

# **DAYANANDA SAGAR UNIVERSITY**

**KUDLU GATE, BANGALORE – 560068**



**Bachelor of Technology  
in  
COMPUTER SCIENCE AND ENGINEERING**

## **Major Project Phase-II Report**

### **FORENSIC FACE SKETCH CONSTRUCTION AND RECOGNITION**

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**DAYANANDA SAGAR UNIVERSITY,**

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**(2021-2022)**



**DAYANANDA SAGAR UNIVERSITY**

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## **CERTIFICATE**

This is to certify that the Phase-II project work titled **“FORENSIC FACE SKETCH CONSTRUCTION AND RECOGNITION”** is carried out by **K. VISWESWARA REDDY (ENG18CS0125), PATTABHIRAM N (ENG18CS0204), SUHAS V (ENG18CS0289)**, a bonafide students of Bachelor of Technology in Computer Science and Engineering at the School of Engineering, Dayananda Sagar University, Bangalore in partial fulfillment for the award of degree in Bachelor of Technology in Computer Science and Engineering, during the year **2021-2022**.

<b>Prof. Arjun Krishnamurthy</b>	<b>Dr Girisha G S</b>	<b>Dr. A Srinivas</b>
Assistant/Associate/ Professor Dept. of CS&E, School of Engineering Dayananda Sagar University	Chairman CSE School of Engineering Dayananda Sagar University	Dean School of Engineering Dayananda Sagar University
Date:	Date:	Date:

**Name of the Examiner**

**Signature of Examiner**

1.

2.

# DECLARATION

We, **K. Visweswara Reddy (ENG18CS0125), Pattabhiram N (ENG18CS0204), Suhas V (ENG18CS0289)**, are student's of seventh-semester B.Tech in **Computer Science and Engineering**, at the School of Engineering, **Dayananda Sagar University**, hereby declare that the phase-I project titled "**Forensic Face Sketch Construction and Recognition**" has been carried out by us and submitted in partial fulfillment for the award of degree in **Bachelor of Technology in Computer Science and Engineering** during the academic year **2021-2022**.

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*We would like to thank our Project Coordinator **Dr. Meenakshi Malhotra** and all the staff members of Computer Science and Engineering for their support. We are also grateful to our family and friends who provided us with every requirement throughout the course. We would like to thank one and all who directly or indirectly helped us in the Project work.*

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## LIST OF ABBREVIATIONS

OTP	One Time Password
AWS	Amazon Web Services
HFA	Heterogeneous Face Recognition
IP	Internet Protocol
MySQL	My Structured Query Language

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# ABSTRACT

In forensic science, it is seen that hand-drawn face sketches are still very limited and time consuming when it comes to using them with the latest technologies used for recognition and identification of criminals.

We present a standalone application which would allow users to create composite face sketch of the suspect without the help of forensic artists using drag and drop feature in the application and can automatically match the drawn composite face sketch with the police database much faster and efficiently using deep learning and cloud infrastructure.

Numerous methods that automatically identify subjects depicted in sketches as described by eyewitnesses have been implemented, but their performance often degrades when using real-world forensic sketches and extended galleries that mimic law enforcement mug-shot galleries.

Moreover, little work has been done to apply deep learning for face photo-sketch recognition despite its success in numerous application domains including traditional face recognition. This is primarily due to the limited number of sketch images available, which are insufficient to robustly train large networks.



# **CHAPTER 1**

## **INTRODUCTION**

# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 PURPOSE**

A criminal can be easily identified and brought to justice using a face sketch drawn based on the description been provided by the eye-witness, 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.

One of the toughest Heterogeneous Face Recognition (HFR) scenarios, involving the comparison of face images residing in different modalities, is face photo-sketch recognition.

Apart from the significant modality gap, algorithms must also contend with inaccuracies in sketch images arising from memory and communication deficiencies when an eyewitness provides the description of a suspect to a sketch artist.

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.

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 in to the applications component set.

### **1.2 INTENDED AUDIENCE**

Our application would even allow the law enforcement team to upload 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.

### **1.3 PRODUCT SCOPE**

To circumvent the single-sketch-per-subject problem, a 3D morphable model is employed to vary facial attributes and automatically synthesize a new large set of images.

## **CHAPTER 2**

# **PROBLEM DEFINITION**

## **CHAPTER 2**

### **PROBLEM DEFINITION**

#### **2.1 PURPOSE**

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.

## 2.2 SOLUTION

### A. SECURITY AND PRIVACY

**Machine Locking:** The Machine locking technique would ensure that the application once installed on a system could not be tampered and could not be operated on any other system, for which the application uses two locking parameters i.e. one software and one hardware locking parameter. HD ID – Volume serial of hard-drive with OS. NET ID – Hardware ID – MAC Address.

**Two Step Verification:** Every law enforcement authorized user would be given an official EMail ID which would use to login on to the application, thus using this step would require the user to enter a random code been shared with them on their mobile/desktop in order to complete the logging process.

**Centralized Usage:** The system which has the application been installed would be connected to a centralized server of the law enforcement department campus containing the database and the other important feature set of the application, thus the application could not be operated once disconnected from the server.

### B. BACKWARD COMPATIBILITY

The major drawback in adapting any new system is the complication been involved in completing migrating from the previous technique to the new technique, Hence resulting in the wastage of time resources. To overcome this issue, we have designed our application in such a way that even the hand-drawn sketches can be uploaded and the user can use the deep learning algorithms and cloud infrastructure to identify and recognize the criminal using the hand-drawn sketch.

