

Age Recognition App Technical Document

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1 Introduction

1.1 Overview

In the rapidly evolving landscape of digital technology, the integration of machine learning and graphical user interfaces (GUI) has opened new horizons in user experience and application functionality. Our application, developed using Python, stands at this intersection, offering an intuitive GUI for camera operations and image uploads, enriched with advanced face detection and age estimation features. This document serves as a comprehensive guide to the functionalities, architecture, and usage of our application.

1.2 Purpose of the Application

This application is designed to provide users with a seamless and interactive way to engage with camera operations and image processing. It primarily focuses on:

- Face Detection: Utilizing DNN and CNN models, the application can detect faces in real-time from a camera feed or uploaded images and videos.
- Age Estimation: Beyond face detection, the application is equipped with an age estimation feature that predicts the age of detected faces, powered by a pre-trained TensorFlow Keras model.

1.3 Key Features

1. Real-Time Camera Feed Processing
2. Image and Video Upload
3. Dual Face Detection Methods
4. GUI Interaction
5. Age Estimation
6. File and Directory Processing
7. Efficient Performance
8. Robust Error Handling

2 High Level Architecture

Application architecture diagram can be found on the figure below:

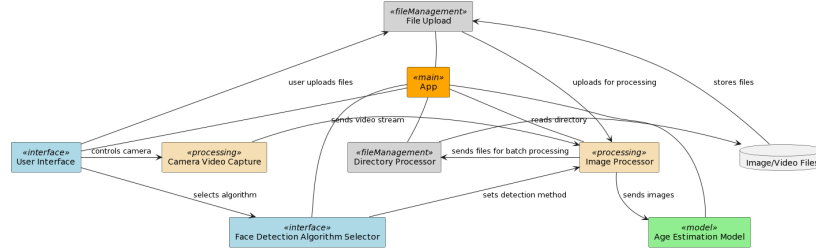


Figure 1: Architecture Diagram

3 Running the Application

To successfully run the application, you need to set up the environment and install the required dependencies. Follow these steps to get started:

3.1 Extracting Files

First, ensure that you have all the necessary files and follow these steps:

1. Locate the archive containing the application files.
2. Extract the files from the archive into a designated folder on your system.
3. Ensure that you maintain the directory structure while extracting the files.

3.2 Setting Up Python Virtual Environment

To run the application Python 3.11 is required. It is recommended to run the application in a Python virtual environment. This keeps dependencies required by different projects separate by creating isolated environments for them. To set up a virtual environment, follow these instructions:

1. Navigate to the folder where you extracted the application files.
2. Open a terminal or command prompt in this directory.
3. Run the following command to create a virtual environment:

```
python -m venv venv
```

4. Activate the virtual environment:

- On Windows, use:

```
.\venv\Scripts\activate
```

- On macOS and Linux, use:

```
source venv/bin/activate
```

3.3 Installing Dependencies

After setting up the virtual environment, you need to install the required libraries:

1. Ensure that the virtual environment is active. You should see `(venv)` before the command prompt.
2. Install all required dependencies by running:

```
pip install -r requirements.txt
```

This command reads the `requirements.txt` file and installs the Python packages listed in it.

3. For installing `dlib`, additional steps are required based on your operating system and CUDA support:

- On Linux or macOS without CUDA support:

```
pip install dlib
```

This command will install `dlib` directly from the Python Package Index.

- On Windows with CUDA support:

- The file is located in `dlib` folder `dlib` wheel file (`dlib-19.24.99-cp311-cp311-win_amd64.whl`)
- Install `dlib` using the wheel file:

```
pip install dlib/dlib-19.24.99-cp311-cp311-win_amd64.whl
```

3.4 Launching the Application

Once the environment is set up and all dependencies are installed, you can proceed to launch the application. Follow these steps to start the application:

- (a) Make sure that the virtual environment is still active in your terminal or command prompt. You should see `(venv)` before the command prompt.

- (b) Navigate to the ‘App’ folder where the ‘app.py’ file is located. You can do this using the command:

```
cd App
```

- (c) Run the application by executing the ‘app.py’ script. Use the command:

```
python app.py
```

Upon successfully running the above command, the application’s GUI should appear, allowing you to interact with its features.

Note: If you encounter any errors during the launch, make sure that the Python script ‘app.py’ is present in the ‘App’ folder and that all previous setup steps have been correctly followed. Additionally, check the terminal or command prompt for specific error messages that can help in troubleshooting.

