"GOD's EYE- EYEWITNESS RENDERED FACIAL DEPICTION AND RECOGNITION"

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ABSTRACT

In this modern age, the overall crime rate is in- creasing day-by-day and to cope up with this the law enforcement departments too should find ways that would speed up the overall process and help them in bringing one to justice. One such way can be using face recognition technology for identifying and verifying the criminal.

The traditional approach here is to use the hand-drawn face sketches drawn by forensic sketch artist to identify the criminal, modernizing this would mean using the hand-drawn sketch and then matching them with the law enforcement departments database to identify the criminal. Using this approach would result in the various limitations with latest technologies and even would be time consuming as there are very few forensic sketch artists available when compared to the increasing crime ratio.

Our project is aimed on decreasing the time span and speeding up this process by providing a standalone platform to the law enforcement department which would allow users to create accurate face sketch of the suspect without the help of forensic sketch artist and no special training or artistic skills. The sketch can be created using drag and drop feature in the application with variety of face elements and can automatically match the drawn composite face sketch with the law enforcement department's database much faster and efficiently using deep learning and cloud infrastructure.

Keywords: *Forensic Face Sketch, Face Sketch Construction, Face Recognition, Criminal Identification, Deep Learning, Machine Locking, Two Step Verification*

1.1 INTRODUCTION

A criminal can be easily identified and brought to justice using a face sketch drawn based on the description been provided by the eyewitness, however in this world of modernization the traditional way of hand drawing a sketch is not found to be that effective and time saving when used for matching and identifying from the already available database or real-time databases.

During the past there were several techniques been proposed to convert hand-drawn face sketches and use them to automatically identify and recognize the suspect from the police database, but these techniques could not provide the desired precise results. Application to create a composite face sketch were even introduced which too had various limitations like limited facial features kit, cartoonist feel to the created suspect face which made it much harder to use these applications and get the desired results and efficiency.

The above applications and needs motivated us into thinking of creating an application which would not just provide a set of individual features like eyes, ears, mouth, etc. to be selected to create a face sketch but also would allow user to upload hand- drawn individual features on the platform which would then be converted into the applications component set. This in turn would make the created sketch much more like the hand-drawn sketch and would be much easier for the law enforcement departments to adapt the application.

Our application would even allow the law enforcement team to upload a previous hand-drawn sketch in order to use the platform to identify and recognize the suspect using the much more efficient deep learning algorithm and cloud infrastructure provided by the application.

The machine learning algorithm would learn from the sketches and the database to suggest the user all the relatable facial features that could be used with a single selected feature in order the decrease the time frame and increase the efficiency of the platform.

1.2 Overview

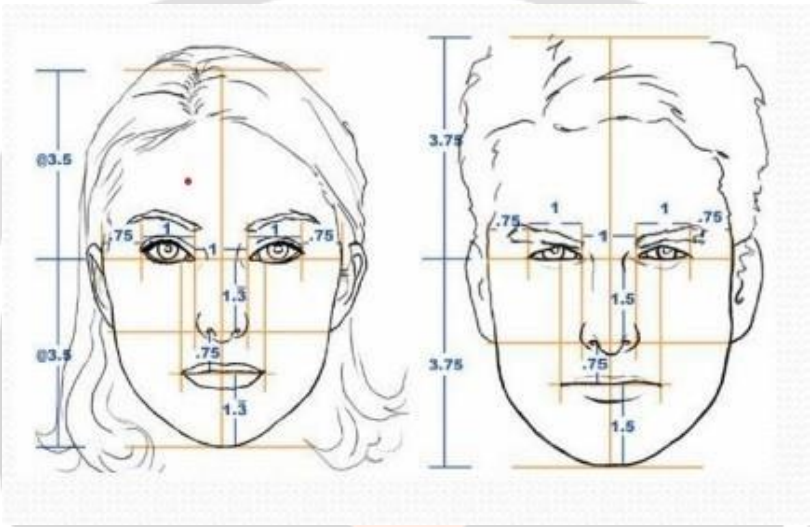

Fig 1: Facial features

This is a standalone application, allowing user to construct accurate composite face sketch using the predefined facial feature sets provided as tools that can be resized and repositioned as per requirement/described by the eyewitness.

Moreover, the constructed composite face sketch can then be matched with the law enforcement departments database using deep learning and the speed and efficiency of cloud infrastructure to identify and verify the criminal. The same process can even be done with the hand-drawn sketch making the application backward compatible with traditional approaches.