## **C. FACE SKETCH CONSTRUCTION USING DRAG AND DROP**

Face Sketch Construction using Drag and Drop In this application, accurate composite face sketch can be constructed using the predefined facial feature sets provided as tools allowing to be resized and repositioned as per requirement/described by the eye-witness. Here, the human face is categorized into various facial features such as head, eyes, eyebrow, lips, nose, ears, etc. and some important wearable components such as hats, specs, etc. too are been available in the application for use. Every facial feature when selected would open a wide range of options to choose from based on the requirement/description of the eye-witness. The machine learning algorithm would learn and in future try to suggest all the facial features which could suit the single selected feature and would try to help in completing the composite face sketch much sooner and much efficiently.

# **CHAPTER 3**

## ***LITERATURE SURVEY***

## CHAPTER 3

### *LITERATURE SURVEY*

SL.NO	TITLE	AUTHOR	YEAR	DESCRIPTION
01	Bio-inspired Learning and Intelligent systems for security	Charlie Frowd, AnnaPetkovic, KamranNawaz YasmeenBashir	2009	Automating the Processes involved in facial composite production and the identification
02	Face Photo Sketch Recognition	W. Zhang Wang Tang	2011	Coupled information theoretic encoding
03	Face Sketch ID System	Klum	2014	They are Sensitive to variations on poses, expressions,etc.,



Sl.NO	TITLE	AUTHOR	YEAR	DESCRIPTION
04	Biometric Technology for human identification	B. Klare A. Jain	2010	It is a Sketch to the photo based approach which is used for the matching of a feature based approach
05	Face Photo Sketch Recognition	H. Han B. Klare K. Bonnen A. Jain	2013	Matching composite sketches to face photos it is a composite based approach

