easing the task of recognition for OCR. Hence, OCRA and OCRB were developed by ANSI and EMCA in 1970, that provided comparatively acceptable recognition rates[2] .

During the past thirty years, substantial research has been done on OCR. This has lead to the emergence of document image analysis (DIA), multi-lingual, handwritten and omni-font OCRs [2]. Despite these extensive research efforts, the machine's ability to reliably read text is still far below the human. Hence, current OCR research is being done on improving accuracy and speed of OCR for diverse style documents printed/ written in unconstrained environments. There has not been availability of any open source or commercial software available for complex languages like Urdu or Sindhi etc.

One of the most important steps of offline character recognition system is skew detection and correction which has to be used in scanned documents as a pre-processing stage in almost all document analysis and recognition systems. This paper describes the skew detection and correction of scanned document images written in Assamese language using the horizontal and vertical projection profile analysis [5]. Documents with background images in OCR cause an error. A non-linear transformation is used to enhance the contrast of each channel image. The experimental results show that the recognition accuracies are improved significantly after removing background images [7]. For pre-processing Fourier Transform is used which decomposes an image into sine and cosine components with increasing frequencies. Fourier transform converts spatial domain onto frequency domain which is easily used for further processing [1]. Reading text from photographs is a challenging problem. They applied recently developed machine learning algorithms for learning the features automatically from unlabeled data. They proposed text detection and recognition system based on a scalable feature learning algorithm and applied it to images of text in natural scenes [8]. Since past few years, research has been performed to develop machine printed Chinese/English characters. In this paper, they

described the search and fast match techniques. High-performance Chinese/English OCR engine is used to construct a large vocabulary. They have collected 1862 text lines from varied sources such as newspapers, magazines, journals, books, etc [9]. H. Wang and J. Kangas [10] proposed a method of identifying character- like regions in order to extract and recognize characters in natural color scene images automatically. Connected component extraction is used to check the block candidates. Priority adaptive segmentation (PAS) is implemented to obtain accurate foreground pixels of the character in each block. Paper [11] presented a system for text extraction based on the open-source OCR algorithm. The system is used for functional verification of TV sets. J. Diaz-Escobar [12] proposed a new method for recognition of content-less characters in degraded images using the phase congruency and local energy model. The suggested phase features are invariant to non-uniform illumination and slight geometric distortions. Degraded images were compared with that of the SIFT method in terms of recognition metrics. Another approach in the paper [13] Hauling the scene text from image and video is challenging due to the complex background, changeable font size, dissimilar style, unknown layout, poor resolution and blurring, position, viewing angle and so on. For text extraction region and connected component based methods are used. Artificial Neural network (ANN) is used as the classifier to filter out the text and non-text component

The main purpose of Optical Character Recognition (OCR) system based on a grid infrastructure is to perform Document Image Analysis, document processing of electronic document formats converted from paper formats more effectively and efficiently. This improves the accuracy of recognizing the characters during document processing compared to various existing available character recognition methods. Here OCR technique derives the meaning of the characters, their font properties from their bit-mapped images. The primary objective is to speed up the process of character recognition in document processing. As a result the system can process huge number of documents with-in less time and hence saves the time. Since our character recognition is based on a grid infrastructure, it aims to recognize multiple heterogeneous characters that belong to different universal languages with 3 different font properties and alignments.

Features :-

Despite of the significant amount of research in OCR, recognition of characters for language such as Arabic, Sindhi and Urdu still remains an open challenge. An overview of OCR techniques for these languages has been planned as a future work. Another important area of research is multi-lingual character recognition system. Finally, the employment of OCR systems in practical applications remains an active are of research.

EXISTINGSYSTEM:

In the current existing system, It aims to find spatial and temporal criminal hotspots using a set of real-world datasets of crimes. We will try to locate the most likely crime locations andtheir frequent occurrence time. In addition, we will predict what type of crime might occur next in a specific location within a particular time. Finally, we intend to provide an analysis study by combining our findings of a particular crimes dataset with its demographics information. There has been countless of work done related to crimes. Large datasets have been reviewed, and information such as location and the type of crimes have been extracted to help people follow law enforcements. Existing methods have used these databases to identify crime hotspots based on locations. There are several maps applications that show the exact crime location along with the crime type for any given city.

