
Pose Classification for Martial Arts

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Problem Statement

I can be difficult to find time to train martial arts with a teacher. This can be particular true during coronavirus or other social limitations. My goal is to create a computer vision model that would be able to detect the pose of the practitioner. This could then be used to make sure the pose is correct that way the student can practice even when away from the dojo.

The data will be gathered from video of me doing the iaido kata and certain important poses will be classified that will then be used to create the classifier for use by other people.

Tools

p5 - Web editor

Javascript library for setting up a canvas and using your browser for input including a webcam

ML5 neural network

Browser based machine learning with tensorflow.js

poseNet

Output is 17 key points using a X and Y coordinate

17 Pose Keypoints
Returned by PoseNet



▼ pose:

▼ keypoints: Array(17)

- 0: {score: 0.9996891617774963, part: "nose", position: {...}}
- 1: {score: 0.9996440410614014, part: "leftEye", position: {...}}
- 2: {score: 0.9997344613075256, part: "rightEye", position: {...}}
- 3: {score: 0.9519966840744019, part: "leftEar", position: {...}}
- 4: {score: 0.8696701526641846, part: "rightEar", position: {...}}
- 5: {score: 0.25439006090164185, part: "leftShoulder", position: {...}}
- 6: {score: 0.0718826875090599, part: "rightShoulder", position: {...}}
- 7: {score: 0.021140888333320618, part: "leftElbow", position: {...}}
- 8: {score: 0.0025672120973467827, part: "rightElbow", position: {...}}
- 9: {score: 0.015422427095472813, part: "leftWrist", position: {...}}
- 10: {score: 0.003994571976363659, part: "rightWrist", position: {...}}
- 11: {score: 0.00464298389852047, part: "leftHip", position: {...}}
- 12: {score: 0.0010674574878066778, part: "rightHip", position: {...}}
- 13: {score: 0.0018405886366963387, part: "leftKnee", position: {...}}
- 14: {score: 0.0010035105515271425, part: "rightKnee", position: {...}}
- 15: {score: 0.0027645344380289316, part: "leftAnkle", position: {...}}
- 16: {score: 0.0010671826312318444, part: "rightAnkle", position: {...}}

[1]

[2]

Data

Gathered using video of 8 different poses during an iaido kata.

20 seconds on each pose with the data then put into a ml5 neural network to train a classification model

All poses held by me, so data was only on my movements

Testing the Data

Took Json file to a jupyter notebook

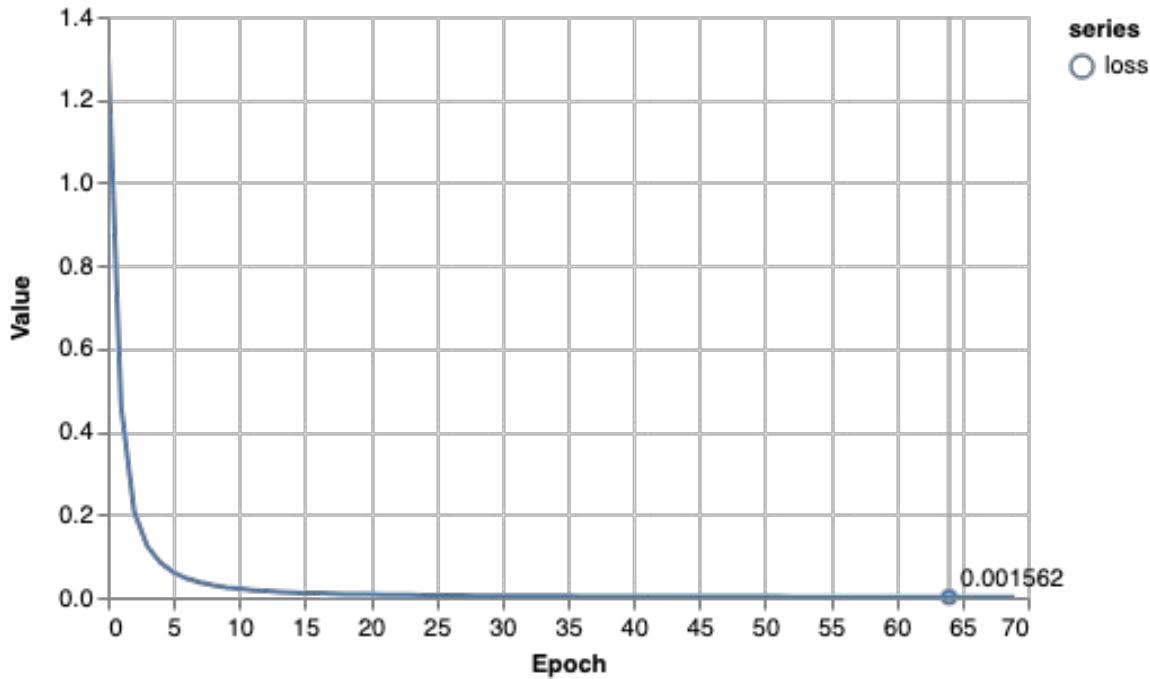
Created a baseline KNN model to classify the poses

Had nearly 100% success between train and test

Data is good and clear for the different poses, the tools then allow for real time classification using the trained model

Looking at the model

Training the ml5 neural network on the input data



8 poses

Seiza mae



Yoko ichi monji



Kirioroshi



O-chiburi 1



O-chiburi 2



Noto 1



Noto 2



End



Videos

Switch to view the videos of a student showing the kata to test the model

Conclusion

The model was able to classify the 8 poses well

The model also worked with another person who has a very different body type

Some limitations:

- Used only a laptop webcam so not very high quality
- Problem with certain clothing like the hakama
- Potential problems with poses that are very close to each other
- Camera and position are important

With some work this could be very helpful to correct posture and position when a student is training alone

Future Work

Creating a better display for the classifier that shows current step of the kata, next step, and if it is complete

Figuring out a way to make the model more robust so that it can detect even with a hakama

Adding more kata or other things to the classifier to expand the usage

References

[1] MOHD SANAD ZAKI RIZVI, JUNE 14,2019

<https://www.analyticsvidhya.com/blog/2019/06/build-machine-learning-model-in-your-browser-tensorflow-js-deeplearn-js/>

[2]

<https://medium.com/tensorflow/real-time-human-pose-estimation-in-the-browser-with-tensorflow-js-7dd0bc881cd5>

The Coding Train youtube series

<https://www.youtube.com/watch?v=FYgYyq-xqAw>