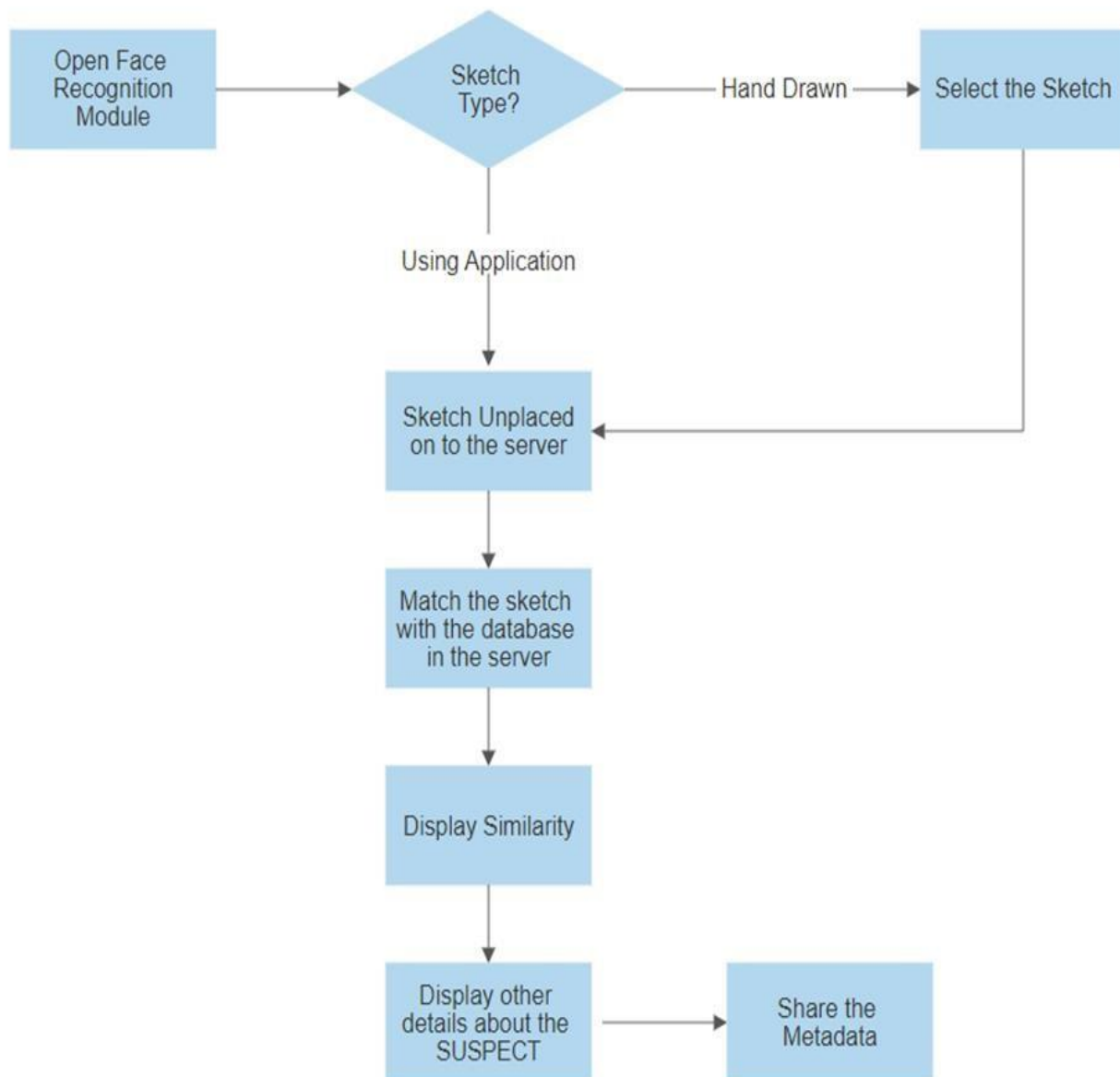
## **CHAPTER 4**

# **PROJECT DESCRIPTION**

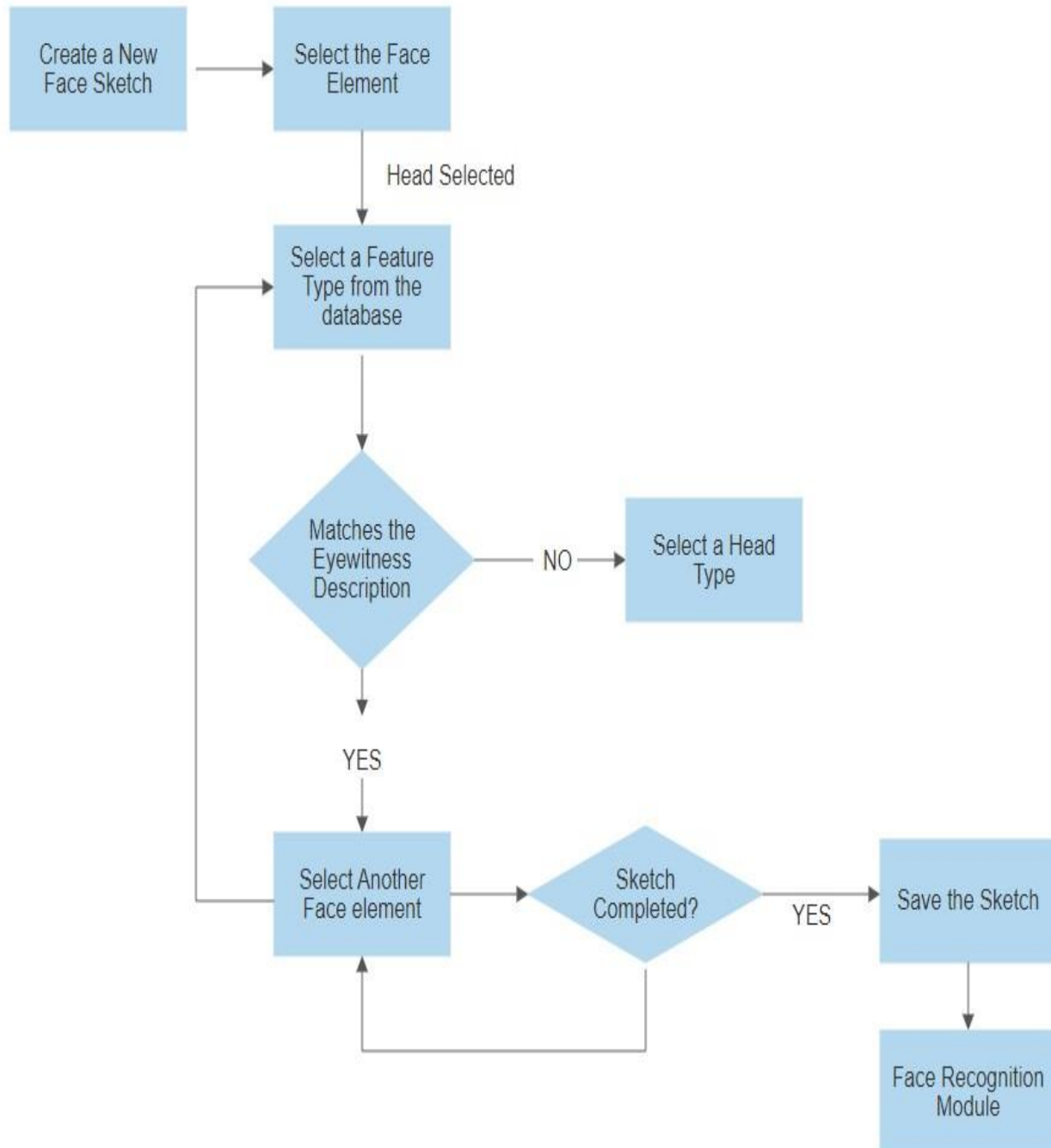
## CHAPTER 4

### PROJECT DESCRIPTION

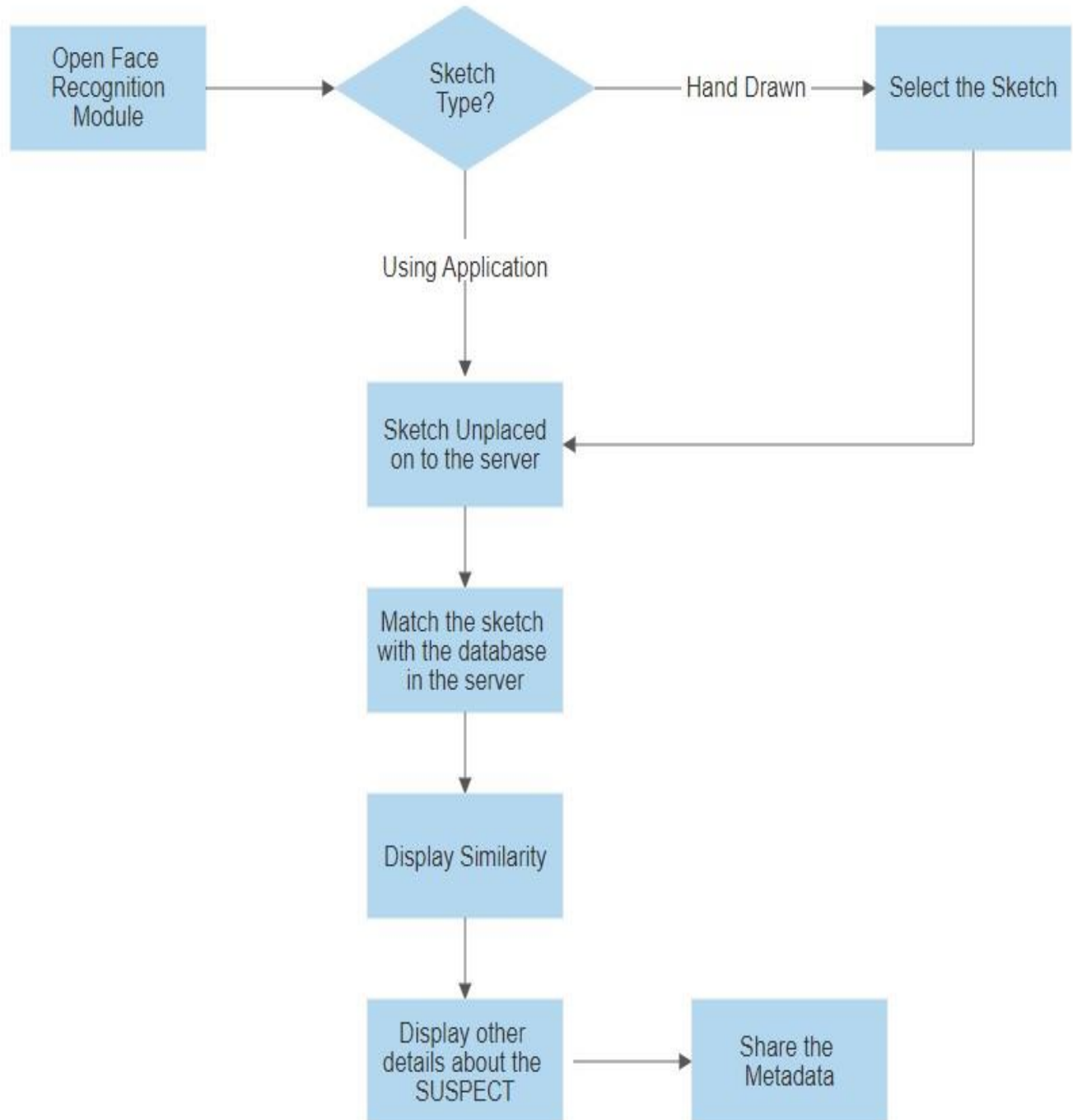
#### 4.1 PROPOSED DESIGN SYSTEM FLOW



## FACE SKETCH CONSTRUCTION



## FACE SKETCH RECOGNITION



## 4.2 ASSUMPTIONS

- We assume that the witness recognizes the suspects face properly and suggests the police to construct the face shape properly, so that the face ID matches in the police database.
- We assumed deep learning algorithm in order to solve the given problem from the case.

## **CHAPTER 5**

## **REQUIREMENT**

## **CHAPTER 5**

### **REQUIREMENT**

#### **5.1 FUNCTIONAL REQUIREMENT**

Sketching Platform for witness to choose features to build the prototype. Database of Previously convicted felons / suspects accessed through cloud. Comparison and Matching constructed Images to prestored data.

- Using Drag & Drop Features for Constructing the Sketches.
- Two Step Verification
- AWS (AMAZON WEB SERVICES)
- CENTRALIZED COMPUTING
- DEEP LEARNING FOR FACE RECOGNITION

#### **5.2 NON-FUNCTIONAL REQUIREMENT**

Enhances the chances of Police discovery of criminals beyond the Database of Previously convicted felons/ suspects accessed through cloud.

Improves sketching ability of the computer artist involved in communication with the witness.



