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## EE/CprE/SE 492 BI-WEEKLY REPORT 1

Jan 25 – Feb 8

Group number: sdmay21-05

Project title: AR Chess Advisor

Client &/Advisor: Dr. Joseph Zambreno is both our client and advisor

Team Members/Role:

Dillon Peters: Team Lead

Parker Bibus: Computer Vision Lead

Jake Aunan: Augmented Reality Lead and Tuesday MOM Scribe

Jamie Peterson: Mobile Lead and Thursday MOM Scribe

Aidan Sherburne: Report Manager and Computer Vision Developer

Brett Santema: Testing Manager and Mobile/Glasses Developer

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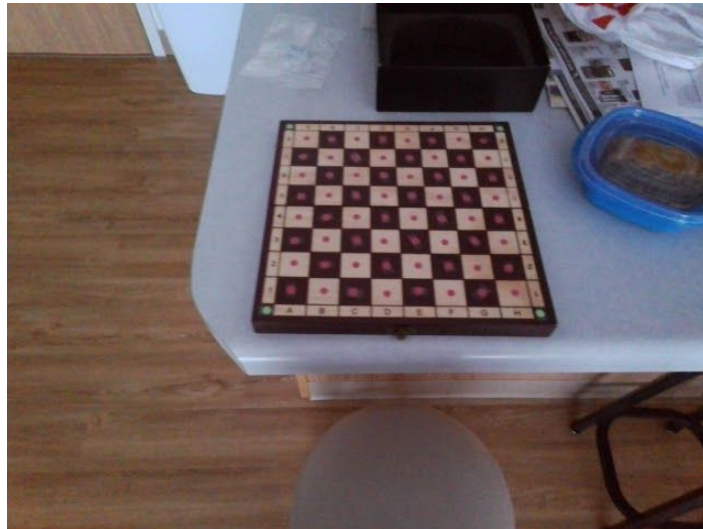
**Bi-Weekly Summary:** The team got back into the swing of things for the semester with our kickoff meeting Monday with Dr. Zambreno. We met to discuss the state of the project and changes we intend to make going forward this semester. We discussed any work that was done over winter break, and how it affected the project as a whole, mainly the decision to restart the computer vision module using a different approach. The first half of this reporting period was used to remind ourselves of the state of our project, our goals, and to discuss plans going forward before getting back to the actual work this past week. During the second half of the reporting period we made progress on the computer vision portion of the project and brought two team members up to speed on this notebook so that they could begin helping in developing this module. We also completed capturing test images for the computer vision module during this period.

Past two week accomplishments

- Dillon Peters:
  - Accomplishments and their description
  - Organization and Scheduling for the Semester
    - Created a doodle pool for team members and Dr. Zambreno that allowed me to schedule our meetings for the semester
      - Advisor Meetings (Monday 1-2)
      - Additional Team Meeting as necessary (Thursday 4-5)
  - Image Testing Set Generation
    - Generated about 1000 real game images by playing a few games in different lighting conditions, with different backgrounds, and from different angles. The image seen below is one of the top down angled images in natural light.



- Generated additional images of the empty chess board so that Parker and Aidan have a variety of images for square and dot detection. One of these images can be seen below:



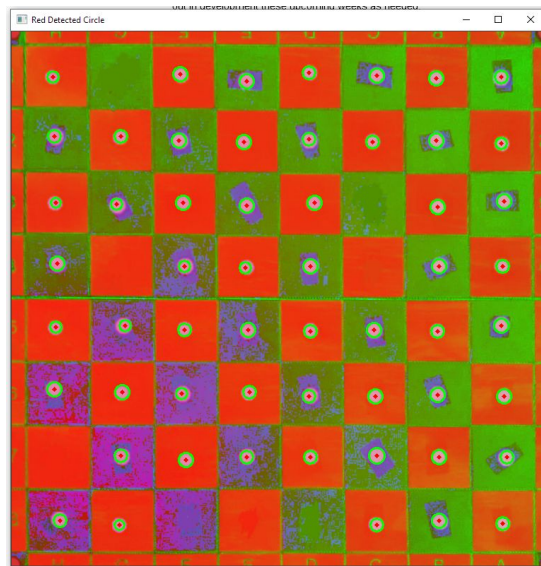
- Briefed on and began looking at the computer vision codebase
  - Met with Parker, Aidan, and Jake Friday from 2-3 to discuss the new approach to computer vision this semester and decide on how we can best allocate developers. Decided we would swap Jake to Computer Vision for now with potential to swap Brett as needed in the future. Installed necessary software for CV. Spent time looking over the

codebase and familiarizing myself so that I can help out in development these upcoming weeks as needed.

