GURU GOBIND SINGH INDRAPRASTHA UNIVERSITY

UNIVERSITY SCHOOL OF INFORMATION, COMMUNICATION TECHNOLOGY

SEMINAR AND PROGRESS REPORT
(IT 456)

Utilizing Face Recognition to Find Missing People

Submitted To:-

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B.Tech CSE (8th Sem)

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DECLARATION BY THE CANDIDATE

I, Esshaan Mahajan, solemnly declare that the Seminar and Progress Report on Finding Missing People Using AI is based on the work carried out by me during the course of study under the supervision of Dr. Sartaj Singh Sodhi. I assert the statements made and conclusions drawn are an outcome of our research work. I further certify that:

1. The work contained in the report is original and has been done by us under the general supervision of our supervisors.

2. The work has not been submitted to any other Institution for any other degree/diploma/certificate in this university or the any other University of India or abroad.

3. We have followed the guidelines provided by the university in writing the report.

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BTech CSE 8th Sem

Introduction

The project aims to provide an innovative solution to the problem of finding people, especially children, who go missing. Police come across several challenges while investigating a missing person case. This project can be used as an important tool by the police and cyber cell to locate a missing person. Furthermore, this application allows the general public to help in the investigation by uploading image which can then be matched in the existing database.

We use face recognition and classification in this project. Face recognition is a biometric modality that uses computer vision and machine learning to identify or classify human faces in digital images or videos. Face recognition systems typically consist of three stages: face detection, feature extraction and classification. Face detection locates and segments the face regions in an image. Feature extraction transforms the face regions into numerical representations that capture the distinctive characteristics of each face. Classification compares the features of a face with a database of known faces and assigns a label or a score to indicate the identity or the attribute of the face.

Uvicorn

Uvicorn is a fast and lightweight ASGI web server for Python. It supports both HTTP/1.1 and WebSocket protocols, and can run on multiple workers for scalability. Uvicorn is based on uvloop, a high-performance event loop implementation, and httptools, a low-level HTTP parser. Uvicorn can be installed with pip and run from the command line with a simple syntax: uvicorn app:app. Uvicorn can also be integrated with popular frameworks such as FastAPI and Django. Uvicorn has several advantages over other web servers, such as:

- It is based on uvloop and httptools, which are highly optimized implementations of the asyncio event loop and the HTTP protocol respectively. This makes Uvicorn very fast and efficient in handling concurrent requests.
- It supports HTTP/2 and WebSockets, which enable bidirectional communication between the server and the client. This is useful for building real-time applications such as chatbots, games, and streaming services.
- It has a simple and elegant API that allows developers to easily configure and customize the server. Uvicorn also provides a command-line interface and a reload option that automatically restarts the server when code changes are detected.
- It is compatible with multiple ASGI frameworks and applications, which gives developers the flexibility to choose the best tools for their needs. Uvicorn can also run multiple workers in parallel to scale up the performance and handle high traffic.

Uvicorn is a powerful and versatile web server that can help developers create fast, modern, and scalable web applications with Python.

PostgreSQL

PostgreSQL is a powerful, open-source object-relational database system that uses and extends the SQL language. It has more than 30 years of active development and a proven architecture that has earned it a strong reputation for reliability, data integrity, and correctness. PostgreSQL runs on all major operating systems and supports a wide range of features, such as transactions, concurrency control, user-defined types and functions, full-text search, JSON and XML data types, and spatial and geographic extensions. PostgreSQL is also highly extensible and customizable, allowing developers to create their own data types, operators, index methods, and procedural languages. PostgreSQL is suitable for many kinds of applications, from small-scale projects to large-scale enterprise systems. Some of the advantages of PostgreSQL are:

- It is highly scalable and can handle large volumes of data and concurrent users.
- It is compliant with the SQL standard and supports many advanced data types and functions.
- It offers high performance and reliability through its robust architecture and transaction management system.
- It is extensible and customizable, allowing users to define their own data types, operators, functions, and extensions.
- It has a rich ecosystem of tools and libraries that facilitate development, administration, and integration with other systems.

Fast API

FastAPI is a web framework for building APIs with Python 3.7+ based on standard Python type hints. It offers high performance, easy to learn, fast to code, and ready for production features. Some of the benefits of using FastAPI are:

- Automatic interactive documentation with OpenAPI and JSON Schema.
- Data validation and serialization with Pydantic.
- Dependency injection system with advanced techniques.
- Support for OAuth2, CORS, background tasks, testing, and more.