## **CHAPTER 6**

# **METHODOLOGY**

## **CHAPTER 6**

### **METHODOLOGY**

In this Project we have used MySQL as our database where we can be able to store the data or the data points that are required to draw the sketch. In this project we are using JAVA JDK8 as our frame work which can be used in the front end part and we will collect various types of face recognizing elements like eyebrow samples, nose samples, etc.,

we will be able to access the criminal database where it will store in the amazon webservices which is our cloud storage and by using the drag and drop feature we will be able to draw the sketch of the suspect and we will upload the sketch into the amazon web services as it is our cloud storage platform then we will be matching the sketches available in the criminal database.

Then it will be matching the sketches available in the database and it shows the similarity in the Percentage. Therefore the sketching will be more easy and in the perfect manner. Here we are using SQL Lite as our database.

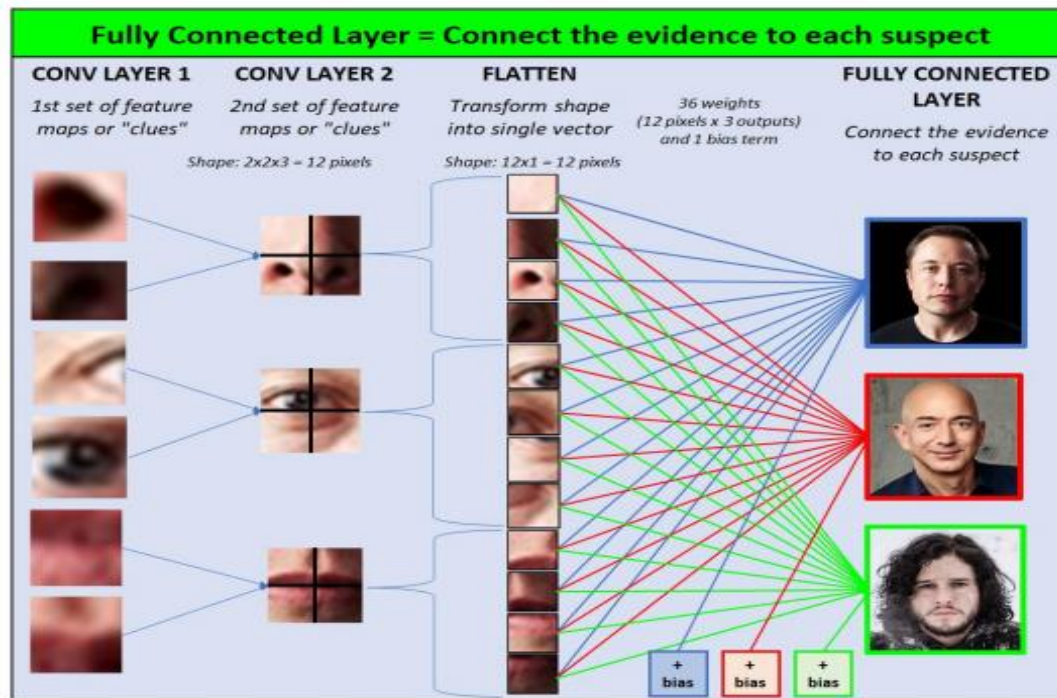
The Face Sketch which was drawn if it is already in the criminal database then the face sketch will be matched if it is not in the database then it will be stored in the database. This is how the project works.

