Yoga Pose Classification Using LSTM Architecture

Group Members:

Min Khant Soe
Pyae Sone
Win Win Phyo

Outline

- Project Description
- Objective
- Data Collection
- Preprocessing
- LSTM Model Architecture

Project Description

- In this project, we collected the videos of 5 yoga poses such as Cobra, DownDog, Standing Forward Bend, Tree and Warrior 1 to classify them with deep learning model, LSTM which is suitable for classifying data based on time series.

- In testing, we use a recorded video and live actions, and label the poses with the names of the specific yoga poses classified by LSTM model.

- Yoga position recognition can be used to create an exercise system that helps people to learn and perform activities correctly on their own with minimal investment of time, money and effort.

Objective

- To apply deep learning knowledge
- To accurately classify yoga poses (as a human pose estimation) on recorded videos.
- To identify the postures and also to assist the people to perform yoga more accurately.

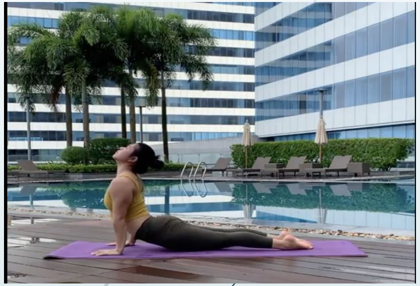
Data Collection

Videos were collected from 2 yoga practitioners and some of our friends from AIT.

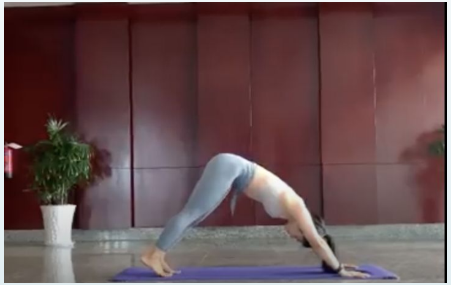
- Cobra: 30 videos
- DownDog: 30 videos
- Standing Forward Bend: 30 videos
- Tree: 30 videos
- Warrior1: 30 videos

