BMS COLLEGE OF ENGINEERING

(Autonomous Institute, Affiliated to VTU, Belagavi)

DEPARTMENT OF MACHINE LEARNING

(UG Program: B.E. in Artificial Intelligence and Machine Learning)

Course : Video Analytics using Open CV
Course Code: 24AM6PEVCV

SIGN LANGUAGE FOR DEAF AND DUMB

Presented By,
Student Name & USN :
Archit Subudhi (1BM21AI026)
Aryaman Sharma (1BM21AI027)
Ayush Kumar Dubey (1BM21AI028)
Chetna Mundra (1BM21AI036)

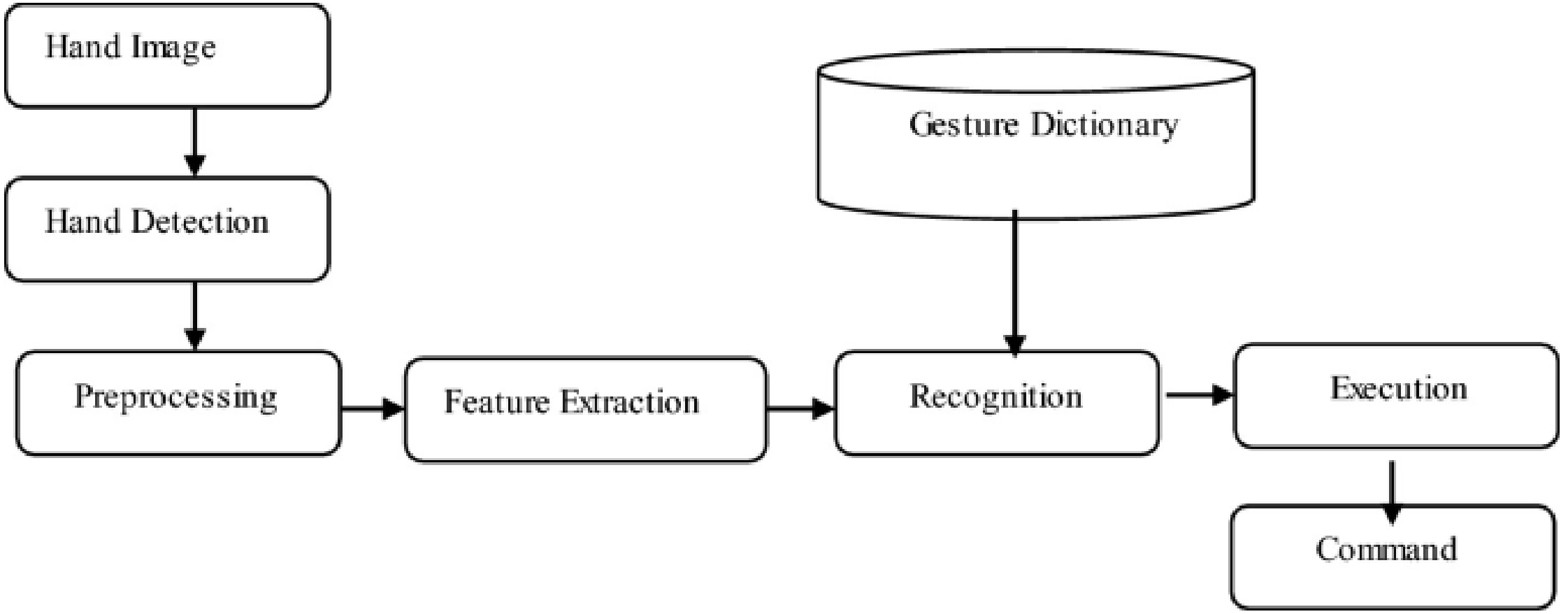
Semester & Section: **6A**

Faculty In-Charge:
Dr. Seemanthini K
Assistant Professor
Department of Machine Learning
BMS College of Engineering

Introduction

- Importance of sign language in communication.
- Challenges faced by the deaf and hard-of-hearing community.
- Overview of sign language recognition systems.
- Advancements in computer vision and machine learning.

