

EE/CprE/SE 491 WEEKLY REPORT 03

10/11/24 – 10/18/24

Group number: 11

Project title: Slowpitch Softball Pitch Detector

Client &/Advisor: Nick Fila

Team Members/Role:

Andrew Vick - Machine Learning Integration

Casey Gehling - Client Interaction

Sullivan Fair - Individual Component Development

Ethan Gruening - Team Organization

Josh Hyde - Research

Cameron Mesman - Testing

- **Weekly Summary**

This week, we developed a much better model that can more accurately determine the height of the ball. Additionally, we enhanced some machine-based AI learning models that scanned thousands of pictures to more accurately identify the softball consistently. Lastly, we started developing a rough sketch idea of what we might want our flutter app to look like.

- **Past week accomplishments**

- **Andrew Vick:**

- This week, I continued training and testing a non-linear regression model to accurately predict the ball's distance from the camera. Our group went to a softball field to capture some video and test/train the model to further improve the accuracy of the model. From our testing, we found that the model will work to find the distance to the ball even when the ball is far away. However, we will need to refine the height calculations as they were slightly off.
- TLDR
 - Tested model on softball field
 - Collected video data for further testing

- **Sullivan Fair:**

- This week, I spent time prototyping a MOSSE-based softball detection script to see what was possible with non-machine learning. I also went to the softball fields with other members of the team to collect videos with height references that will hopefully allow us to further develop our machine-learning approaches to detecting the height of the ball. Finally, I finished my screen sketches and provided them to the team to review.
- TLDR
 - Developed MOSSE detection script
 - Collected video data for detection training
 - Finished screen sketches and shared them with the team to review

- **Casey Gehling:**

- This week, I continued prototyping our app within Flutter, experimenting with different methods of interfacing the app with a phones built in camera. I found a dart package that will be useful in our implementation, and I am continuing to experiment with Flutter and the overall hierarchy of our app.
 - Considered some different options for video storage for the app for previous calls – experimenting with either using SQLite or a different storage strategy for organizing videos internally.
- Created a screen sketch for our application. Mainly wanted to focus on what the camera implementation will look like and what UI elements we can include on that screen. Went back and refreshed myself on

some good UX design strategies so that we keep a consistent design strategy for our application going forward.

- **Ethan Gruening**

- This week I worked to write the slides for Lightning Talk #3, evaluating our user needs and the engineering standards associated to our project.
- I additionally created the calibrate-color branch in GitHub. Within this branch is a calibrate.py script which can act as an imported function to use OpenCV to view a softball in random distances and frame positions. This will compute and return the average ball RGB color of the softball given the certain lens and lighting. This can be used in the non-machine learning object detection for detection by color.
- I continued research on height detection with using gyroscopic sensors within iOS and Android devices and how that may help us calculate height given a set of coordinates. Having the angle at which the camera is recording, you can use trigonometry to determine the distance of the ball from the camera.

- **Josh Hyde**

- This week I worked on creating my own screen sketches for the potential flutter app that we will be using for our project. I tried to create a settings/calibration page to control some of the different variable options for our app. I also created a page that is meant to contain some of the past pitches that were recorded and the time of when the pitch happened as well as the result of the pitch.
- Additionally, I put in work researching a potential non-AI-based object detection solution for our project to detect a softball consistently and accurately. I also revised my code to be able to work better for softballs that are farther away, as most of the models I had before didn't really work for softballs farther away from the camera and made it slightly better, however, it only goes a certain range and doesn't really work past that. I tried using a model that wouldn't only rely on color detection but also some movement detection as well.

- **Cameron Mesman**

- This week, I continued to develop screen sketches for our potential app. The sketches are just to generate ideas on what the different screens could look like and what features we'll want on each screen. The details and final design of each screen will be determined later after we've evaluated the pros and cons of all our sketches.
- I also continued to research photogrammetry to find effective ways to calculate the height of the ball without machine learning.

- Lastly, I started looking into Flutter since that's what we'll likely be using for app development. I just wanted to get a grasp of the basic concepts of how the software works and what tools it offers that we can make use of.

- **Pending issues**

We will need to work on converting our detection and tracking logic over to C++, and find a framework to develop an Android and IOS app that can run C++ code on the phone. We are also still running into issue with getting accurate distance data and then using that to find the height of the ball.

- **Individual contributions**

<u>NAME</u>	<u>Individual Contributions</u> <i>(Quick list of contributions. This should be short.)</i>	<u>Hours this week</u>	<u>HOURS cumulative</u>
Andrew Vick	OpenCV testing, Object detection, photogrammetry research	5	30
Casey Gehling	Screen sketches, flutter camera integration, video storage research/experimentation	4	29
Sullivan Fair	Screen sketches, pushed default Flutter app	4	28
Josh Hyde	ScreenSketches for app, Research into non-AI based object detection	5	29
Ethan Gruening	Height detection research, OpenCV calibration, presentation templating	5	30
Cameron Mesman	Object height/OpenCV research, product research, react refresher	3	15

- **Plans for the upcoming week**

- Andrew Vick
 - Refine height calculations
 - Port my code from Python to C++
- Casey Gehling
 - Finish app camera implementation, start implementing app based on compiled

team screen sketches

- Experiment with ways to create a minified OpenCV C++ library so that our application size isn't too bloated with unnecessary features
- Continue experimenting with video storage strategies.
 - Potentially just cache videos for apps lifecycle
- Ethan Gruening
 - Test the color range for detection by color on different cameras and settings
 - Test and calculate more height detection techniques
 - Integrate the calibrate.py into the ball_track.py
- Josh hyde
 - I want to make a more solidified well designed and visually appealing screens for our app that we want to develop.
 - I want to put a little more effort and time into seeing what non-AI-based object detection solutions may work for our project
- Sullivan Fair
 - Review screen sketches with the team
 - Further research on non-machine learning object detection
 - Determine if non-machine learning will work for our desired implementation
- Cameron Mesman
 - Look over everyone's screen sketches and start developing sketches that implement the best features of all of ours.
 - Continue looking into Flutter for app development.