## **CHAPTER 7**

# **EXPERIMENTATION**

## CHAPTER 7

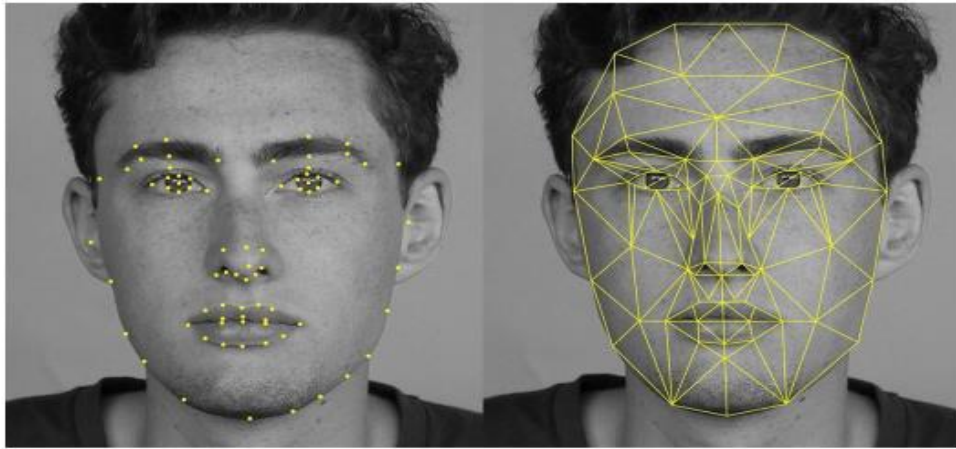
### EXPERIMENTATION



**Feature extraction by the Platform**

The above image demonstrates the first part before using the platform to recognize faces is making the existing records in with the law enforcement department suitable for our platform by training and making the platforms algorithm recognize and assign IDs to the face photo to the user in the existing records in with the law enforcement department. For this the platforms algorithms gets connected to the records and breaks each face photo in to various smaller feature and assign an ID to the multiple features generated for a single face photo.

Once the sketch is uploaded on to the server the algorithm first traces the sketch image in order to learn the features in the sketch and map the features as shown in the below figure in order to match those with the features of the face photos in the records.