DIS-ADVANTAGE:

Even though crime locations have been identified, there is no information available that includes the crime occurrence date and time along with techniques that can accurately predict what crimes will occur in the future.

PROPOSEDSYSTEM

In the modern era, advanced machine learning tools have been key to crime prevention, identification and surveillance applications. Most of the crime-based analysis are being done today using some or other machine learning approaches. Crime rate diagnosis against women using machine learning approach has been reported. The authors have used previous data to predict the crime. In this proposed a methodology to identify criminal activities through a image capturing and video stream by capturing the person by the person through previous records that have been recorded in the database. Different CNN architectures like DCNN, RNN (Recurrent Neural Network), etc. have been employed to capture the abnormal

behavior in the video frames. The DCNN can help in identifying important features from the frames with the help of the HDL algorithm. It is possible to detect the criminal in real-time using videos, images, and alert can be sent to a nearby police station. The pre-trained deep learning models like VGG-19 and have been used in the related literature. Real-time crime detection using Machine Learning and Deep Learning for the prevention of crime have been occurred and this proposed system application helps the police officers to know about the possible incident which may happen around in real-time and also gives the previous recorded information available about the criminal that is about his Identity and previously commited crimes.

ADVANTAGE:

Identifying criminal out of a large crowd or predicting the criminal would be easy and less time is consumed, While the investigation is going on, It becomes handy for the investigation process for facial recognition of criminal and identification of his/her details.

METHODLOGY

CNN: In deep learning, a **convolutional neural network** (**CNN/ConvNet**) is a class of deep neural networks, most commonly applied to analyze visual imagery. Now when we think of a neural network we think about matrix multiplications but that is not the case with ConvNet. It uses a special technique called Convolution. Now in mathematics **convolution** is a mathematical operation on two functions that produces a third function that expresses how the shape of one is modified by the other
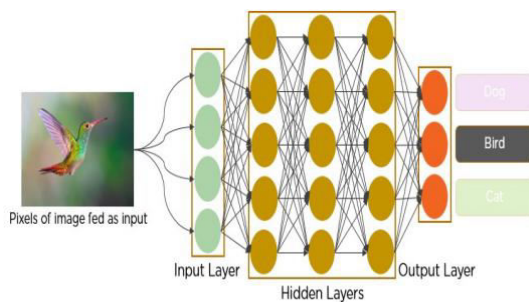

CNN Architecture

RNN: RNN are a powerful and robust type of neural network, and belong to the most promising algorithms in use because it is the only one with an internal memory.

Like many other deep learning algorithms, recurrent neural networks are relatively old. They were initially created in the 1980's, but only in recent years have we seen their true

potential. An increase in computational power along with the the massive amounts of data that we now have to work with, and the invention of long short-term memory (LSTM) in the 1990s, has really brought RNNs to the foreground. Because of their internal memory, RNN's can remember important things about the input they received, which allows them to be very precise in predicting what's coming next. This is why they're the preferred algorithm for sequential data like time series, speech, text, financial data, audio, video, weather and much more. Recurrent neural networks can form a much deeper understanding of a sequence and its context compared to other algorithms.

RNN Architecture
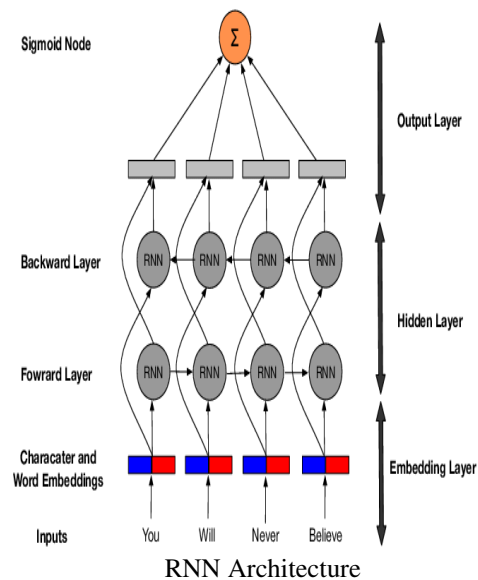
DCCN: Data communications refers to the transmission of this digital data between two or more computers and a computer network or data network is a telecommunications network that allows computers to exchange data. The physical connection between networked computing devices is established using either cable media or wireless media. The best-known computer network is the Internet.