1.2 Problem Statement

In this modern age, the overall crime rate is increasing day-by-day and to cope up with this the law enforcement departments too should find ways that would speed up the overall process and help them in bringing one to justice. One such way can be using face recognition technology for identifying and verifying the criminal.

The traditional approach here is to use the hand-drawn face sketches drawn by forensic sketch artist to identify the criminal, modernizing this would mean using the hand-drawn sketch and then matching them with the law enforcement departments database to identify the criminal. Using this approach would result in the various limitations with latest technologies and even would be time consuming as there are very few forensic sketch artists available when compared to the increasing crime ratio.

Thus, there is a need for creating an application which would not just provide a set of individual features like eyes, ears, mouth, etc. to be selected to create a face sketch that would help in finding the criminal much faster and efficiently.

1.3 Motivation

The motivation behind undertaking the project "Eyewitness- Rendered Facial Depiction and Recognition" is rooted in the critical intersection of artistry, technology, and the pursuit of justice. In forensic investigations, the ability to construct accurate facial sketches plays a pivotal role in aiding law enforcement in identifying and apprehending individuals involved in criminal activities. Traditional methods often rely on witness descriptions, which can be subjective and prone to inaccuracies.

1.4 Aim

The primary aim of the "Eyewitness-Rendered Facial Depiction and Recognition" project is to develop an integrated system that combines artistic facial sketch construction with advanced recognition algorithms. This system aims to enhance the accuracy and efficiency of forensic investigations, pro- viding law enforcement agencies with a powerful tool for identifying and apprehending individuals involved in criminal activities.

1.5 Goals

1.5.1 Achieve High Accuracy:

Aim for a facial recognition accuracy rate that surpasses current industry standards, reducing false positives and negatives in identification.

1.5.2User-Friendly Interface:

Design an interface that is intuitive, user-friendly, and accessible to both artistic professionals and law enforcement personnel with varying levels of technical expertise.

1.5.3 Real-world Applicability:

Ensure that the developed system is applicable in real-world forensic scenarios, contributing to the successful resolution of criminal cases.

1.6.4 Contribution to Forensic Science:

Make a significant contribution to the field of forensic science by providing law enforcement agencies with an advanced and reliable tool for facial identification.

2. RECENT WORK

2.1 Forensic Art with Image Recognition and Brain Computing Interface

Author: J. Suganthi; S. Sivaranjani; M. Hariharan

Date of Publishing: April - 2023

This project uses software to generate forensic facial art by obtaining information directly from the human brain via a BCI headband. We can quickly cut the time necessary to design the victim's face by automatically picking the pre drawn structure.

The above suggested approach will not only sketch the victim's face, but it will also search the criminal database at random to see if the victim's face has previously been recorded. First, we use the Brain Computing Interface Band to get the EEG signal from the witness's brain. The EEG data is then processed in bit Brain to categorize it into each instruction, and the classified signal is then moved to the next phase to choose the face portion. This study includes the previously collected pre-drawn facial components and categorized the images by this point. The CNN algorithm is significantly more accurate in classifying the images, and the classified images are saved with the trail in BCI computing to select the image in an accurate way.

A categorized image data collection is used to generate the processed EEG signal. to discover the face region that is equivalent to an EEG signal. Drawing software was used to choose the selected face portion, which was then placed at the fundamental facial structure. When the painting is 40% complete, the face structure is compared to an existing criminal database to check whether the facial structure matches any previous crimes. This initiative aids in the identification of criminals and the creation of forensic art in considerably less time than the traditional method.

2.2 Deep Learning based Forensic Face Sketch Recognition

Author: R. Naga Sravana Jyothi; G. Bhargavi; M. Gowthami; B. Dhana Lakshmi; V. Tejaswi

Date of Publishing: March - 2022

The necessity towards technology that can distinguish, discover and recognize culprits is skyrocketing nowadays. For crime investigations and forensics experts in Machine Vision, analyzing and interpreting how individuals recognize face portraits created by forensics illustrators is critical. In government validation and surveillance, connecting the drawing to the photographs is critical since it has been used to monitor culprits or perpetrators. Suspects have been known to wear customized masks to conceal common facial traits such as the nose, eyes, lips, and color. However, the bottom - level aspects of facial biometrics cannot be eliminated. For this, it was focused on a few human face geometry elements that may be utilized to determine correspondent rates between the prototype

Photographic databases and the analytical artworks. The construction of a system for forensic facial drawing authentication using deep learning algorithms is described in this work.

