Software Requirements Specification

for

Criminal Record Search by Sketch-photo synthesis

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**Revision History**

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Date** | **Reason For Changes** | **Version** |
|  |  |  |  |
|  |  |  |  |

# Introduction

## Purpose

The purpose of criminal record search by sketch-photo synthesis is to aid law enforcement in automatic retrieval of photos and details of potential suspects. The main objective of the system is to generate realistic images of suspects despite the inaccuracies in hand-drawn sketches and provide precise matching of these images in the mug shot database.

## Scope

The scope of this product is to assist law enforcement agencies in the process of identification of suspects by sketch-photo synthesis which speeds up the criminal investigation. This results in improvement in the criminal record search and makes it possible for large number of cases to be solved in a short amount of time. This can be used by the Police for various types of cases. Our mini-project includes a few of those cases.

## Definitions, Acronyms and Abbreviations

|  |  |
| --- | --- |
| **Term** | **Definition** |
| Mug shot | An identifying portrait style photo shot of a person that law enforcement takes once a criminal has been caught and booked. |
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| **Acronym** | **Expansion** |
| GANs | Generative adversarial networks |
| RDBMS | Relational Database Management System |
| NoSQL | Not only SQL(Structured Query Language) |
| GUI | Graphical User Interface |
| FBI | Federal Bureau of Investigation |
| CBI | Central Bureau of Investigation |

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## References

//add later

## Overview

In criminal investigations, photos of suspects are usually hard to acquire and it is known that commercial software or experienced artists are sought to generate sketches of a suspect based on the description of eyewitness. Since human observation of specific facial features is often indistinct, the exact replica of the criminal remains elusive. This often leads to mismatch and eventually delay in verdict. If somehow, the portraits drawn can be transformed into realistic images then there is an increased chance of precise matching with mug shots. Thus, sketch to photo synthesis becomes important to speed up the process of investigation.

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The rest of this SRS document is organized as follows:

Section 2 gives an overall description of the product, it’s functions, dependencies and some general constraints on the system.

Section 3 provides specific requirements which includes functional and non-functional requirements.

# Overall Description

## Product Perspective

* Our product is a way to improve the already existing manual comparison of the sketch and the criminal records
* It is a way of automating this process and making it faster as compared to original method.
* This also encourages saving the criminal records in a database than in papers.

## Product Functions

* Hand-drawn sketches of suspects are transformed into real photos when fed into a well-trained GANs model.
* The photos obtained are then run against the mugshot database to retrieve the identity of the suspect if it exists. The process involves face to face matching using FaceNet.
* More details about the identified suspect is obtained from criminal record database.
* A final criminal report is returned which contains personal details and past crime records of the suspect.

## User Classes and Characteristics

1. Law enforcement/government agencies like FBI, CBI

Activities include gathering and analyzing information to determine that a law has been violated and identifying person or persons responsible for the same.

1. Maintainers

Database maintainers are continuously involved in updating the mugshot and criminal record database.

## General Constraints

* The age gap between the current photo made and the photo in criminal records is more.
* Twin Criminals exist under the same criminal records.
* Wrong explanation by eye suspect about the features of the face.
* Plastic surgery done by the criminal as compared to when the photo in criminal records were taken.

## Assumptions and Dependencies

The system assumes to identify criminals involved in drug offense, robbery , traffic violation and violence against other cases only. However, it can be extended to include crime records of other types.

It also assumes that the sketch obtained is correct and to the best knowledge of the eye suspect. This also results in a dependency on the accuracy of the sketch with respect to the real person.

# External Interface Requirements

## User Interfaces

* A stand-alone application developed using python-tkinter to provide a highly interactive GUI
* Back-end: MySQL Workbench, MongoDB to update criminal records.

## Software Interfaces

|  |  |
| --- | --- |
| Software | Description |
| Operating System | Ubuntu 18.04 and above |
| Database | Oracle MySQL server-To store details of criminals and their past crime records  MongoDB version 1.18.0-To store photos of criminals (mug shot) |
| python | To train GANs model |
| CUDA | An API which provides direct access to the GPU's virtual instruction set and parallel computational elements. |

## Hardware Interfaces

* Processor with 2GHz frequency and above
* A minimum of 4GB RAM
* Monitor resolution 1024 x 768 or higher
* A minimum of 20 GB of available space on hard disk
* GPU-NVIDIA GeForce 940MX

## Communications Interfaces

* The sketch of the suspect should be scanned properly and saved in a folder on the hard disk.
* All the libraries used should be installed in the GPU available for the neural network to work faster and efficiently using CUDA
* Different python libraries are used to interface between frontend and backend.

# Functional Requirements

* 1. **Sketch-Photo Synthesis**

**Input :**Hand-drawn sketches of suspect based on description of eyewitness is fed

**Output:** Realistic photos

* 1. **Face-to-face Matching**

**Input:** Photos obtained from previous step

**Output:** Criminal ID of matched photo (if exists).

* 1. **Retrieving personal details**

**Input:** Criminal ID

**Output:** Personal details of criminal

* 1. **Retrieving past criminal records**

**Input:** Criminal ID

**Output:** Records of committed crimes

A final report containing complete details of the suspect and his/her past crime records is produced which helps in the investigation process and tracking down of the suspect with ease..

# Non-functional Requirements

## Performance Requirements

* Generative Adversarial Network model developed must provide minimum accuracy of 70%
* Face verification and recognition must be efficient enough to overcome pose and illumination issues.
* A message is popped at each stage to display if a photo is generated, if a match exists etc.

## Safety Requirements

If there is extensive damage to a wide portion of the database due to catastrophic failure, such as a disk crash, the recovery method restores a past copy of the database that was backed up to archival storage (typically tape) and reconstructs a more current state by reapplying or redoing the operations of committed transactions from the backed up log, up to the time of failure.

## Security Requirements

Security systems need database storage just like many other applications. However, the special requirements of the security market mean that vendors must choose their database partner carefully. Crime records are to be kept confidential.

## Software Quality Attributes

* ***AVAILABILITY:***The application should be available at all times.
* ***CORRECTNESS:***The face matching algorithm and the overall working of the application must be correct.
* ***MAINTAINABILITY:***The administrators should be able to maintain the application and apply necessary restrictions*.*
* ***USABILITY:***

## Business Rules

**Appendix A: Glossary**

**Appendix B: Analysis Models**

*<Optionally, include any pertinent analysis models, such as data flow diagrams, class diagrams, state-transition diagrams, or entity-relationship diagrams*.>

**Appendix C: To Be Determined List**

*<Collect a numbered list of the TBD (to be determined) references that remain in the SRS so they can be tracked to closure.>*