Design architecture



Mathematical Analysis

- Formulation of hand detection as a classification problem.

$$B = f_\theta(\text{image})$$

- Preprocessing steps: normalization and augmentation.

$$I' = P(I)$$

- Feature extraction: landmark identification.

$$L = \{(x_1, y_1, z_1), (x_2, y_2, z_2), \ldots, (x_{21}, y_{21}, z_{21})\}$$

Mathematical Analysis

- Recognition and execution steps based on gesture dictionary.

$$g = M(L, G)$$

$$\mathcal{L}(\theta) = \sum_i \text{loss}(M(L_i; \theta), g_i)$$

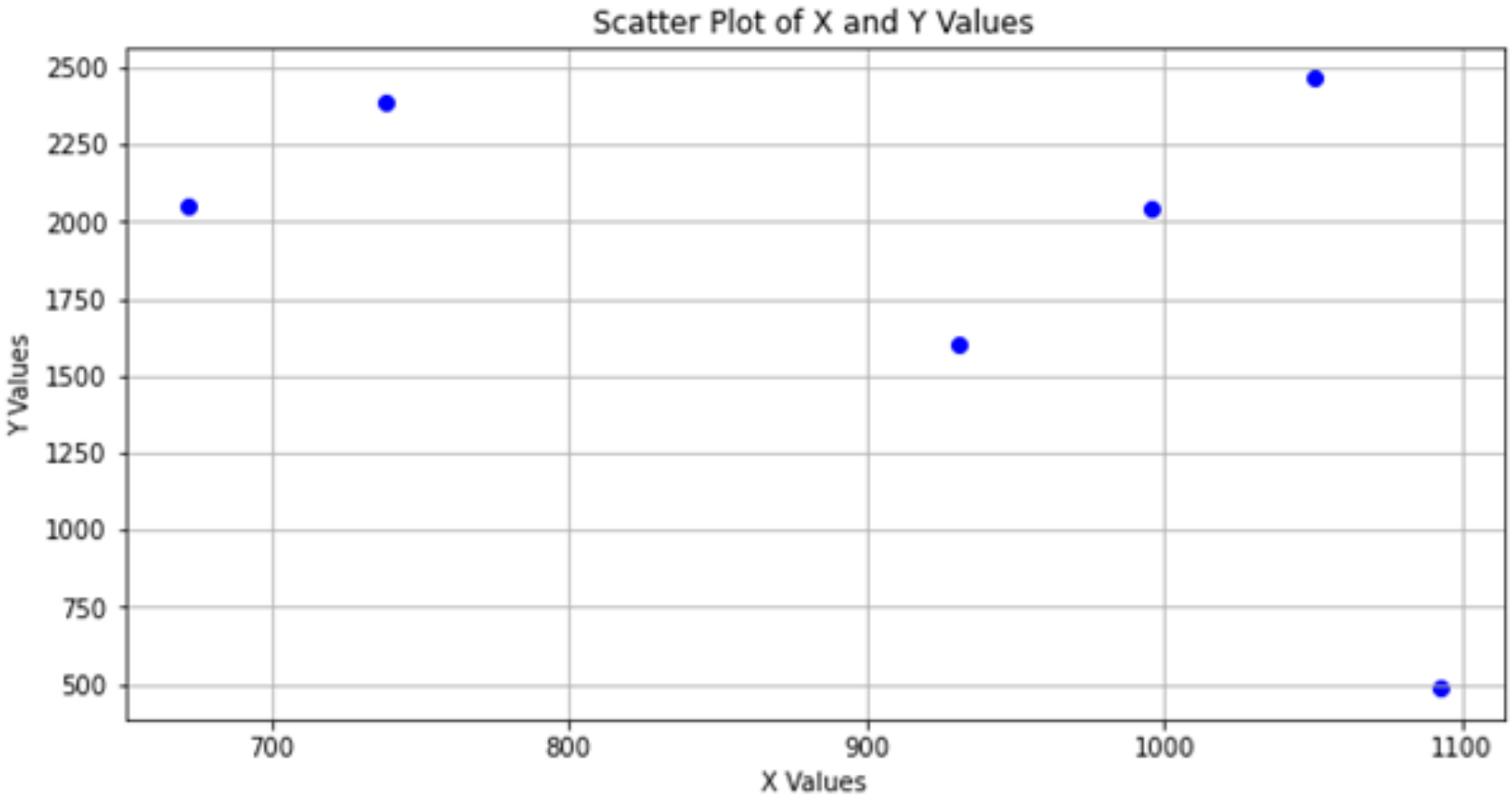
$$C = \text{execute}(g)$$

Implementation

- Dataset creation using OpenCV and MediaPipe.
  - Tools and functions used: OpenCV (cv2), MediaPipe (mp).

- Details of data preprocessing: normalization and averaging.
