Yoga Pose Detection Application Project Proposal

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COSC 490: Student-Directed Seminar

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February 18, 2022

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Over the last two years, COVID-19 resulted in a rise in popularity of at-home exercising due to public health measures including the closure of gyms and social distancing (Lesser & Nienhuis, 2020). Yoga is an exercise that is welcoming for all ages and provides health benefits such as improved health, strength, flexibility, fitness, and a reduction in depressive symptoms (Shaw & Kaytaz, 2021 & Jain et al., 2021). According to Andersson and Andreasson (2021), over the course of the pandemic, group fitness instructors had a negative attitude toward streaming classes and most were reluctant to teach online. In a virtual setting, instructors encounter many challenges, such as providing motivation and appropriate feedback to their clients for encouragement and to prevent injury. Learning Yoga and avoiding injury becomes more challenging when an individual attempts poses on their own without the presence of an instructor. Our goal is to provide a tool for clients, and potentially instructors, to address some of these issues by training a Convolutional Neural Network (CNN) to learn common Yoga poses and recognize when a user is correctly and incorrectly performing certain poses.

Application Description

The application will present a Yoga pose routine that has a series of 10 poses for the user to attempt. The user will either upload an image of themselves doing the pose, or the app will use a timer to take a picture of the user's pose. After receiving the image, the app will classify the user's pose; this classification is performed by the trained CNN model which will match it to one of 10 yoga pose classes. If the classed yoga pose does not match with the routine, then the model will assume that the user is incorrectly performing the pose and will inform the user that their pose "Needs Improvement." If the user's pose is classified correctly, the app will inform the user that their pose is "Correct."

Technical Overview

This project consists of two layers: the application layer and the model layer. The application layer will be a python-based application, initially starting in the terminal, with potential to be expanded to include a graphical user interface (GUI) as well as web hosting. These features are considered to be quality of life improvements (QOL), and will be implemented if additional time and resources are available. The application layer will act as an interface between the user and the model, prompting the user to perform a pose, and take a picture. This picture will be preprocessed by the application layer before being sent to the model for classification. Once classified, the model will present its findings to the application, which will then provide the user with feedback regarding how accurately they performed the specified poses. The model will follow the standard structure of a CNN, with the goal of being able to correctly classify poses being performed. The exact details of our model will be determined

through experimentation using the dataset of our choice. Provided additional resources are available, another QOL improvement we would like to implement is the ability for our model to perform classification on video and live video, to allow for users to receive feedback in real time.

Dataset

There are numerous datasets available for yoga poses; however, we decided to use this dataset: Yoga-82: A New Dataset for Fine-grained Classification of Human Poses (Verma, Manisha and Kumawat, Sudhakar and Nakashima, Yuta and Raman, Shanmuganathan). This dataset was chosen because of the quality of images, with many being very clear, and some images presenting noise. In addition, this dataset contains popular poses, and our goal is to classify poses which are considered to be more common and well known.

If the selected dataset does not work as expected, we found the following alternatives:

- https://www.kaggle.com/niharika41298/yoga-poses-dataset
- https://www.kaggle.com/shrutisaxena/yoga-pose-image-classification-dataset

Aspirations

There are many goals outside of the scope of the model creation that we would like to achieve. In addition to providing feedback about pose correctness, we would like our app to also provide suggestions on how the user should correct their pose. For example, if the user was incorrectly trying to attempt a dog pose but their back was bent instead of straight, our app would provide the feedback: “Straighten your back!” In order to reduce the overhead of image uploads, our goal for the app would be to run live footage of the user and provide live feedback. Challenges for this implementation would be figuring out how to process video files and how to provide live feedback on top of a live video feed. Finally, we would like to run this app outside a terminal in order to test this application in a user-friendly setting, and we acknowledge this feature as a challenge because it requires more advanced development knowledge.

Overall, we want this app to show that users can learn at-home exercises with the help of convolutional neural networks, and we hope that this project introduces new ways to improve virtual teaching to help with learning exercises and reduce the possibility of injuries.

Limitations

There are many limitations to our Yoga pose detection application. There is no professional injury prevention detection in the detection model, and the dataset being used has biases based on body shape, skin tone, and other characteristics that may result in incorrect classifications for certain individuals. Furthermore, none of our group members are yoga instructors and as such, we will be relying on external resources and datasets that may or may not provide correct yoga pose information. Should further limitations arise, we will discuss them in detail in our final report.

Timeline

Week	**Tasks**
Week 1 (2/14 - 2/20)	1. Complete Proposal 2. Select Dataset 3. Research topic
Week 2 (2/21 - 2/27)	1. Choose model 2. Customize model 3. Start model training 4. Finalize Schedule
Week 3 (2/28 - 3/6)	1. Continue training model 2. Optimize model from the output of the model
Week 4 (3/7 - 3/13)	1. Start making the application 2. Design the application 3. Processing classification output to make more optimization for the model
Week 5 (3/14- 3/20)	1. Complete classification model 2. Continue building the application 3. Start incorporating the model into the application
Week 6 (3/21 - 2/27)	1. Finalize the application 2. Run first-time demo 3. Debugging
Week 7 (3/28 - 3/31)	1. Documentation (report, readme, etc.) 2. Prepare for presentation
Week 8 (4/1 - 4/10)	1. Complete documentation and wrap-up

References

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