2.3 Identification of Criminal and Non-Criminal Face Using Deep Learning and Image Processing
Author: Raj Kumar R; Shyam Sundar A; Ruban Haris B; Ragul K; Cloudin S.
Date of Publishing: July - 2021

This paper executes a criminal face affirmation using deep learning Algorithm. The data is used to get ready and test using Image Processing count. The longing of this paper is to execute using a pre-trained significant learning network called Convolution neural association. In this paper, we address a methodology for face acknowledgment using Dense net pre-trained of which is definite and less incidents count for picture face area. Now we use Densenet for classifiers faces. The accuracy of the face affirmation is high. The proposed structure can adequately see more than one face which is useful for quickly glancing through assumed individuals as the figuring time is low. In India, we have a system for seeing occupant called Aadhaar. Our technique works in future to perceive this as a citizenship data base we can isolate among resident and outsider and further inspect if the recognized individual is criminal.

3. ALGORITHM

3.1 Convolutional Neural Networks (CNNs):

Convolutional Layers

CNNs are composed of convolutional layers that apply filters to input images, capturing hierarchical features at different scales. This allows the network to learn spatial hierarchies of features.

Pooling Layers

These layers down sample the spatial dimensions, reducing computational complexity while preserving important features.

Fully Connected Layers:

These layers combine the high-level features learned by convolutional and pooling layers to make final predictions.

3.2 Architecture:

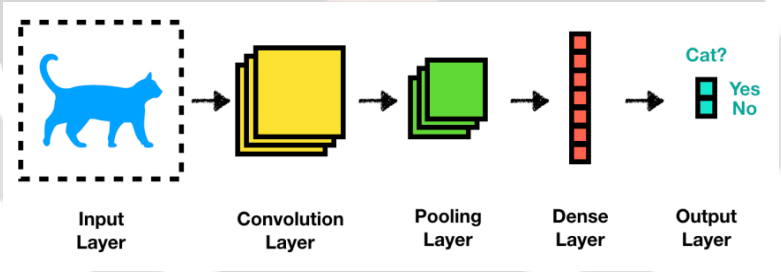

Fig 2: CNN Architecture

4. RESULT AND IMPLEMENTATION

4.1 Project Part - 1: Face Sketch Construction Module

As mentioned earlier, security and accuracy are the key features been focused while developing our platform for the law enforcement department. So, this module of the project mainly focuses on creating a face sketch based on the description been provided by the Eyewitness to the Law enforcement department.

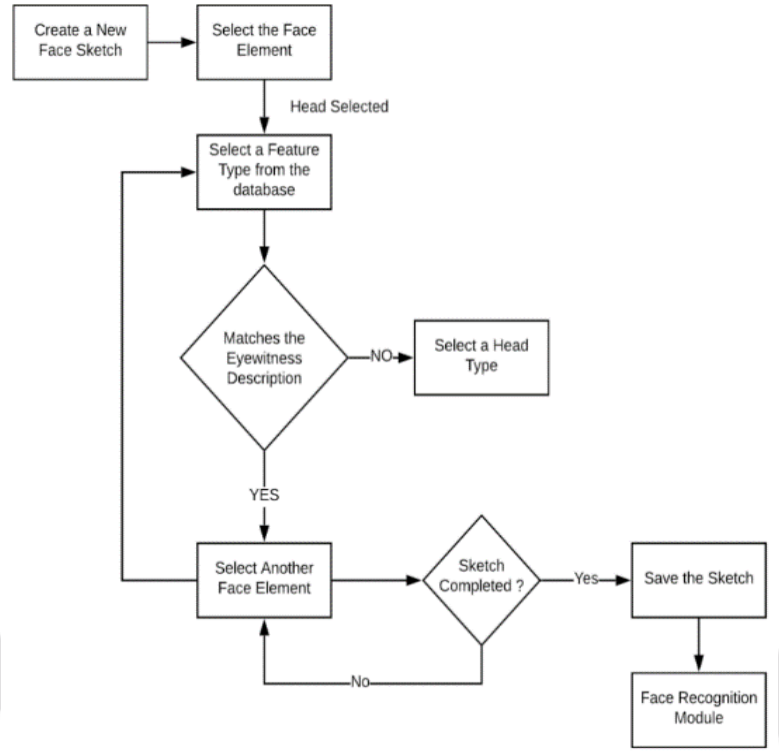

Fig 3: Flow chart creating a sketch in the application

The above flowchart illustrates the users flow been followed by the platform to provide a construct accurate face sketch based on the description, the dashboard is designed simple in order to encourage no professional training to go through before using this platform already saving the timeframe which would have been taken a lot time and resources of the Department

