***EE/CprE/SE 492 SEMESTER 2 WEEKLY REPORT***

***4/4/2025 – 4/17/2025***

***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***

o **Weekly Summary**

* **4/4 - 4/10**
  + Trained a new YOLO model on our custom dataset of images taken at the softball fields. Then deployed and tested the new model at softball fields, we also tested the accuracy of our height calculations.
* **4/11 - 4/17**
  + Testing the trained YOLOv8 model showed great accuracy and inference time. We can improve the accuracy and inference time with a YOLOv11 model, and the new model training has started. The translation from the YOLO coordinate system to the image’s coordinate system has been difficult and we have began looking into mapping our key field points in the YOLO coordinate system to standardize our coordinates. Additionally, prototypes have been made for both arming the system and pinpointing the maximum height of the pitch.

o **Past week accomplishments**

* **Andrew Vick:**
  + **4/4 - 4/10**
    - This week, I worked on training the model with our new custom dataset we gathered at the softball fields. Then, we deployed the model and returned to the fields for further testing. In our testing, we found that the screen and camera previews were orientated incorrectly, so I also worked on fixing that as well.
  + **4/11 - 4/17**
    - Worked on adding better debug logs to understand better where yolo is saying the ball is at on the screen versus where the coordinates for the height reference lines are.
    - Looked deeper into the issue with confidence, coming back as 100% no matter what was being detected. I found out that it's how the plugin and iOS handle confidence calculations. To fix this, the ultralytics team recommends writing our own swift code for handling the post-processing of detections.
    - When looking into how to fix the confidence scores, I found out that we can actually run the newer Yolo11 architecture instead of relying solely on the outdated and poorer yolov8n model architecture. I then began training a new yolo11s model, which should help us not only achieve a more accurate track of the ball when it's in flight but also find the ball from greater distances and improve inference times.
* **Sullivan Fair:**
  + **4/4 - 4/10**
    - This week, the model was finished training and went to the fields, where we recorded the training videos to test. Our new model can detect the ball from farther away, but it is still inconsistent with finding the ball in general.
  + **4/11 - 4/17**
    - Continued working on the bounding box to arm the pitcher. In its current state, I can draw the box on the screen, but there is a mismatch between the Yolo camera preview and the setup picture coordinates.
    - I also spent time testing our updated model, which had much better results. We are getting very accurate tracking with fast inference times. The bounding boxes lag when drawn, but more model refining may help.
    - Ethan updated the yolo screen to solely reference the yolo coordinate space, so we went to the field to test the new logic and were able to get reasonable height measurements! I was also able to implement the bounding box logic with the new coordinate system and we now have automatic arming of our tracking algorithm.
* **Casey Gehling**
  + **4/4 - 4/10**
  + **4/11 - 4/17**
    - Spent time testing our model and assessing results.
    - Fixed various UI bugs pertaining to initial camera setup – subject to change going into only using ultralytics, may remove the need for using flutter camera plugin as we have been using.
* **Ethan Gruening**
  + **4/4 - 4/10**
    - This week, I built TensorFlow’s Docker container to use the TensorFlow library in Python to export a trained YOLO model in TensorFlow Lite format for using the Ultralytics plugin on Android devices
    - Additionally, I linked the YOLO model running in the Ultralytics plugin to update the ball’s coordinates when a new object is detected to display the calculated height to the screen.
  + **4/11 - 4/17**
    - Prototyped the illegal handler where a listener is set up to monitor the ball coordinates and report the maximum height from a pitch.
    - Took some time to test the model, and analyzed the returned coordinates. There were inconsistencies with the coordinate system, so I began working on using only the Ultralytics Plugin for the setup to standardize the points.
    - Updated the UI for the widgets to be rotated correctly when using the portrait-oriented app in landscape.
* **Josh Hyde**
  + **4/4 - 4/10**
    - Worked an helped with the testing and debugging of our current model. It had some issues that we for the most part fixed for now.
    - Added an mp3 audio file of me saying “illegal” to be used in the future fir when an illegal pitch is called/detected. Could be slightly changed in the future to be a little quicker or maybe a little more legible, but I tried to make it as legible and as fast as possible so it can be used properly without many issues.
    - Looked into adding potentially of adding the pitching box around the pitcher’s mound to perhaps be used for when detecting when an actual pitch is being thrown and not just any ball being in frame.
  + **4/11 - 4/17**
    - Worked on adding the illegal audio on to the yolo model screen to be able to be played when an illegal height either being too high or too low is detected. Also worked on implementing a system that will detect if the max height of a ball is detected and the next 5 inputs are all less than that max value, then it will determine that max value to be the max height and then therefore used in the calculations for if the pitch is illegal or not.
    - Also helped to test the model on the field, particularly in getting a better idea of the coordinates we were getting and the edges of the screen.
* **Cameron Mesman**
  + **4/4 - 4/10**
    - This week, I helped test and train our new model
  + **4/11 - 4/17**
    - Tested our newest model out in the field. The ball is now being tracked pretty well, but the calculated height is inaccurate.
    - Brainstormed and tested what is wrong with the height calculations
* **Pending issues** 
  + **4/4 - 4/10**
    - The orientation fixes for IOS changed the Android orientation to be off now, so we might need more platform specific orientation changes.
    - Further testing and enhancing of our current model
    - Further work and implementation of pitching box and detecting when a pitch is being thrown and not just any ball in frame.
  + **4/11 - 4/17**
    - Our conversion of YOLO coordinates to standard image size is not functioning. We need a new way of mapping our coordinates used in height calculations.
    - Full functionality is present within individual components and need to be integrated into the full system.

