**Sign Language Detection and Conversion Programs**

This folder contains a set of Python programs designed to capture, train, and recognize sign language gestures, converting them into text and speech. These programs utilize OpenCV, MediaPipe, and machine learning techniques to create a sign language to text and speech converter, enhancing accessibility for individuals with hearing and speech impairments.

**Overview of Programs**

**NOTE:** Watch the “HOW TO USE” video for more info.

1. **Dataset Collection Script** (Collect Images.py):
   * **Purpose**: Captures images of various hand gestures or characters using a webcam and stores them in a structured dataset.
   * **Usage**:
     + The script prompts you to start capturing images for each gesture by pressing 'r'.
     + Captures 300 images per gesture, which are stored in a directory corresponding to the gesture label.
     + Press 'x' to exit the program at any time.
2. **Data Preprocessing Script** (Create the dataset.py):
   * **Purpose**: Processes the captured images, detects hand landmarks, normalizes the data, and prepares it for training.
   * **Usage**:
     + The script reads images from the dataset directory.
     + Uses MediaPipe to detect hand landmarks and normalizes the coordinates.
     + Saves the processed data and corresponding labels to a pickle file (data.pickle).
3. **Model Training Script** (Train the model.py):
   * **Purpose**: Trains a machine learning model (Random Forest Classifier) using the preprocessed data to recognize gestures.
   * **Usage**:
     + The script loads the data from data.pickle.
     + Pads the data to ensure uniformity in input length.
     + Splits the data into training and testing sets.
     + Trains a Random Forest Classifier model and evaluates its accuracy.
     + Saves the trained model to a pickle file (model.p).
4. **Gesture Recognition Script** (Make predictions & detect hand gestures.py):
   * **Purpose**: Recognizes hand gestures in real-time using a webcam, based on the trained model.
   * **Usage**:
     + The script captures video frames from the webcam.
     + Detects hand landmarks and uses the trained model to predict the gesture.
     + Displays the recognized gesture on the video feed along with a bounding box around the hand.
     + Press 'x' to exit the program.
5. **Gesture to Text and Speech Script** (Convert hand gestures to text and speech.py):
   * **Purpose**: Converts recognized gestures into text and then into speech using Google Text-to-Speech (gTTS).
   * **Usage**:
     + The script continuously captures frames and recognizes gestures.
     + Captures a sentence when the '!' gesture is held for 2 seconds.
     + Converts the recognized gestures into text and then into speech.
     + The captured text is played as speech using the playsound module.

**Setup Instructions**

1. **Install Dependencies**:
   * As specified in the requirements.txt file.
2. **Collect Dataset**:
   * Run the Collect Images.py script to capture images for each gesture.
3. **Preprocess Data**:
   * Run the Create the dataset.py script to preprocess the captured images and save the data for training.
4. **Train the Model**:
   * Run the Train the model.py script to train the Random Forest Classifier model using the preprocessed data.
5. **Run Gesture Recognition**:
   * Use the Make predictions & detect hand gestures py script to test real-time gesture recognition with the trained model.
6. **Convert Gesture to Text and Speech**:
   * Run the Convert hand gestures to text and speech.py script to convert recognized gestures into text and speech.

**Notes**

* The accuracy of the model depends on the quality and diversity of the dataset. Ensure that you capture clear images for each gesture.
* Make sure your camera is properly configured and functioning before running the scripts.
* Adjust the min\_detection\_confidence in the MediaPipe configuration if hand landmarks are not detected reliably.