Data Collection

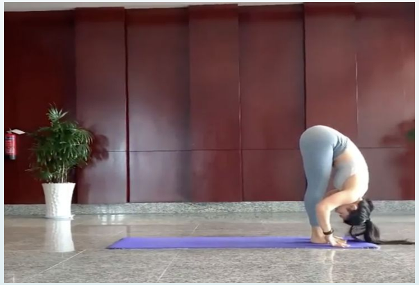
Cobra



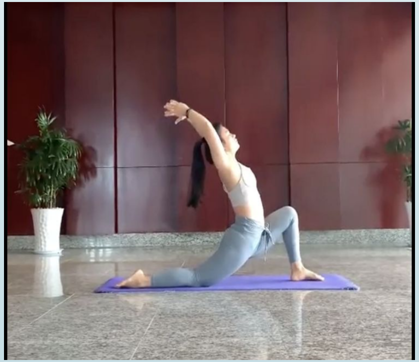
DownDog



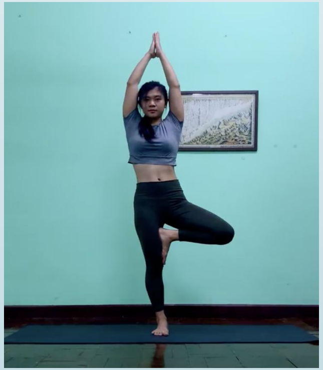
Standing Forward Bend



Warrior1

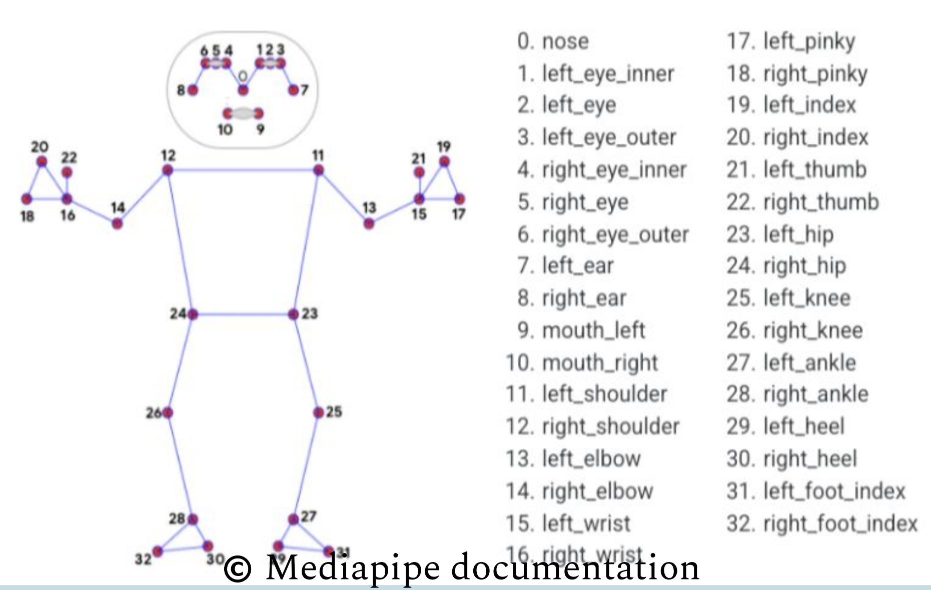


Tree



Preprocessing

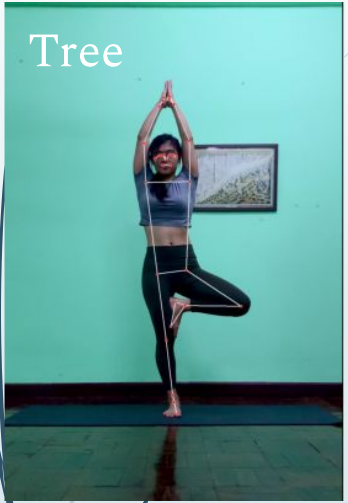
- OpenCv to load the videos of yoga poses for data preprocessing.
- Mediapipe to detect the yoga pose and extract the key points.
  - 30 videos recording of approximately 50s each.
  - Images are captured for 5 sequences at 5 fps (frame per second) from each video.
  - 33 Pose detection Key points.
  - Total keypoints: 132 (x,y,z and visibility of landmarks: 33 each)

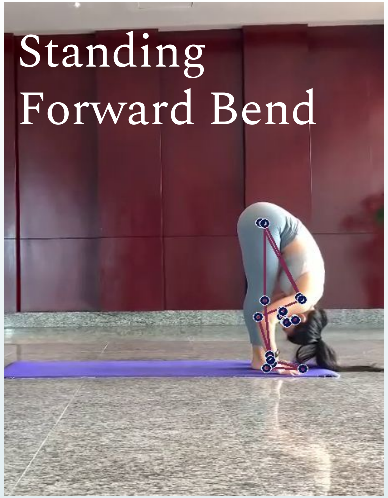


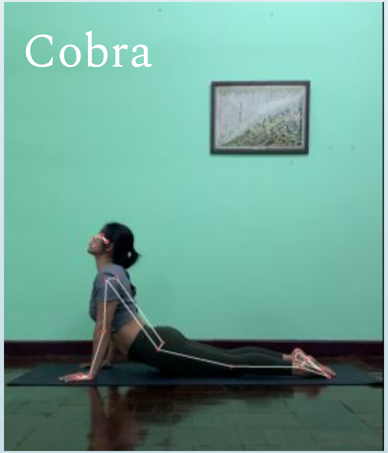
0. nose
1. left_eye_inner
2. left_eye
3. left_eye_outer
4. right_eye_inner
5. right_eye
6. right_eye_outer
7. left_ear
8. right_ear
9. mouth_left
10. mouth_right
11. left_shoulder
12. right_shoulder
13. left_elbow
14. right_elbow
15. left_wrist
16. right_wrist
17. left_pinky
18. right_pinky
19. left_index
20. right_index
21. left_thumb
22. right_thumb
23. left_hip
24. right_hip
25. left_knee
26. right_knee
27. left_ankle
28. right_ankle
29. left_heel
30. right_heel
31. left_foot_index
32. right_foot_index