Fig 4: Splash image

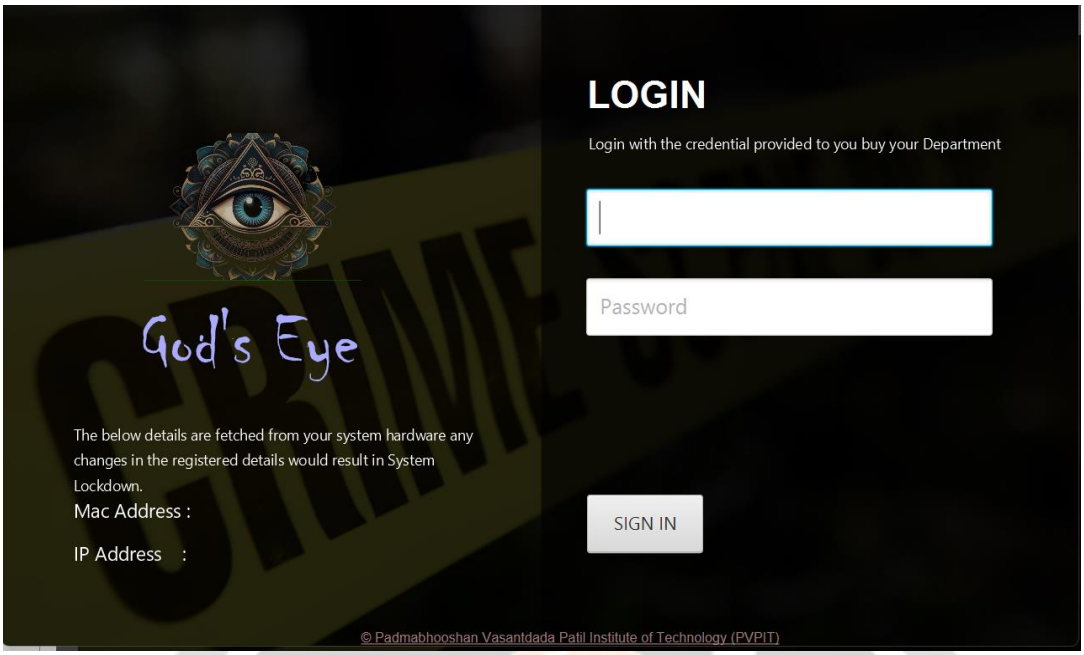

Fig 5: Login Image

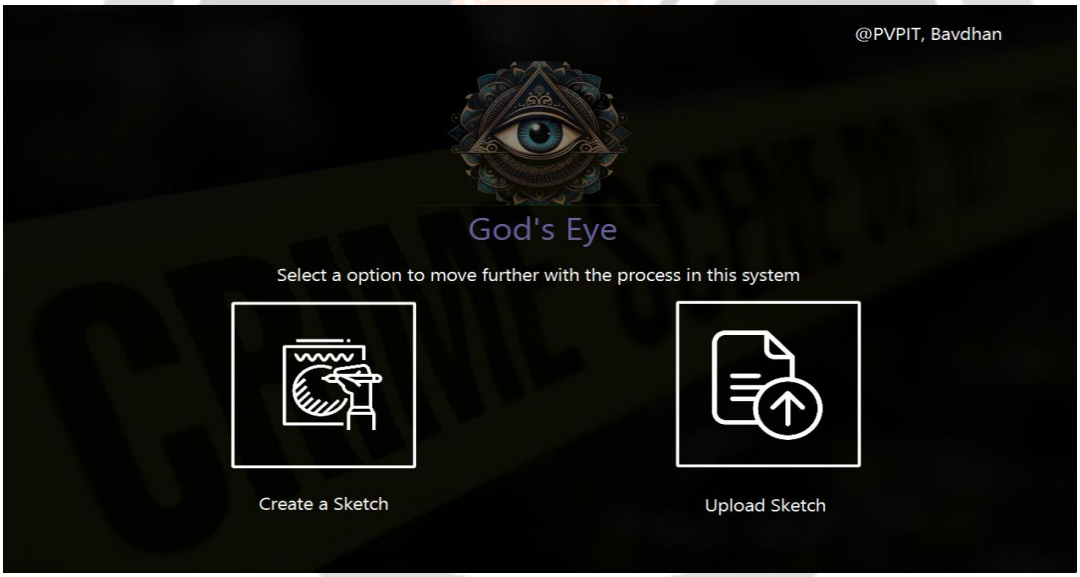

Fig 6: Menu Screen Image

4.2 Project Part 2: Face Sketch Recognition Module

As mentioned earlier, security and accuracy are the key features been focused while developing our platform for the law enforcement department. So, this module of the project mainly focuses on recognizing a face sketch in the Law enforcement department face photo records with accuracy and confidence.