FastAPI is built on top of Starlette, a lightweight ASGI framework that is compatible with other async libraries and tools. FastAPI also integrates well with popular databases, ORMs, and web templates. You can use FastAPI to create RESTful APIs, GraphQL APIs, WebSocket applications, or any other type of web service. Its key features are:

Fast: Very high performance, on par with NodeJS and Go (thanks to Starlette and Pydantic). One of the fastest Python frameworks available.

Fast to code: Increase the speed to develop features by about 200% to 300%.

Fewer bugs: Reduce about 40% of human (developer) induced errors.

Intuitive: Great editor support. Completion everywhere. Less time debugging.

Easy: Designed to be easy to use and learn. Less time reading docs.

Short: Minimize code duplication. Multiple features from each parameter declaration. Fewer bugs.

Robust: Get production-ready code. With automatic interactive documentation.

Standards-based: Based on (and fully compatible with) the open standards for APIs: OpenAPI (previously known as Swagger) and JSON Schema.

Psycopg2

Psycopg is the most popular PostgreSQL database adapter for the Python programming language. Its main features are the complete implementation of the Python DB API 2.0 specification and the thread safety (several threads can share the same connection). It was designed for heavily multi-threaded applications that create and destroy lots of cursors and make a large number of concurrent “INSERT”s or “UPDATE”s.

Psycopg 2 is mostly implemented in C as a libpq wrapper, resulting in being both efficient and secure. It features client-side and server-side cursors, asynchronous communication and notifications, “COPY TO/COPY FROM” support. Many Python types are supported out-of-the-box and adapted to matching PostgreSQL data types; adaptation can be extended and customized thanks to a flexible objects adaptation system.

Psycopg2 is a popular and efficient PostgreSQL database adapter for Python. It has several advantages over other Python database drivers, such as:

- It is written in C, which makes it faster and more secure than pure Python implementations.
- It supports the full Python DB API 2.0 specification, which ensures compatibility and consistency with other database adapters.
- It is thread-safe, meaning that multiple threads can use the same connection without interfering with each other.
- It supports advanced features of PostgreSQL, such as client-side and server-side cursors, asynchronous communication, notifications, and COPY commands.

Psycopg2 is a reliable and robust choice for working with PostgreSQL databases in Python.

Dlib

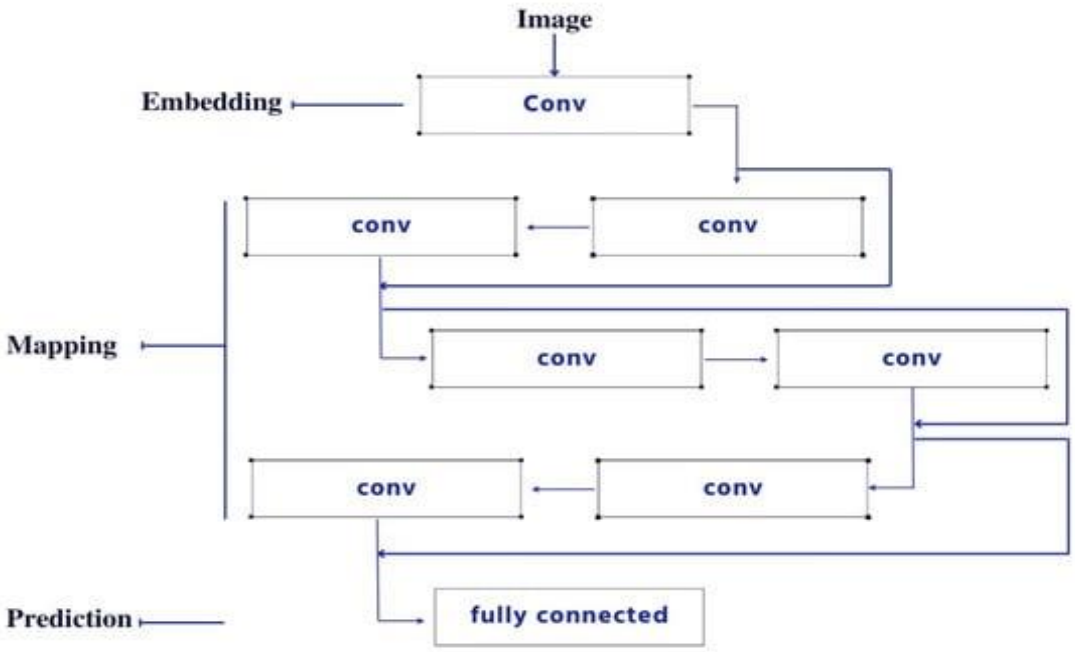
Dlib is a cross-platform software library that provides a range of algorithms and tools for machine learning, computer vision, image processing, and numerical optimization. Dlib is written in C++ and can be used as a standalone library or integrated with other frameworks such as TensorFlow, PyTorch, and OpenCV. Dlib is open source and licensed under the Boost Software License, which allows for both commercial and non-commercial use.