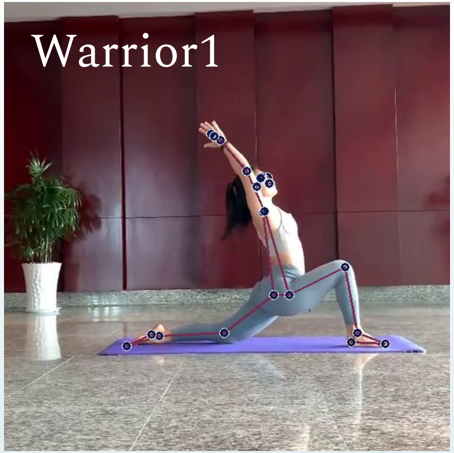
© Mediapipe documentation

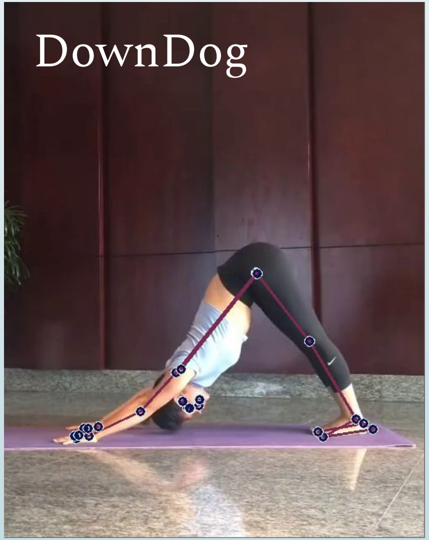
Preprocessing


Tree


Standing Forward Bend


Cobra

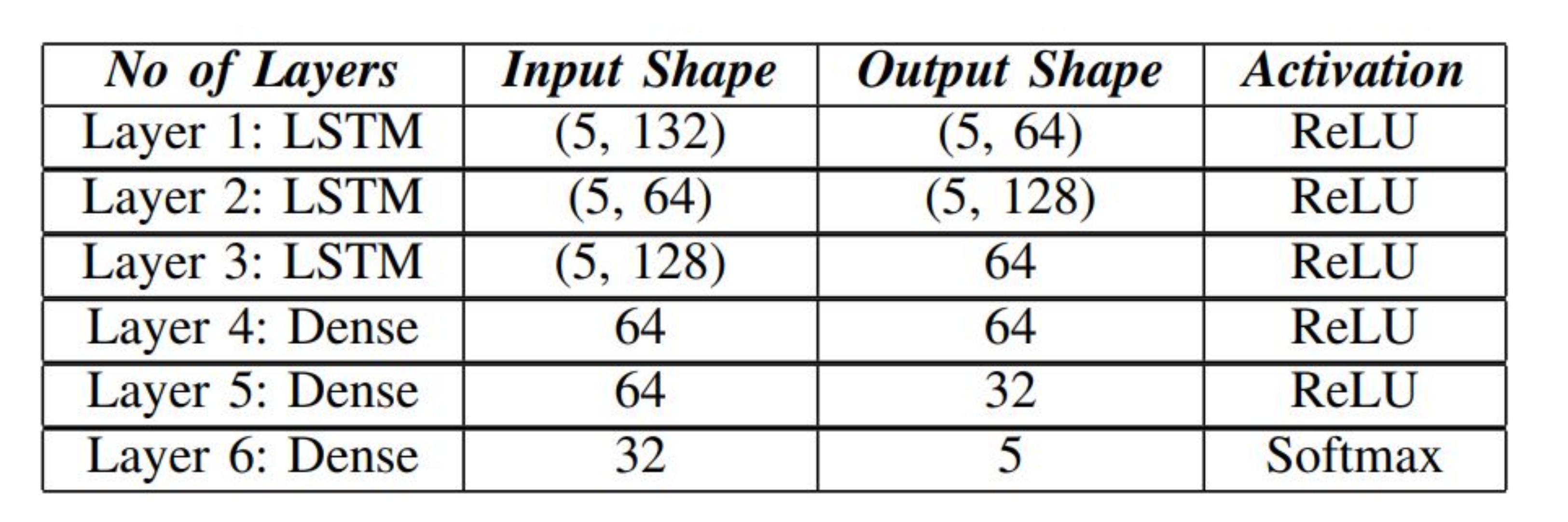

Warrior1


DownDog

LSTM Model Architecture

- LSTM model is used because of the gradient vanishing and memory problem of ordinary RNN
- LSTM have three types of gates: input gates, forget gates and output gates which control the flow of information
- Output gate decides what we’re going to output
- Input gate decides what new information we’re going to store in the cell state