This tutorial should teach you basics of Data Communication and Computer Network (DCN) and will also take you through various advance concepts related to Data Communication and Computer Network.

Applications of DCCN: Computer systems and peripherals are connected to form a network. They provide numerous advantages:

Resource sharing such as printers and storage devices

Exchange of information by means of e-Mails and FTP

Information sharing by using Web or Internet

TYPES OF TESTS

Unit testing

Unit testing involves the design of test cases that validate that the internal program logic is functioning properly, and that program inputs produce valid outputs. All decision branches and internal code flow should be validated. It is the testing of individual software units of the application .it is done after the

completion of an individual unit before integration. This is a structural testing, that relies on knowledge of its construction and is invasive. Unit tests perform basic tests at component level and test a specific business process, application, and/or system configuration. Unit tests ensure that each unique path of a business process performs accurately to the documented specifications and contains clearly defined inputs and expected results.

Integration testing

Integration tests are designed to test integrated software components to determine if they actually run as one program. Testing is event driven and is more concerned with the basic outcome of screens or fields. Integration tests demonstrate that although the components were individually satisfaction, as shown by successfully unit testing, the combination of components is correct and consistent. Integration testing is specifically aimed at exposing the problems that arise from the combination of components.

Functional test

Functional tests provide systematic demonstrations that functions tested are available as specified by the business and technical requirements, system documentation, and user manuals.

Functional testing is centered on the following items:

Valid Input : identified classes of valid input must be accepted.

Invalid Input : identified classes of invalid input must be rejected.

Functions : identified functions must be exercised.

Output : identified classes of application outputs must be exercised.

Systems/Procedures : interfacing systems or procedures must be invoked.

Organization and preparation of functional tests is focused on requirements, key functions, or special test cases. In addition, systematic coverage pertaining to identify Business process flows; data fields, predefined processes, and successive processes must be considered for testing. Before functional testing is complete, additional tests are identified and the effective value of current tests is determined.

System Test

System testing ensures that the entire integrated software system meets requirements. It tests a configuration to ensure known and predictable results. An example of system testing is the configuration oriented system integration test. System testing is based on process descriptions and flows, emphasizing pre-driven process links and integration points.

White Box Testing

White Box Testing is a testing in which in which the software tester has knowledge of the inner workings, structure and language of the software, or at least its purpose. It is purpose. It is used to test areas that cannot be reached from a black box level.

Black Box Testing

Black Box Testing is testing the software without any knowledge of the inner workings, structure or language of the module being tested. Black box tests, as most other kinds of tests, must be written from a definitive source document, such as specification or requirements document, such as specification or requirements document. It is a testing in which the software under test is treated, as a black box .you cannot "see" into it. The test provides inputs and responds to outputs without considering how the software works.

Unit Testing

Unit testing is usually conducted as part of a combined code and unit test phase of the software lifecycle, although it is not uncommon for coding and unit testing to be conducted as two distinct phases.

Test strategy and approach

Field testing will be performed manually and functional tests will be written in detail.

Test objectives

- All field entries must work properly.
- Pages must be activated from the identified link.
- The entry screen, messages and responses must not be delayed.

IntegrationTesting

Software integration testing is the incremental integration testing of two or more integrated software components on a single platform to produce failures caused by interface defects.

The task of the integration test is to check that components or software applications, e.g. components in a software system or – one step up – software applications at the company level – interact without error.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

Acceptance Testing

User Acceptance Testing is a critical phase of any project and requires significant participation by the end user. It also ensures that the system meets the functional requirements.

Test Results: All the test cases mentioned above passed successfully. No defects encountered.