  - Normalization and averaging of landmark positions.
  - Visualization using Matplotlib for normalized gestures.

Implementation



Implementation

- Training and testing: Euclidean distance calculation and nearest-neighbor classification.
  - Calculation of Euclidean distance between gestures.
  - Classification based on the closest match in the preprocessed dataset

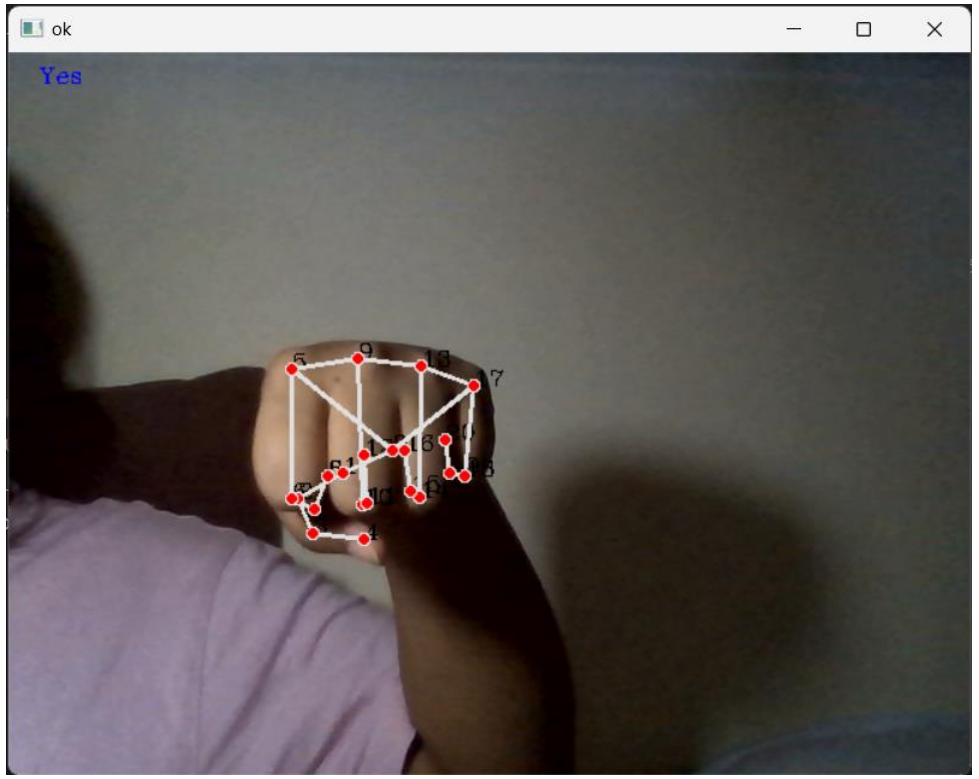
```
[1302, 1800]
710.4689489615198
389.1158995920897
420.75544278485006
1330.4449049595516
679.28588336725
814.178601245456
goodbye
[693, 357]
2137.71406749574
1710.2184838561657
1267.6623820679947
420.3898492243241
1697.327078771833
2030.9500831558025
yes
[891, 2009]
482.76588499573404
109.40113828445979
408.7389373068083
1536.290356988032
223.54755503433103
408.103295351192
goodbye
```