- Forget gate decides what information we’re going to throw away from the cell state.
- The hidden layer output of LSTM includes hidden states and memory cells.
- Only hidden states are passed into the output layer
- Memory cells are entirely internal
- LSTMs can cope with vanishing and exploding gradients

LSTM Model

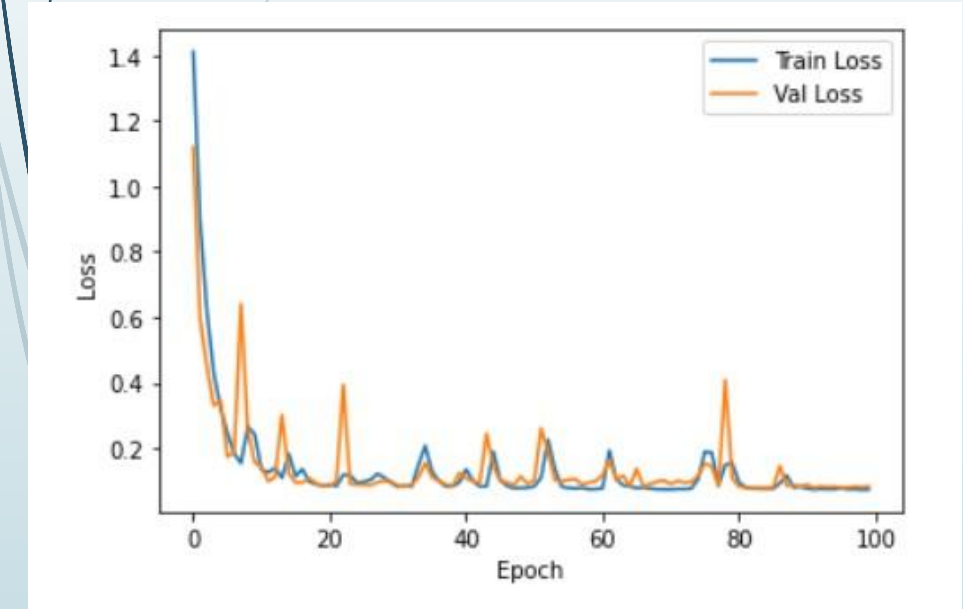


No of Layers	*Input Shape*	*Output Shape*	*Activation*
Layer 1: LSTM	(5, 132)	(5, 64)	ReLU
Layer 2: LSTM	(5, 64)	(5, 128)	ReLU
Layer 3: LSTM	(5, 128)	64	ReLU
Layer 4: Dense	64	64	ReLU
Layer 5: Dense	64	32	ReLU
Layer 6: Dense	32	5	Softmax

