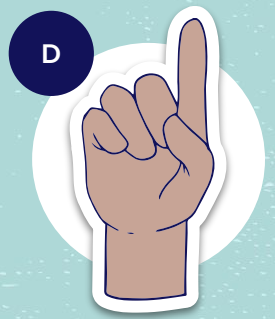


WEEK 1: Sign Language Translator

Meet Your Project Leads!

Dennis

- Grade: Junior
- Major: Data Science
- Minor: Music / PAT
- Ask me about keyboard percussion, synthwave, and camping!
- Email Me: dennisfj@umich.edu

Sharanya

- Grade: Junior
- Major: Computer Science
- I love to read, play board games with friends, and watch TV!
- Email Me: sharas@umich.edu

Icebreaker!

- Find people near you and form small groups of 2-3 people
- Introduce yourself!
    - Name, major, grade
    - If you were transported to the last movie/TV show you watched, are you surviving?
- Jeopardy

Why Is This Important?

- ASL translation to English is not exact
- Grammar, facial expressions, and motion matter
- Many existing tools focus on fingerspelling only
- Real-time ASL translation is still an open problem
- Supports inclusion

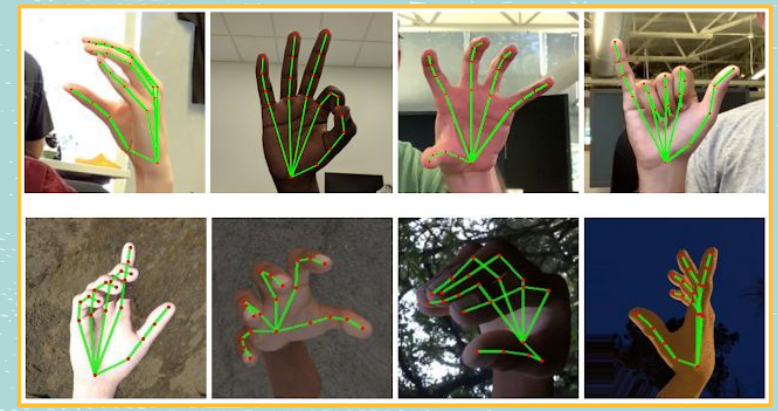
Timeline

1–2: Hand Tracking & Feature Extraction

- Extract and visualize hand landmarks from video using MediaPipe and OpenCV

3–7: Gesture Recognition Models

- Learn static hand pose classification → extend to motion-based gestures using RNNs / LSTMs



8–10: Real-Time Application Development

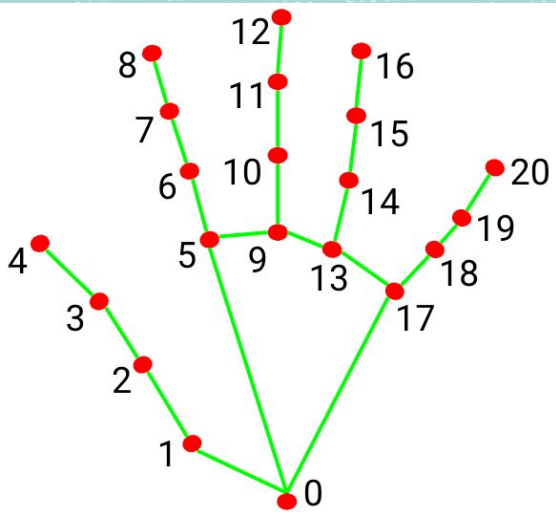
- Integrate trained models into a Streamlit app with live webcam input and immediate feedback

What is MediaPipe?

- Google framework for real-time perception
- Pretrained pipelines for
  - Hands
  - Various poses
  - The face

Why MediaPipe?

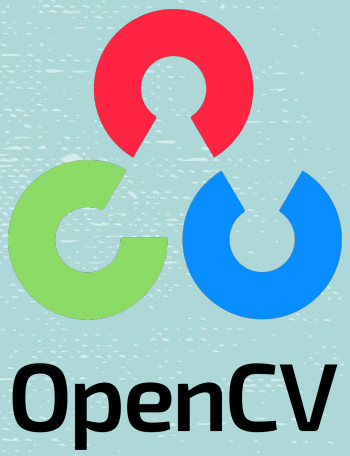
- Detects **21 landmarks** per hand
- Converts pixels into structured coordinates
- Removes the need for manual image processing



0. WRIST
1. THUMB_CMC
2. THUMB_MCP
3. THUMB_IP
4. THUMB_TIP
5. INDEX_FINGER_MCP
6. INDEX_FINGER_PIP
7. INDEX_FINGER_DIP
8. INDEX_FINGER_TIP
9. MIDDLE_FINGER_MCP
10. MIDDLE_FINGER_PIP
11. MIDDLE_FINGER_DIP
12. MIDDLE_FINGER_TIP
13. RING_FINGER_MCP
14. RING_FINGER_PIP
15. RING_FINGER_DIP
16. RING_FINGER_TIP
17. PINKY_MCP
18. PINKY_PIP
19. PINKY_DIP
20. PINKY_TIP

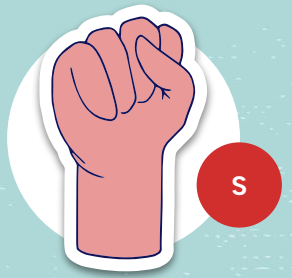
What is OpenCV

- Open source library for computer vision, machine learning, and image processing
- Uses:
  - Captures webcam video
  - Processes frames one at a time
  - Displays output

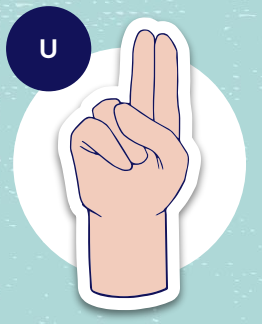


Try It Yourself!

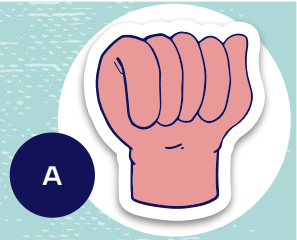
- Jupyter Notebooks exercise
- Live activity with opencv, hands.process
- Reading what hands returns, –> landmarks
- Group exercise



Next Week: Feature Representation and the WLASL Dataset



Further Reading



- Landmark Recognition Using Machine Learning
- What is OpenCV Library? - GeeksforGeeks
- Google Walkthrough (really good MediaPipe resource)
- MediaPipe Hands Paper

Download an image:

```
!wget -q -O image.jpg
https://storage.googleapis.com/mediapipe-tasks/hand_landmarker/woman_hands.jpg
```