RESULTS:

8.1 OUTPUT SCREENS:

Use python home.py command on the command prompt of Project folder
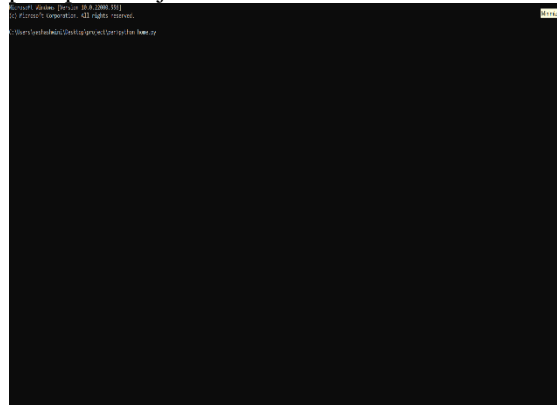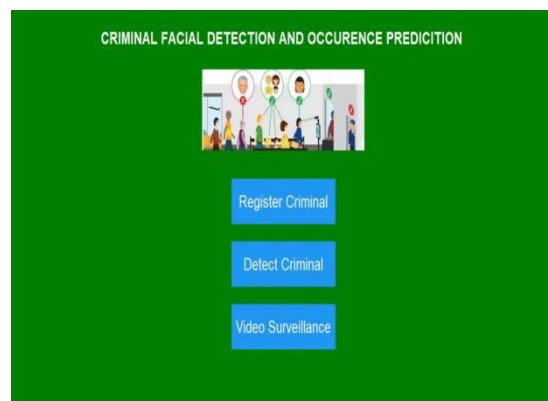

Fig 8.1.1. Command used to obtain Criminal Detection GUI

Fig 8.1.2. GUI of Criminal Detection

We get the above GUI with the following Three options:
1.Register Criminal
2.Detect Criminal
3.Video SurveillFig
 8.1.3. Enter the Criminal Details

Fig 8.1.3:Enter Criminal details

In the above screen we enter the details of the Criminal such as Name Crimes Done etc. to Register the Criminal in the Database the Star mark Indicates Mandatory details.
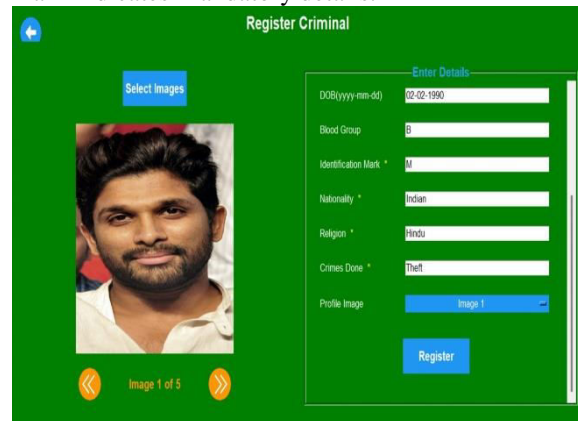

Fig 8.1.4 Select five Images of appropriate size

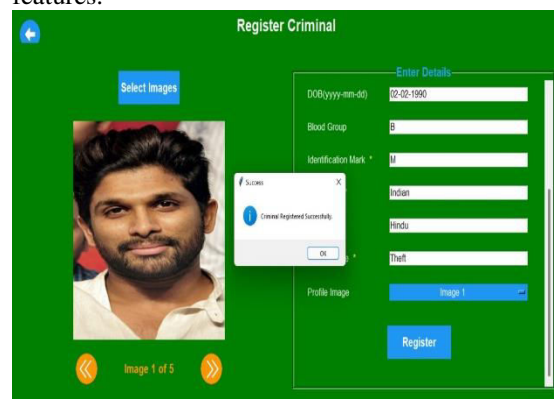Images should be selected and those of the same size and the person with clear enhanced facial features.