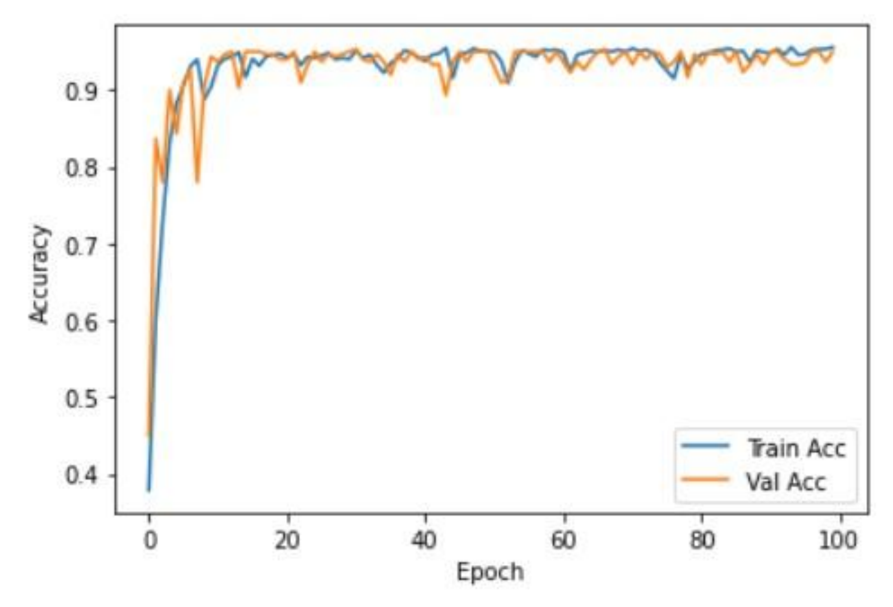
Results

Validation Accuracy: 94%

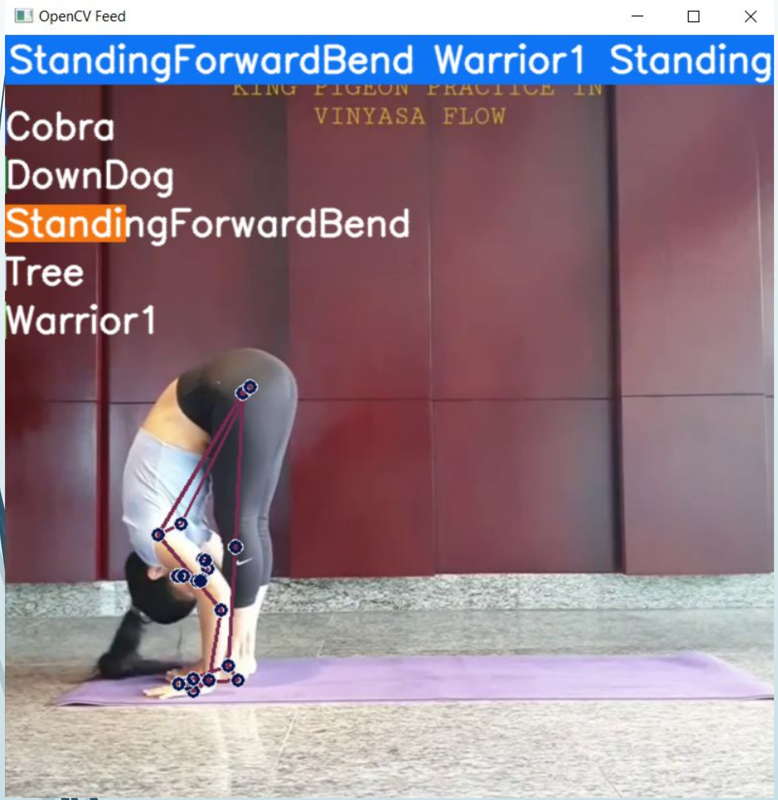
Loss Curve



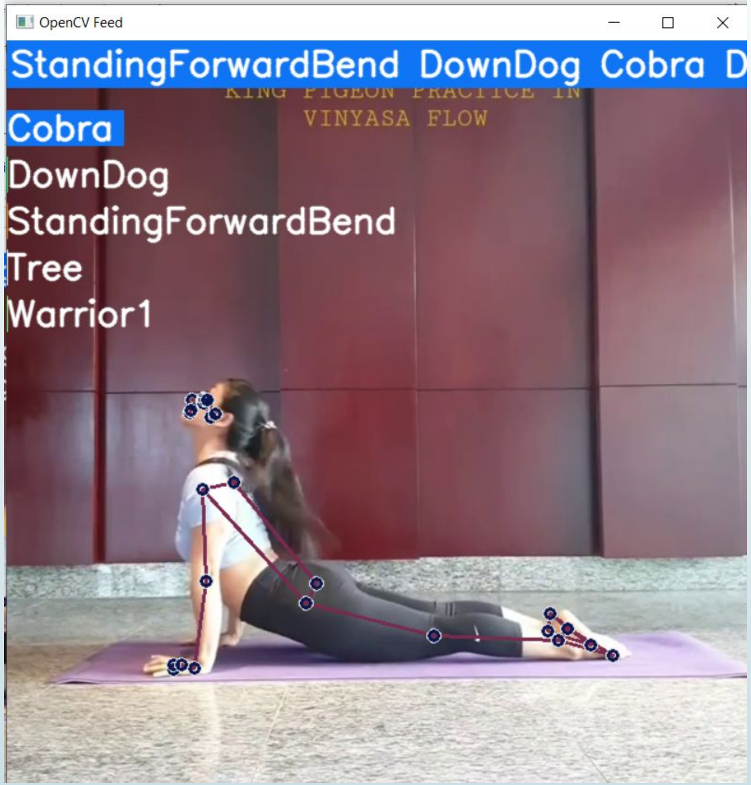