Implementation

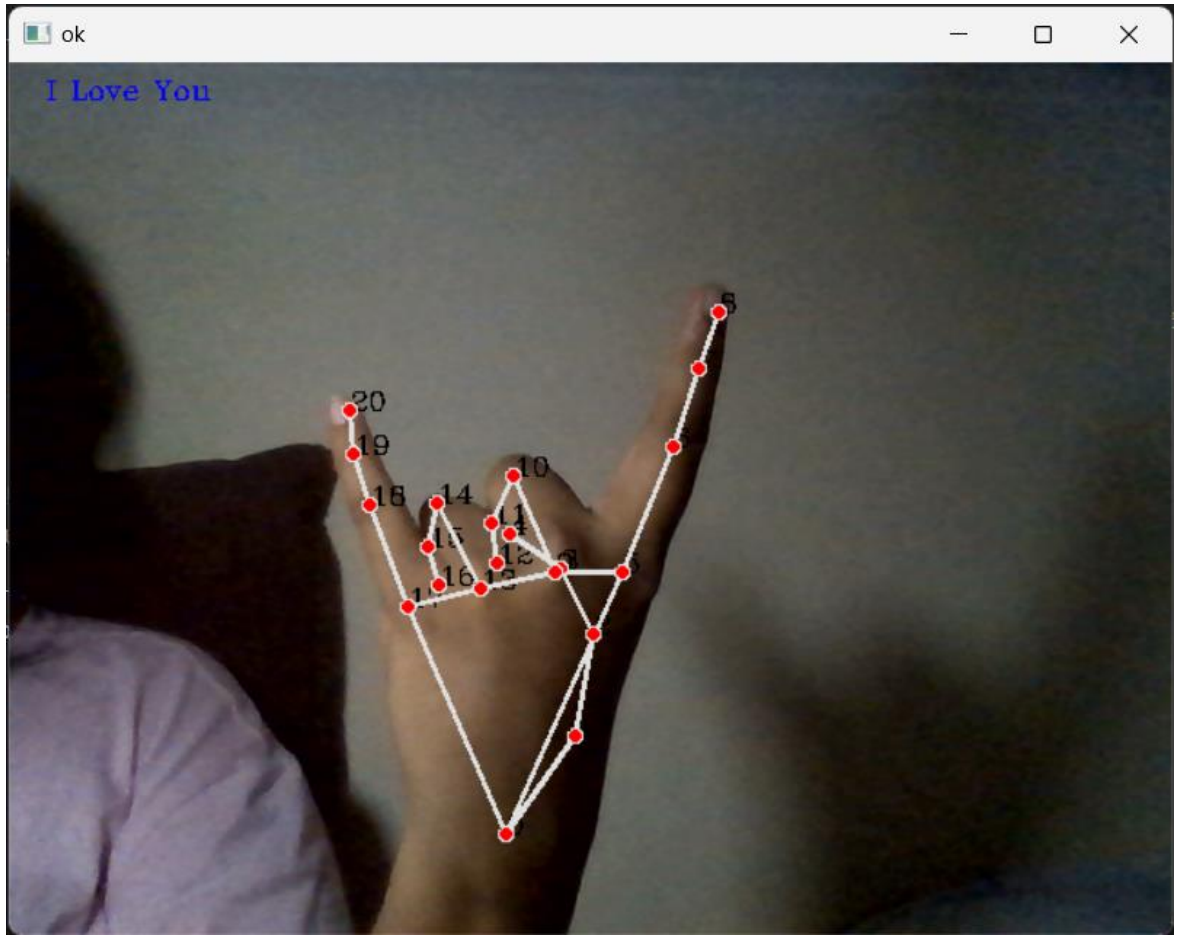
- Real-time prediction using MediaPipe and OpenCV.
  - Data Postprocessing
  - Integration of hand gesture recognition with nearest-neighbor approach.
  - Real-time display of recognized gestures on webcam feed.