Face Sketch been mapped on the Platform

## Drag & Drop Features



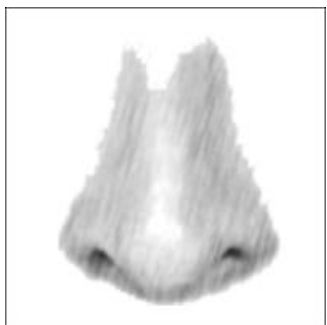
Face Feature – Head



Face Feature – Eyes



Face Feature – Lips



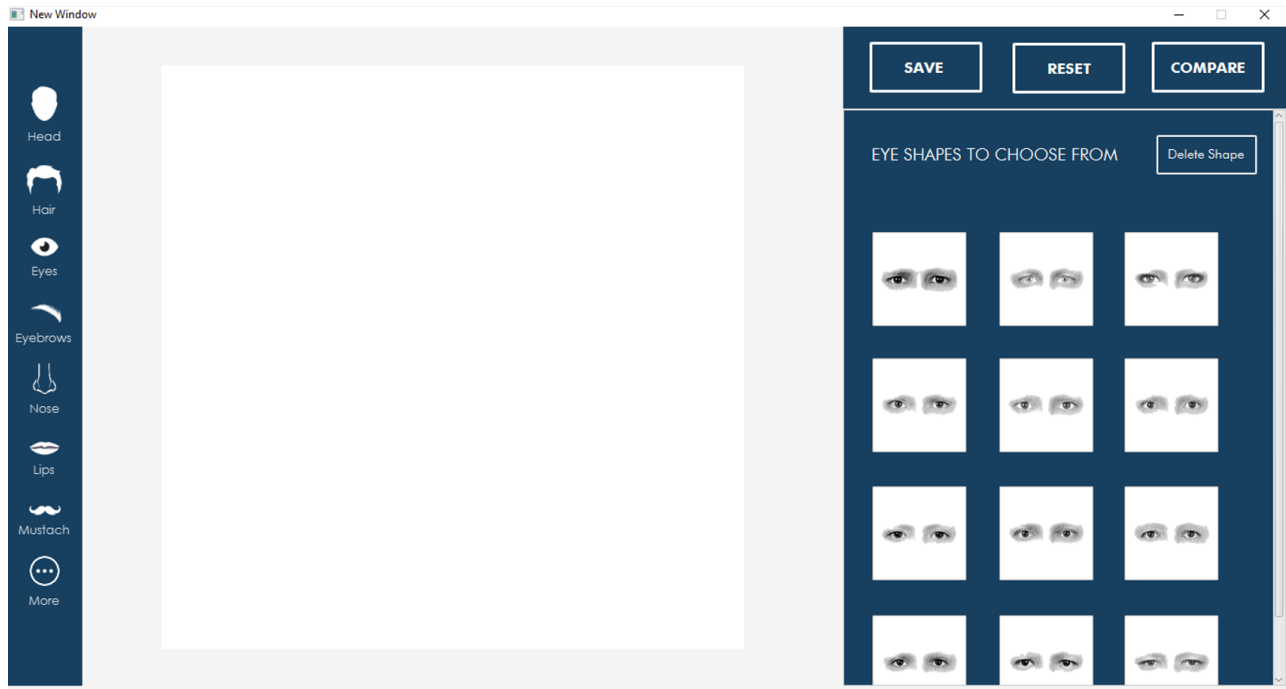
Face Feature – Nose



Face Feature – Ear

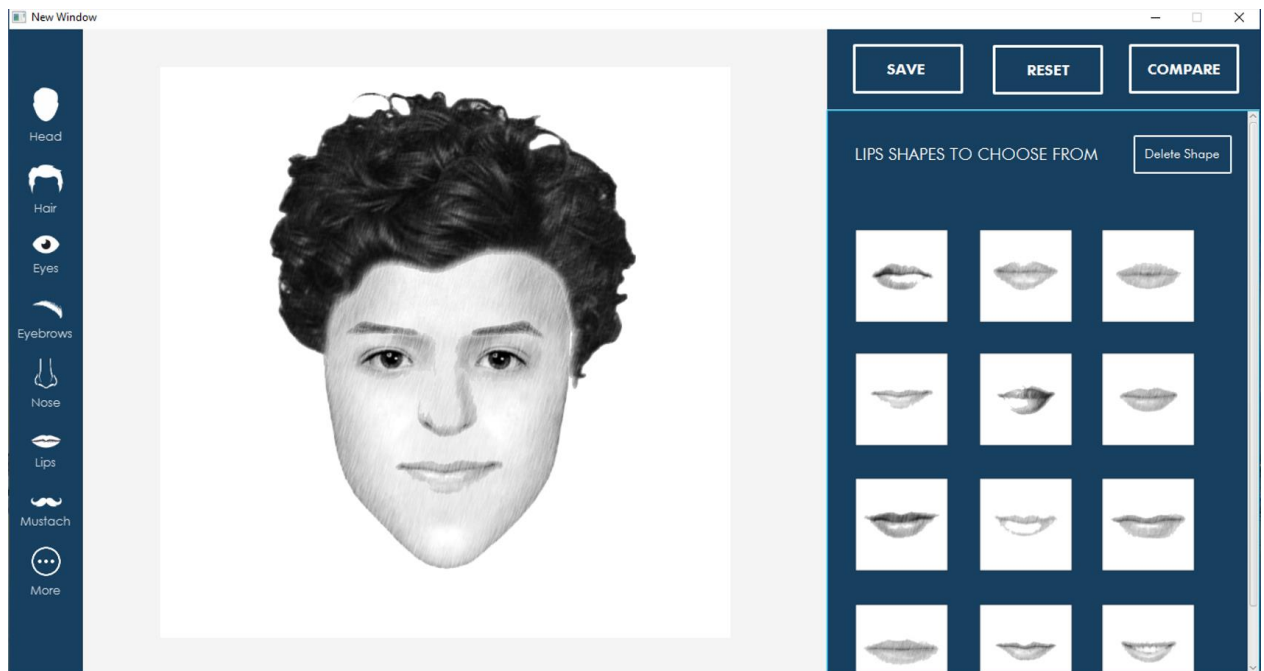


Face Feature – Hair



**Dashboard to Create a Facial Sketch**

**CONSTRUCTED SKETCH:**



**A Complete Face Sketch in Dashboard**

## **CHAPTER 8**

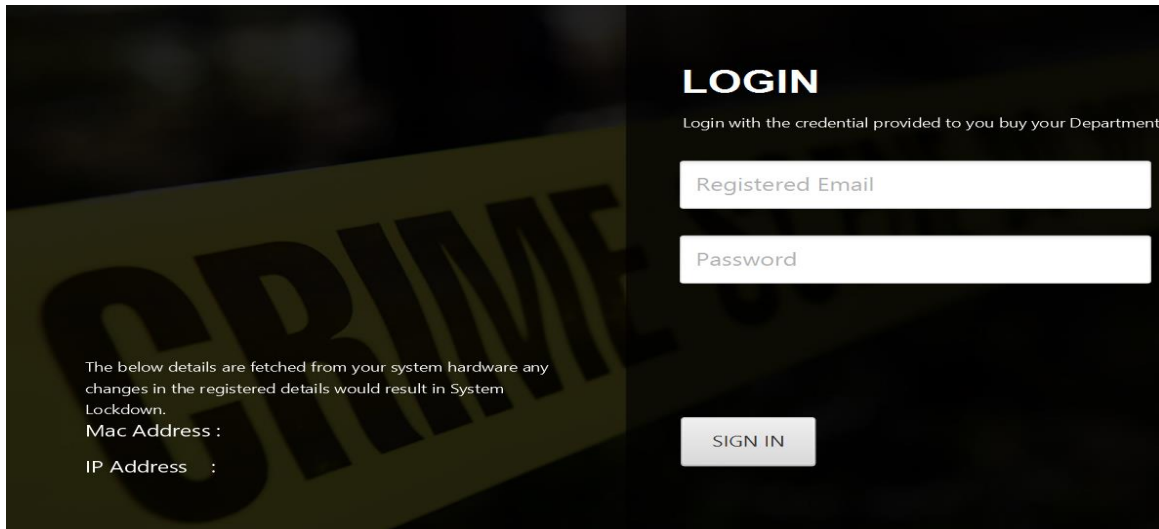
# **TESTING AND RESULTS**

## CHAPTER 8

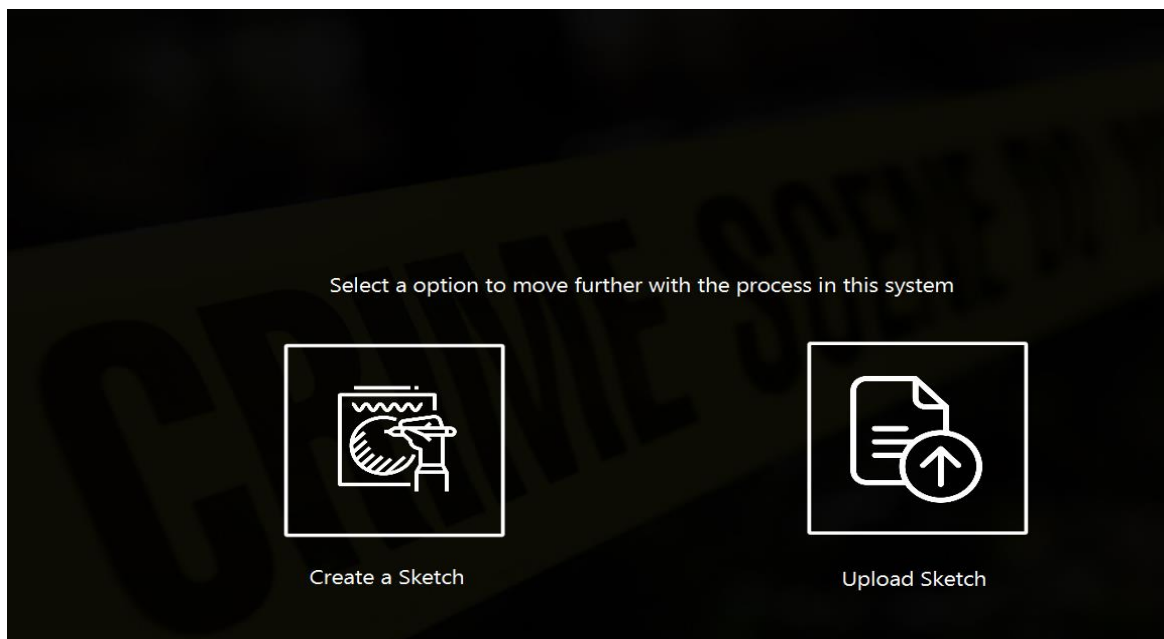
### TESTING AND RESULTS

#### Screenshots:

##### 1. Login Screen of our Standalone Desktop Application

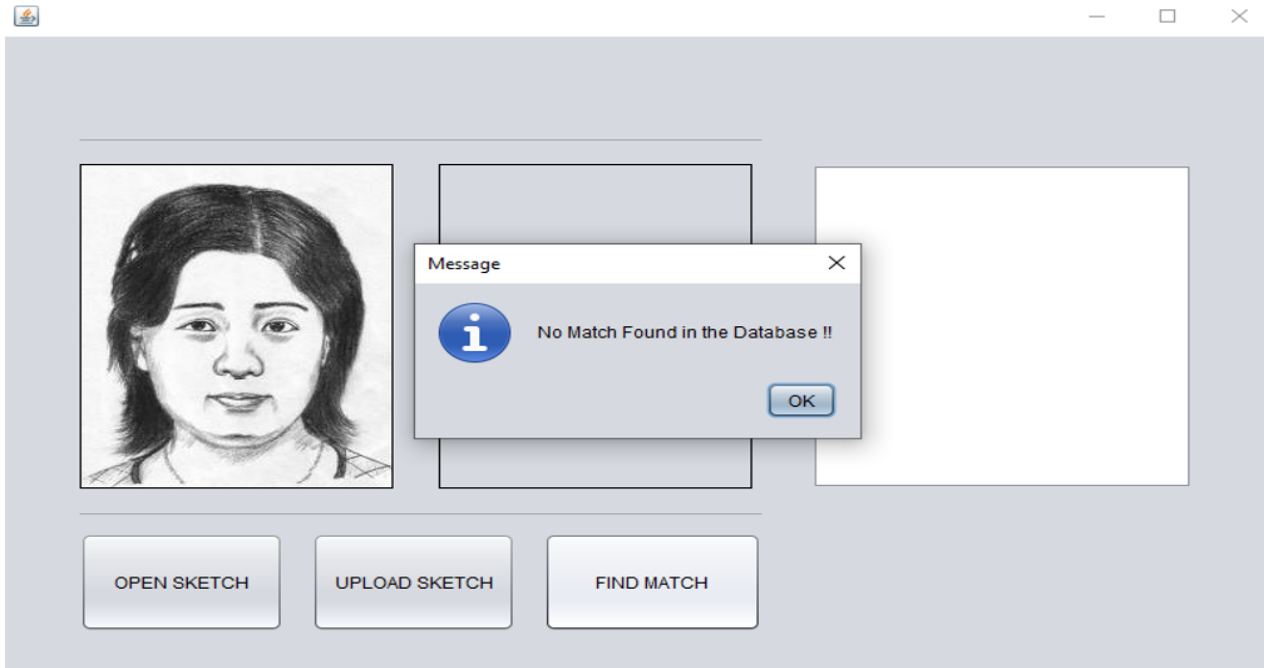


##### 2. Option Selection Screen

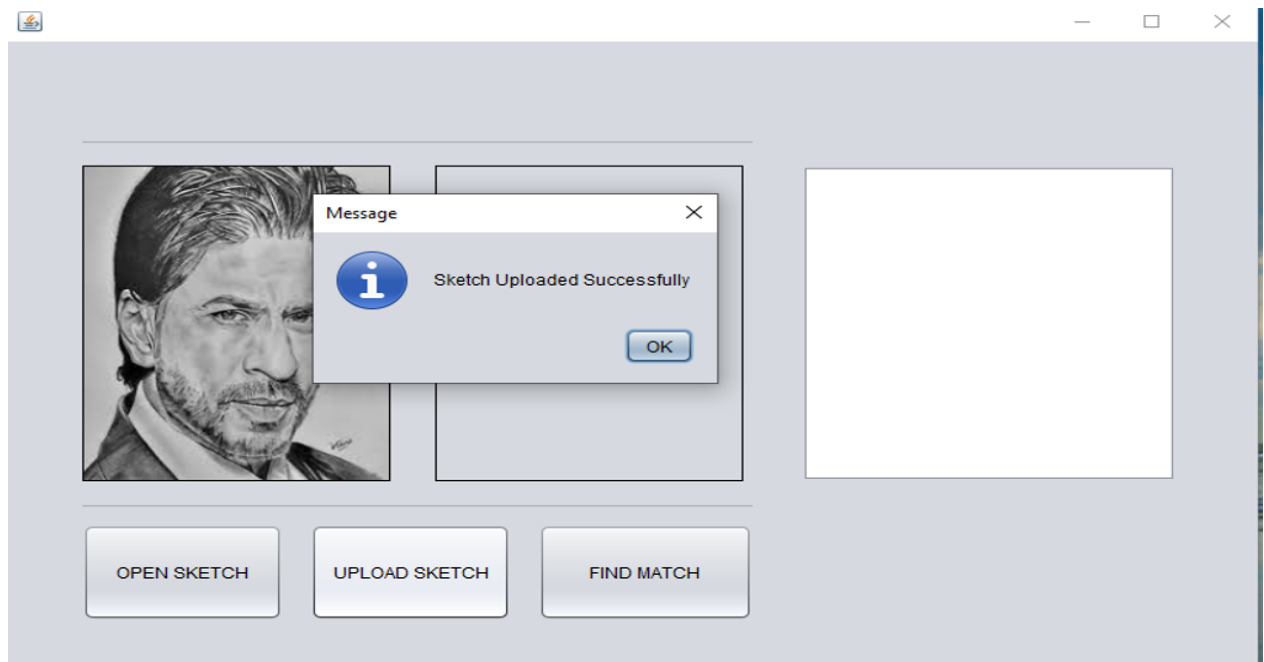





### 3.Face Sketch not matched to Database Record



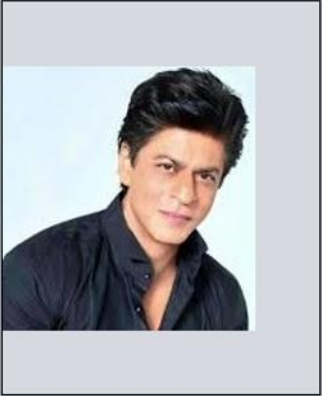

### 4.Face Sketch uploaded to the Server



## 5.Face Sketch matched to Database Record

 — □ ×

**SIMILARITY : 95.97757**



\*\*\*\*\*  
FACE MATCHED  
\*\*\*\*\*

Name in database: a-sharukh.jpg