Accuracy



Results

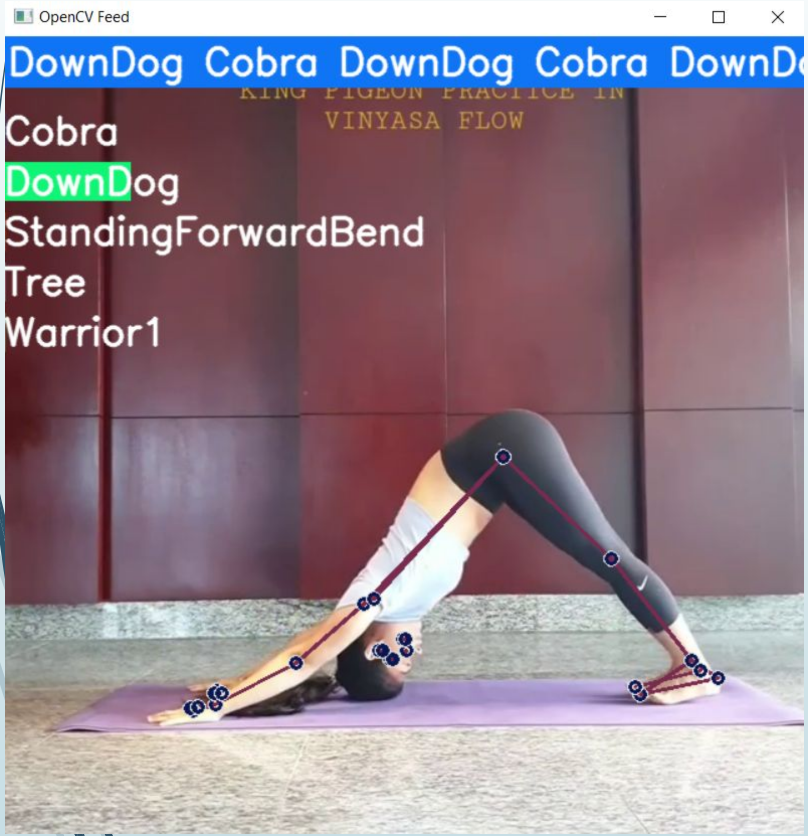


```
StandingForwardBend Warrior1 Standing
Cobra
DownDog
StandingForwardBend
Tree
Warrior1
```