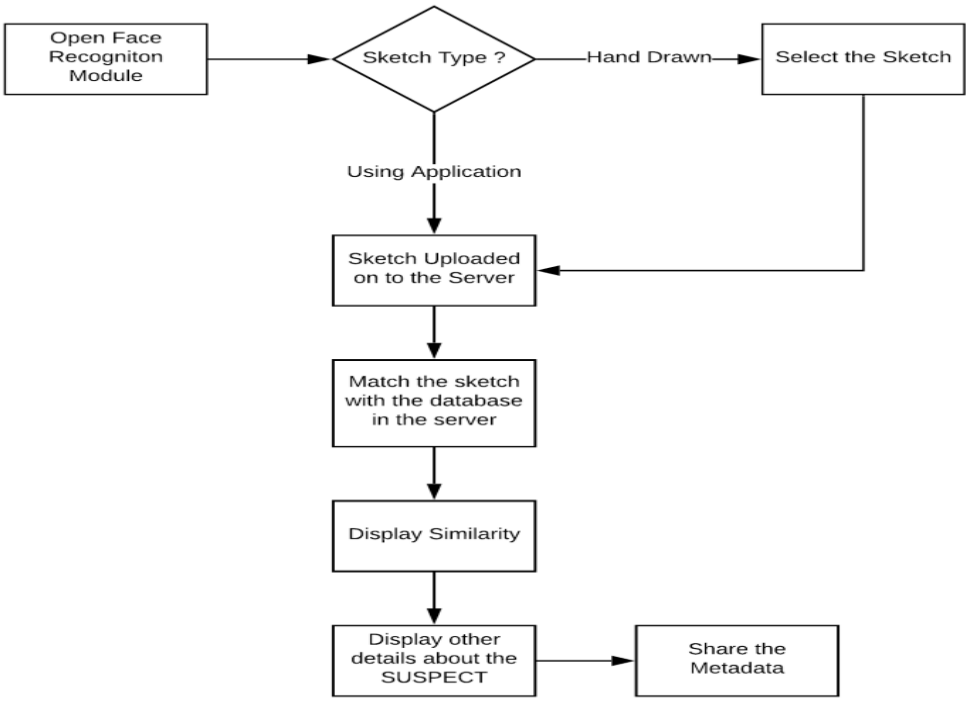

Fig 7: Flow Chart for recognizing a sketch in the application

The above flowchart illustrates the users flow been followed by the platform to provide an recognize accurate face sketch based on the description, the dashboard is designed simple in order to encourage no professional training to go through before using this platform already saving the timeframe which would have been taken a lot time and resources of the Department.

Keeping it simple thus ensures that the user doesn't have to be a professional sketch artist from the forensic department rather any one from the law enforcement department using the descriptions narrated by the eye witness or in some cases the eye witness too can take control of the platform but that would not be recommended as it can tamper the security protocols**.**

Fig 8: Prediction Images 2

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5. CONCLUSION

The Project 'Eyewitness-Rendered Facial Depiction and Recognition' has been designed, developed and finally tested keeping the real-world scenarios from the very first splash screen to the final screen to fetch data from the records keeping security, privacy and accuracy as the key factor in every scenario.

The platform displayed a tremendous result on Security point of view by blocking the platform use if the MAC Address and IP Address on load didn't match the credentials associated with the user in the database and later the OTP system proved its ability to restrict the use of previously generated OTP and even generating the new OTP every time the OTP page is reloaded or the user tries to re login the platform.

The platform even showed good accuracy and speed while face sketch construction and recognition process, provided an average accuracy of more than 90% with a confidence level of 100% when tested with various test cases, test scenario and data sets, which means a very good rate according to related studies on this field.

The platform even has features which are different and unique too when compared to related studies on this field, enhancing the overall security and accuracy by standing out among all the related studies and proposed systems in this field.

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