Some of the advantages of using dlib are:

- It is written in modern C++ and follows the ISO C++11 standard, which makes it easy to integrate with other C++ projects and libraries.
- It has a high-level interface that allows users to write concise and expressive code for complex tasks such as face detection, face recognition, object detection, and pose estimation.
- It has a low-level interface that exposes the underlying implementation details and gives users full control over the performance and memory usage of the algorithms.
- It is well-documented and has extensive examples and tutorials that demonstrate how to use the library for various applications.
- It is open-source and licensed under the Boost Software License, which means that users can freely use, modify, and distribute the library for both commercial and non-commercial purposes.

We use the get_frontal_face_detector method in library dlib to find human faces that are looking more or less towards the camera.
We then use the pose_estimator method that takes in an image region containing some object and outputs a set of point locations that define the pose of the object. The classic example of this is human face pose prediction, where you take an image of a human face as input and are expected to identify the locations of important facial landmarks such as the corners of the mouth and eyes, tip of the nose, and so forth.

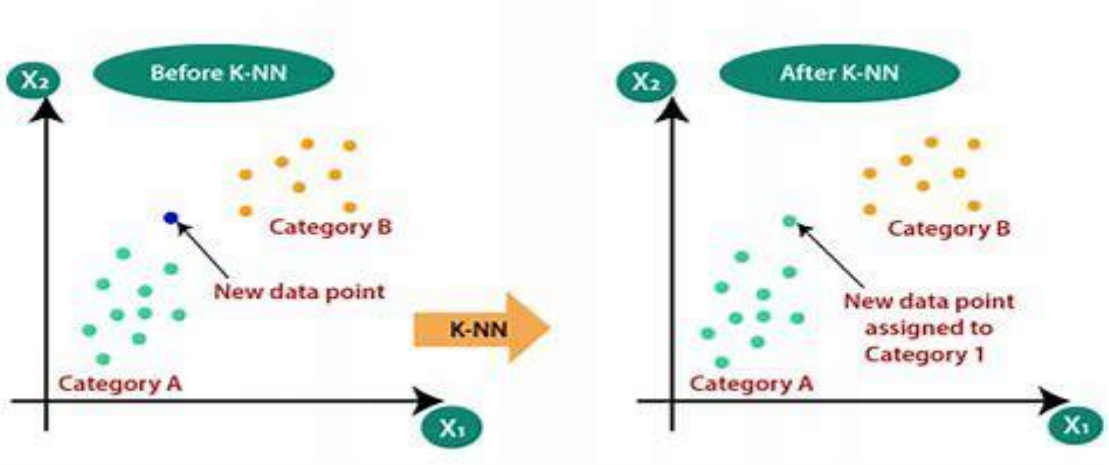
Furthermore, we use a model to covert this data into face encodings. The model used is a ResNet network with 29 conv layers. It's essentially a version of the ResNet-34 network from the paper Deep Residual Learning for Image Recognition.



The basic building block of a ResNet.

The network used was a pretrained one on a dataset of about 3 million faces. This dataset is derived from a number of datasets available.

Our aim is to map an image of a human face to a 128-dimensional vector space where images of the same person are near to each other and images from different people are far apart. Therefore, we can perform face recognition by mapping faces to the 128D space and then checking if their Euclidean distance is small enough. For classification we use KNN algorithm.



PyQt5

Qt is set of cross-platform C++ libraries that implement high-level APIs for accessing many aspects of modern desktop and mobile systems. These include location and positioning services, multimedia, NFC and Bluetooth connectivity, a Chromium based web browser, as well as traditional UI development.

PyQt5 is a comprehensive set of Python bindings for Qt v5. It is implemented as more than 35 extension modules and enables Python to be used as an alternative application development language to C++ on all supported platforms including iOS and Android.

PyQt5 may also be embedded in C++ based applications to allow users of those applications to configure or enhance the functionality of those applications.

Pyqt5 is a Python binding for the Qt framework, which is a cross-platform GUI toolkit that allows developers to create interactive desktop applications with ease. Pyqt5 has many advantages over other GUI libraries, such as:

- It supports multiple platforms, including Windows, Linux, Mac OS, Android and iOS.
- It has a rich set of widgets and layouts that can be customized using CSS.
- It has a tool called Qt Designer that enables drag-and-drop design of the user interface.
- It has a powerful event system that connects widgets with signals and slots.
- It has bindings for many other languages, such as C++, Java, Ruby and Perl.

Pyqt5 is a professional and versatile choice for creating GUI applications in Python.