4 Application GUI Guide

The Graphical User Interface (GUI) of the application is designed for ease of use, allowing users to interact with the system efficiently. You can see the App interface on the Figure below:

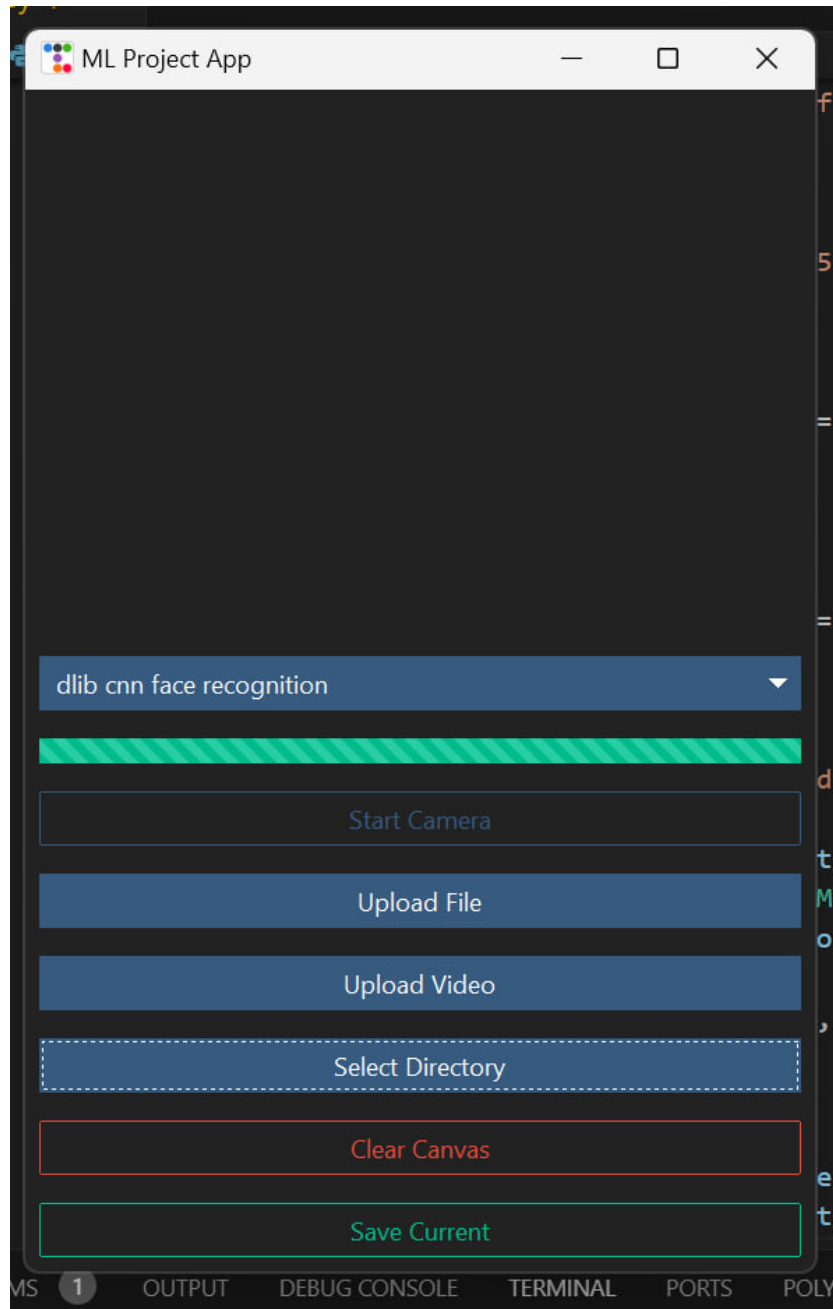


Figure 2: Application GUI

The following subsections provide a guide to the various functionalities

available in the GUI.

4.1 Face Detection Model Selection

At the top of the GUI, you have the option to choose the face detection model. This dropdown menu allows you to select between different face detection algorithms, such as ‘dlib cnn face recognition’ and ‘opencv dnn face recognition’. Your selection here will determine the method used for detecting faces in images and videos.

4.2 Camera Operations

- **Start Camera:** By clicking the ‘Start Camera’ button, you initiate the live feed from your camera. This feature is used to capture real-time video for face detection and age estimation.

4.3 File Operations

- **Upload File:** Use the ‘Upload File’ button to browse and upload an image file. Once uploaded, the image will be processed for face detection and age estimation.
- **Upload Video:** The ‘Upload Video’ button allows you to upload a video file from your computer. Similar to images, the video will be processed to identify faces and estimate ages.

4.4 Batch Processing

- **Select Directory:** This option is used to select a directory containing multiple images and videos. The application will process all supported files within this directory in real-time. A subdirectory named ‘processed’ will be created, containing the output with recognized faces and age labels.
- **Progress Indicator:** During the directory processing, a progress bar is displayed, providing feedback on the ongoing operation.
- **Completion Notification:** Upon successful completion of the batch processing, a notification will appear, informing you of the number of files processed.

4.5 Canvas Operations

- **Clear Canvas:** If you wish to clear the current display on the canvas, you can use the ‘Clear Canvas’ button. This will remove any images or video frames currently shown.

- **Save Current Frame:** The ‘Save Current’ button is used to save the currently displayed frame. When you click this button, you will be prompted to select a directory where the current frame will be saved. This function is particularly useful if you want to keep a record of a specific moment captured by the camera or a frame from the video being displayed.

5 Additional Notes

Please be advised that the model under discussion was specifically trained using the **dlib CNN** face recognition model. It is important to note that the performance and results of this model may differ significantly when compared to those obtained using the **OpenCV** face recognition framework. Users are encouraged to take these differences into consideration when evaluating model performance.

For inquiries or issues related to the application or its code, please reach out to **Vadzim Valodzin**.

For questions specifically concerning the model, contact **Alexander Alexin** for detailed information and support.