o **Individual contributions**

| **NAME** | **Individual Contributions**  *(Quick list of contributions. This should be short.)* | **Hours this**  **week** | **HOURS**  **cumulative** |
| --- | --- | --- | --- |
| Andrew Vick | * **4/4 - 4/10**   + Trained and tested our new model, fixed screen orientations * **4/11 - 4/17**   + Testing, train yolo11s model | 7, 8 | 111 |
| Casey Gehling | * **4/4 - 4/10** * **4/11 - 4/17**   + Testing, UI | , 6 | 98 |
| Sullivan Fair | * **4/4 - 4/10**   + Tested our new model * **4/11 - 4/17**   + Model testing, bounding box development   + Implemented updated logic with yolo coordinate system, now have working implementation | 3, 8 | 119 |
| Josh Hyde | * **4/4 - 4/10**   + Testing, illegal audio, pitching box help * **4/11 - 4/17**   + Illegal audio, illegal pitch detection, testing | 5, 6 | 114 |
| Ethan Gruening | * **4/4 - 4/10**   + TensorFlow model, object detection linkage * **4/11 - 4/17**   + Testing, UI, Yolo Setup | 5, 10 | 143 |
| Cameron Mesman | * **4/4 - 4/10**   + Testing * **4/11 - 4/17**   + Testing | 2, 5 | 106 |

**Plans for the upcoming week**

* Andrew Vick
  + **4/4 - 4/10**
    - Continue refining the model and how the app interfaces with it
  + **4/11 - 4/17**
    - Get a new yolo11s model running on our app and test its performance against our already working yolov8n model.
* Casey Gehling
  + **4/4 - 4/10**
  + **4/11 - 4/17**
    - Final deliverables
    - Final UI updates and cleanup
* Ethan Gruening
  + **4/4 - 4/10**
    - Begin testing the Flutter/YOLO integration and debug as needed
  + **4/11 - 4/17**
    - Final Design Document
    - Poster
    - Continue implementing the YOLO coordinate system.
* Josh hyde
  + **4/4 - 4/10**
    - Enhance pitching box, try and fix android specific issues, make a more in-depth video with audio talking about different aspects of app.
  + **4/11 - 4/17**
    - Testing model
    - Final deliverables
    - Fixing bugs and making our app more efficient
* Sullivan Fair
  + **4/4 - 4/10**
    - Continue to test our detection model as it continues training
  + **4/11 - 4/17**
    - Refine the illegal logic to properly output the sound
    - Continue field testing our app
    - Work on final deliverables
* Cameron Mesman
  + **4/4 - 4/10**
    - Continue testing and refining our model
  + **4/11 - 4/17**
    - Continue testing
    - Fix height calculations
    - Work on design doc