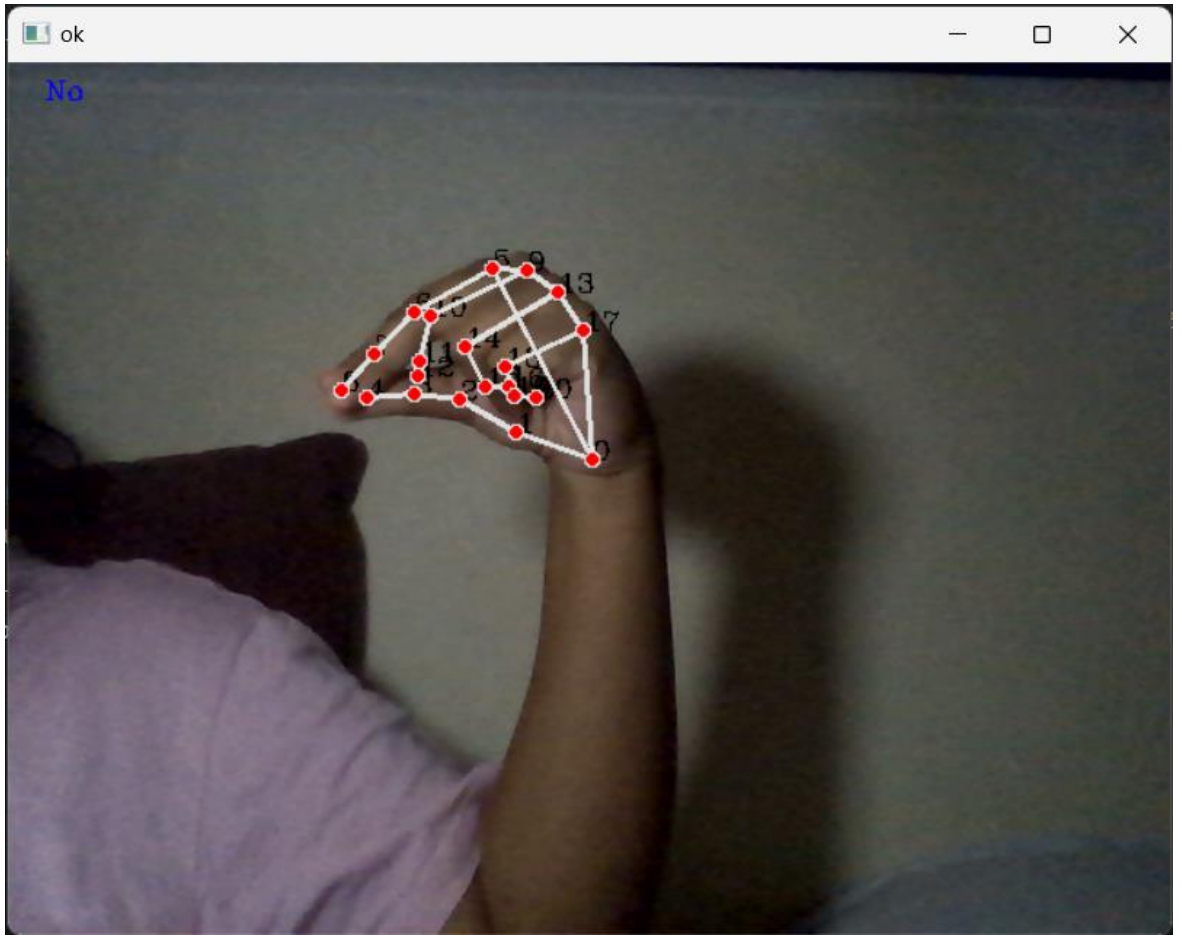
Results and Analysis

- Effectiveness of the real-time hand gesture recognition system.
- Accuracy of gesture classification using the nearest neighbor approach.
- Potential metrics for performance evaluation: accuracy, precision, and recall.
- Demonstration of system's robustness across various gestures.