Fig 8.1.5. Click on RegisterButton

Click on Register. Dialogue box appears with a Message "Criminal Registered Successfully".
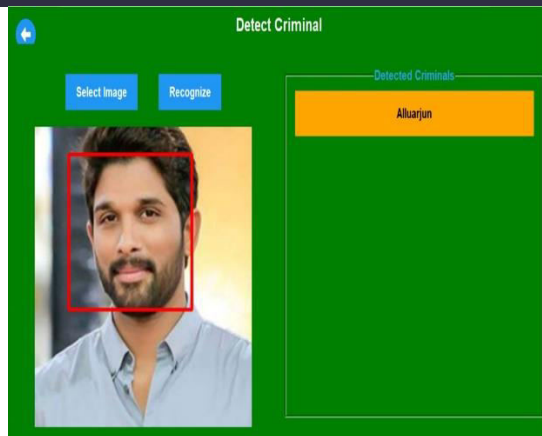
Fig 8.1.6. Detection of Criminal

Select an Image from the database and click on Recognize button to detect the criminal.
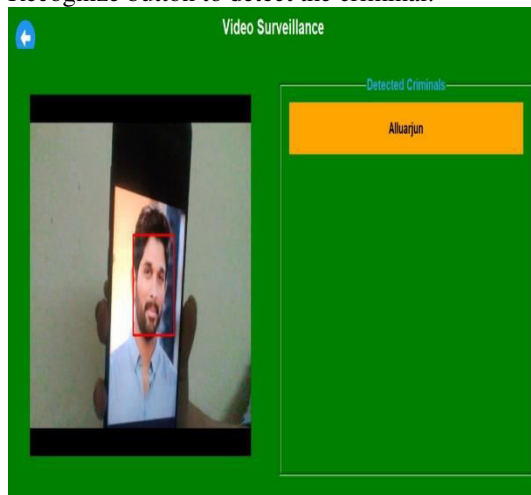

Fig 8.1.7. Video Surveillance.

Go back to the GUI and select video surveillance option. Now place the Image/person in front of the Camera for detection.
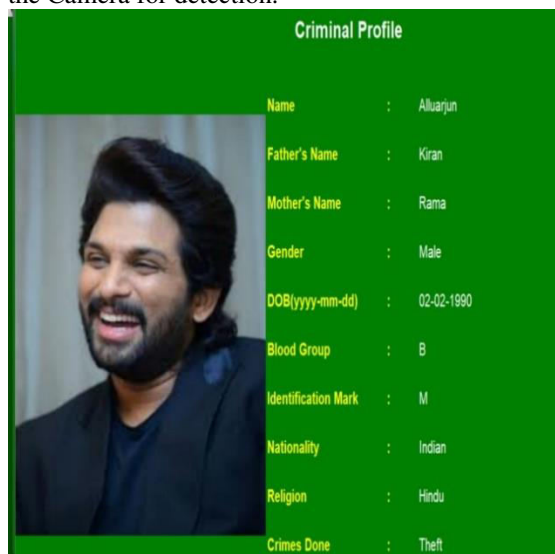

Fig 8.1.8. Details of the Criminal

Click on name of the criminal to get the details.

CONCLUSION :

We can conclude the above work stating that This study may be considered as a new kind of department that can be called as cyber-forensic for dealing the crime by predicting the criminals and detecting the criminals and also giving out the details of the criminals that are been recorded previously in the database. Identifying criminal out of a large crowd or predicting the criminal would be easy and less time is consumed, While the investigation is going on, It becomes handy for the investigation process for facial recognition of criminal and identification of his/her details.

FUTURE SCOPE:

As future work Classification of any person requires effort, but more care and seriousness is needed to classify a criminal or a suspect. The shortcoming of this work can be in its some imperfection, because any wrong classification can have serious effects. It will be very biased and too optimistic for us to say that 99 percent accuracy that has been achieved by CNN is cent percent acceptable. This is because of various reasons like, small size of data-set, all images taken are may not be taken in the same conditions, which can raise questions in this classification. Majorly facial Images are classified using facial emotions and age, so first neutral images and elderly, children images were eliminated. We tried to remove this bias by using haarcascade by cropping the facial part out of the images, but also shown they have less impact on results .So if we create a greater data-set, by taking in account the various factors mentioned above and detecting other personality traits/features can be our future scope of study.

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