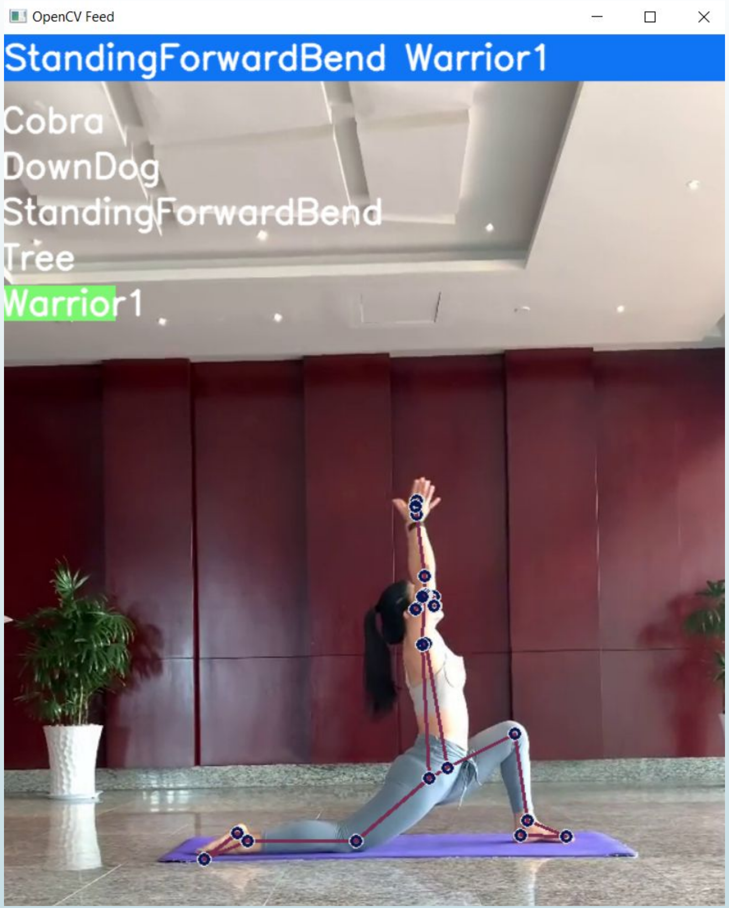
```
StandingForwardBend DownDog Cobra D
Cobra
DownDog
StandingForwardBend
Tree
Warrior1
```

Results


OpenCV Feed

DownDog Cobra DownDog Cobra DownD

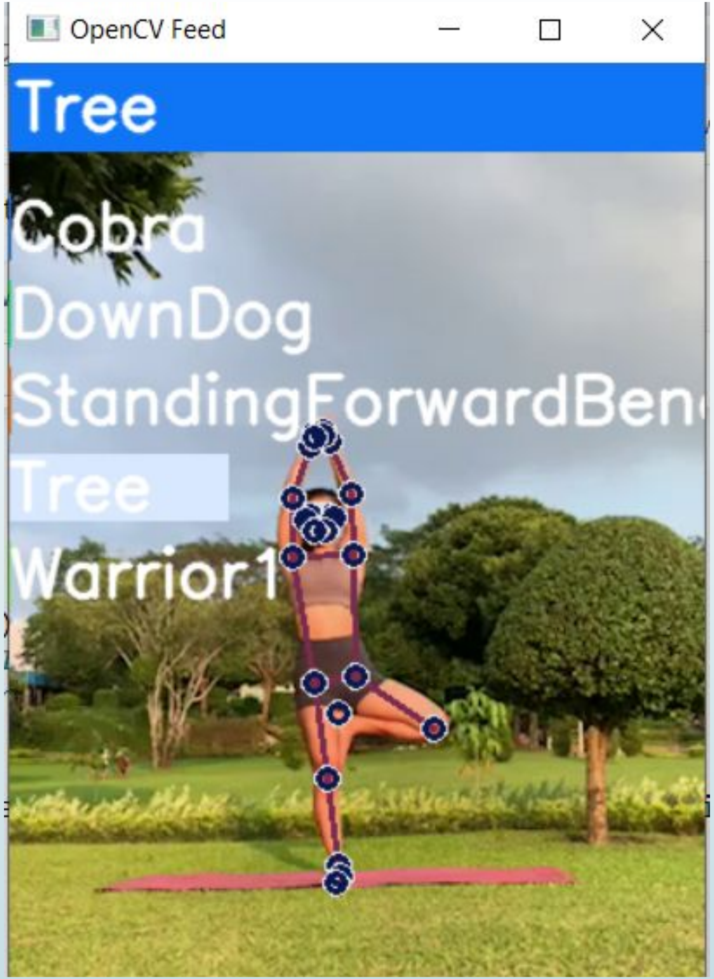
Cobra
DownDog
StandingForwardBend
Tree
Warrior1


OpenCV Feed

StandingForwardBend Warrior1

Cobra
DownDog
StandingForwardBend
Tree
Warrior1

Results


OpenCV Feed
Tree
Cobra
DownDog
StandingForwardBen
Tree
Warrior1

Testing Video

Thank You