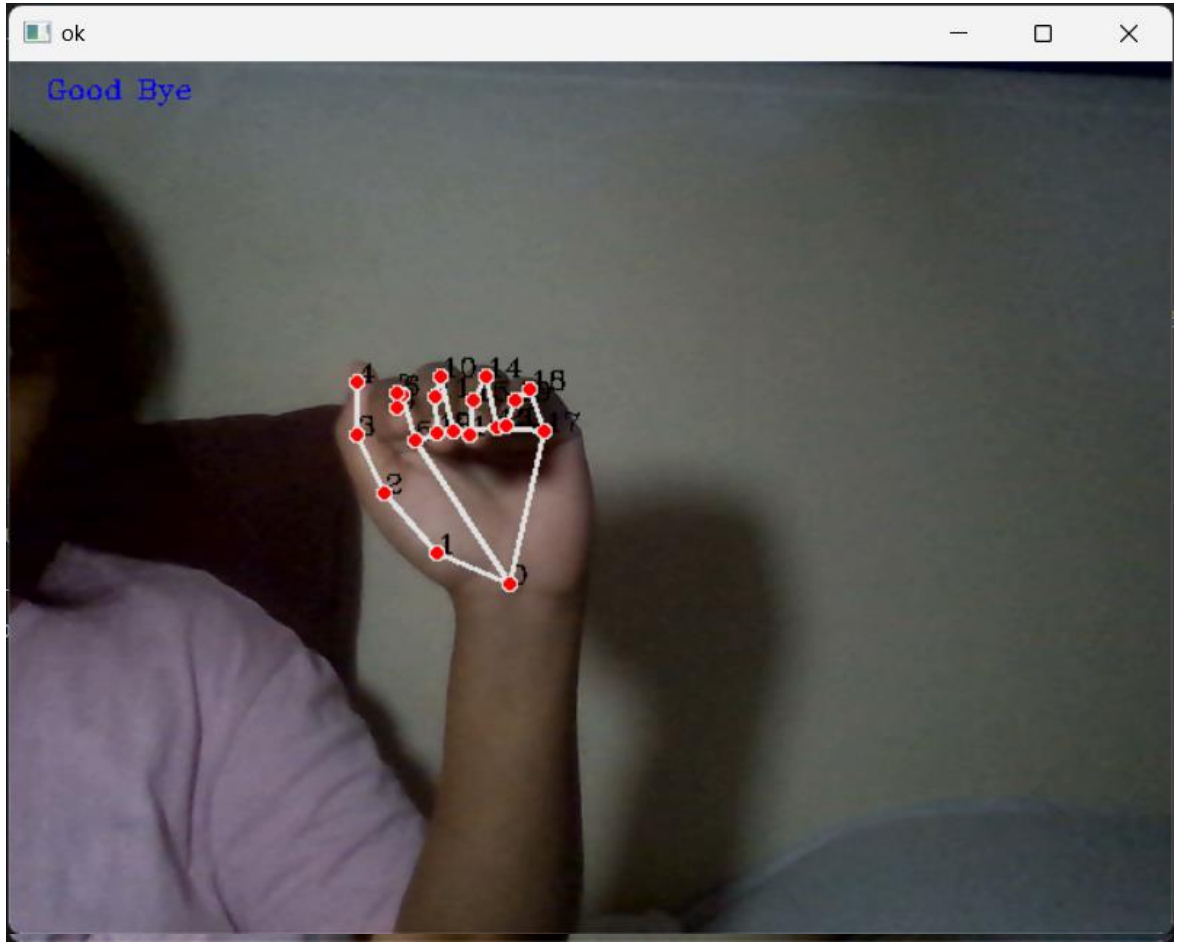


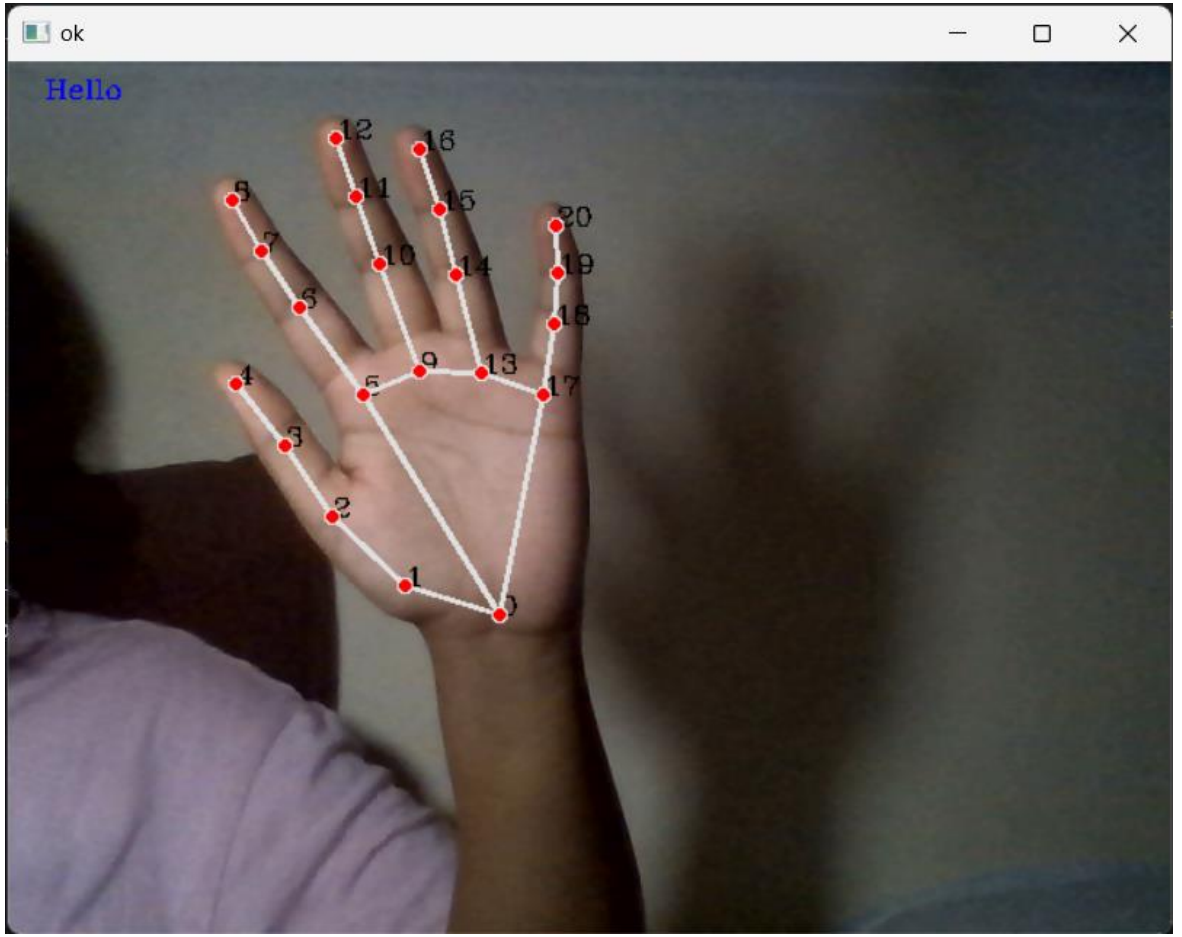
Results and Analysis





Results and Analysis





Conclusion and Future Enhancement

- Impact on bridging communication barriers and enhancing accessibility.
- Potential for widespread adoption in various domains.
- Future enhancements: integration with deep learning models (CNNs, RNNs), dynamic gesture recognition, contextual information incorporation.
- Improving scalability and adaptability across different environments and user preferences.

Thank you !