Similarity: 95.97757

Confidence: 99.9999

OPEN SKETCH

UPLOAD SKETCH

FIND MATCH

## **CHAPTER 9**

## **CONCLUSION**

## **CHAPTER 9**

### **CONCLUSION**

The Project 'Forensic Face Sketch Construction and Recognition' is 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 relog in 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.

## **CHAPTER 10**

### **FUTURE SCOPE**

## **CHAPTER 10**

### **FUTURE SCOPE**

The Project ‘Forensic Face Sketch Construction and Recognition’ is currently designed to work on very few scenarios like on face sketches and matching those sketches with the face photos in the law enforcement records.

The platform can be much enhanced in the future to work with various technologies and scenarios enabling it to explore various media and surveillances medium and get a much wider spread and outputs, The platform can be modified to match the Face sketch with the human faces from the video feeds by using the 3D mapping and imaging techniques and same can be implemented to the CCTV surveillances to perform face recognition on the Live CCTV footage using the Face Sketch.

The platform can further be connected to social media has social media platforms acts has a rich source for data in today’s world, this technique of connecting this platform with the social media platform would enhance the ability of the platform to find a much more accurate match for the face sketch and making the process much more accurate and speeding up the process.

In all the platform could have features which could be different and unique too and easy to upgrade, 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.

## REFERENCES

Bin Sheng, Ping Li, Chenhao Gao, Kwan-Liu Ma, "Deep Neural Representation Guided Face Sketch

Synthesis", IEEE Trans. Vis. Comput. Graph., vol. 25, no. 12, pp. 3216-3230, Dec.2019

N. Wang, X. Gao, and J. Li, "Random sampling for fast face sketch synthesis," Pattern Recognit., vol. 76, pp. 215–227, 2018.

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N. Wang, X. Gao, and J. Li, "Random sampling for fast face sketch synthesis," Pattern Recognit., vol. 76, pp. 215–227, 2018.

