# Machine Learning Task:

**Tasks:**

● Gesture Recognition

● Lip Tracking Preprocessing

● Data Augmentation

Provide an overview of the project, including the objectives and significance.

## *Introduction*

This project focuses on **Gesture Recognition**, **Lip Tracking**, and **Data Augmentation** using modern machine learning techniques, primarily utilizing **MediaPipe** and **TensorFlow**. The objectives of the project are:

- To recognize hand gestures (such as the "OK" gesture) from images or video frames.
- To track lip movements and extract lip-related features from video frames for further analysis.
- To perform data augmentation to expand the dataset, making it more diverse and robust for machine learning models.

By using **MediaPipe** for hand gesture recognition and lip tracking, and **TensorFlow** for image data augmentation, this project combines computer vision and machine learning techniques for real-world applications like **sign language recognition** and **lip-reading**.

## *Project Components*

**1. Gesture Recognition**:

The gesture recognition component uses **MediaPipe**'s hand landmark detection to track the positions of key hand landmarks. By analyzing the relative positions of these landmarks, gestures such as the "OK" gesture can be detected. The detection process involves the following steps:

- Preprocessing the image to convert it to RGB format.
- Detecting hand landmarks using **MediaPipe Hands**.
- Drawing landmarks and evaluating the gesture based on predefined conditions.

**2. Lip Tracking**:

The lip tracking module employs **MediaPipe's FaceMesh** solution to track the positions of facial landmarks, specifically around the lips. The steps are:

- Extracting facial landmarks from video frames.
- Cropping the region around the lips using bounding box coordinates from the facial landmarks.
- Saving and processing these cropped lip images for further use, such as lip-reading or lip-based gesture recognition.

**3. Data Augmentation**:

To increase the size and diversity of the dataset, data augmentation techniques are applied to both gesture and lip images. These techniques include:

- Random rotations, shifts, and zooms.
- Horizontal flips to simulate real-world variations.
- This step is crucial to create a robust dataset that improves the accuracy of models trained on the data.
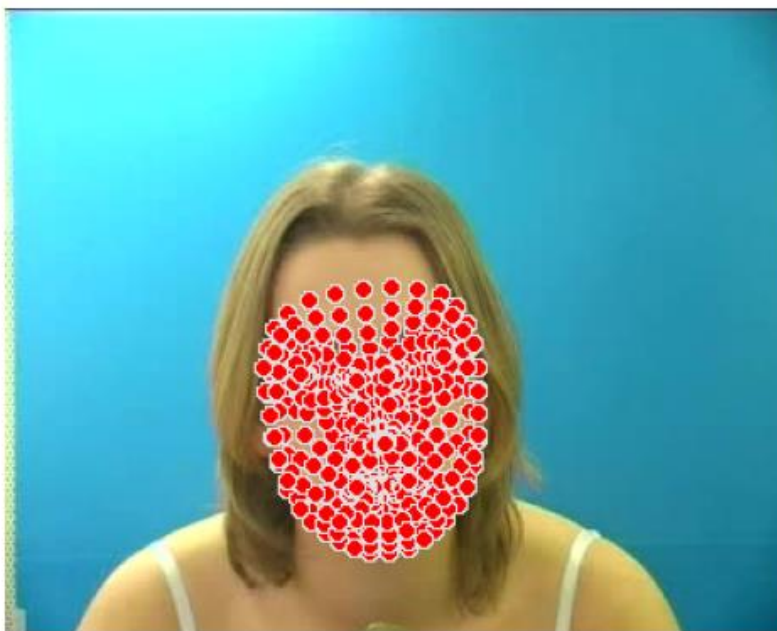


Processed Image with Hand Landmarks

Data augmentation:
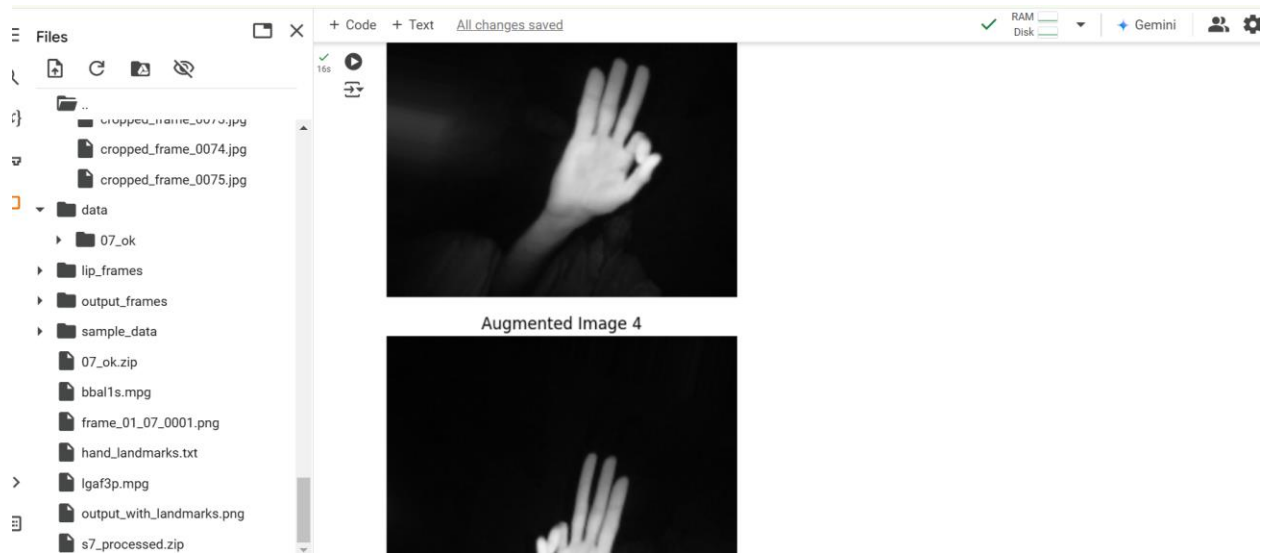
Lip Tracking :



- Cropping the region around the lips using bounding box coordinates from the facial landmarks.

```
[24]  Extracting frames from the video...
6s    Frames extracted and saved in /content/lip_frames
      Processing frames for lip landmarks...
      Cropped lip images saved in /content/cropped_lips
      Applying data augmentation to cropped lips...
      Augmented lip frames saved in /content/augmented_lip_frames
      Displaying processed images...
```