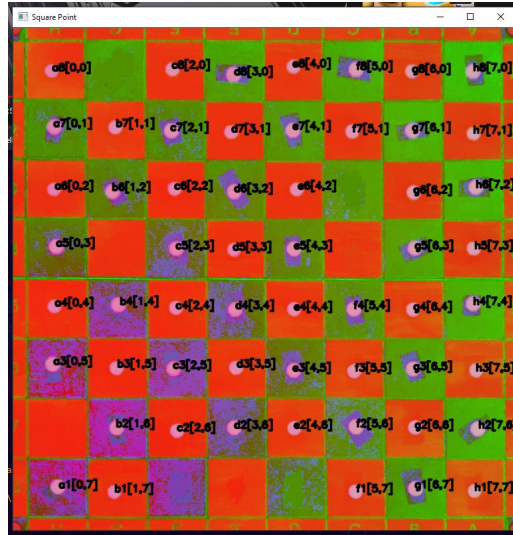
- Discussed the testing plan with Brett for the semester
  - Discussed what the testing plan should look like and how it should be expanded from our design document brief. Also discussed a timeline for the android side testing and test case generation.
- Created Bi-Weekly Report Template to be used for future reports
- Parker Bibus:
  - Introduced Dillon and Jake to the computer vision code base and pipeline.
  - Added documentation to the main code file following the style guide from: <https://github.com/google/styleguide/blob/gh-pages/pyguide.md#38-comments-and-docstrings>
    - Example documentation:

```
def find_board_corners():  
    """Finds the corners of the board using green circles for corner designators.  
  
    Returns:  
        The corners arranged in clockwise order from the close left corner and an accuracy metric  
        to determine if all 4 corners were found. (returns corners, accuracy).  
    """
```

- Implemented a simpler code pipeline
  - Implemented a simpler pipeline to make the flow of the codebase easier to understand and more modular as Aidan and I were slowing on the progress being made.
  - This included setting up basic color and shape detection and then turning the received data into a board output.
  - Example of detected spaces:



- Example of board output:



- Jake Aunan:
  - Got up to speed on computer vision work that had been done last semester.
  - Familiarized myself with our computer vision code that Aidan and Parker have been working on.
    - This semester I am transitioning from working on the Vuzix front end to the computer vision back end to balance out the workload needed for each area of the project.
- Jamie Peterson:
  - Chess Engine Difficulty Activity
    - Working on implementing an activity that will allow us to set the difficulty of the stockfish engine and researching the commands to set engine difficulty
- Aidan Sherburne:
  - Chess board cell individualization and framing



- Cell labeling - The above image is a screenshot of an individually boxed and

- o labeled cell D2
  - o Program organization and documentation
- Brett Santema:
  - o Testing Plan Development
    - Started working on the detailed testing plan and further flushed out acceptance criteria for our functional requirements

**Pending issues**

- Dillon Peters - Android Studio Failed to Recognize the Vuzix Blade
  - o When trying to connect the blade to my computer to deploy the updated application and view/download the test images, I was unable to get Android Studio to recognize the device. Despite reinstalling Android Studio and various other debugging attempts over the course of three hours, I was unable to get connection upon plugging the device in. Eventually, I was able to get Android Studio to recognize the presence of a device, but was told the device is not an Android Device. After spending about three minutes pressing the refresh button on the device list, I was finally able to get Android Studio to recognize Vuzix as an Android Device so that I could deploy the application. I am unsure why it was not recognized initially or why it showed up all the sudden, so this issue is something to keep an eye on.
- Brett Santema - How will computer vision pipeline be tested
  - o Still need to communicate with the CV team to figure out how testing the CV module will work, and also figuring out how communication between the app and the CV module will work since that will affect testing.
- Jamie Peterson - Visuals for changing the difficulty settings. Had some issues with my gradle changing its core file from its project version to my studio version.
  - o I know the command to send, but I am struggling with the visual activity to implement the command. I do not expect this to block me for much longer. The gradle stuff has been fixed but I'm marking it in case it comes up again.

Name	Individual Contributions	Hours this Period	Total Hours So Far
Dillon Peters	Organization and Scheduling for the semester, Testing Image Set Generation, Testing plan timeline, Report Template Creation, Testing Plan Timeline	16.5	16.5
Parker Bibus	Code cleanup, chess board detection, corner and cell	18	18

	masking, perspective shifting, and program documentation. Begin work on cell state determination		
Jake Aunan	Jake spent the period familiarizing himself with the computer vision module, installing necessary software, and brainstorming next steps and solutions to existing CV problems	10	10
Jamie Peterson	Activity for changing the difficulty of the stockfish engine	10	10
Aidan Sherburne	Chess board cell individualization, labeling, framing, and program documentation.	12	12
Brett Santema	Testing Plan Creation and further flushing out of acceptance criteria	2.5	2.5

### Plans for the upcoming week

- Dillon Peters
  - Look at Python Wrapper for Stockfish Engine
    - Explore this wrapper class and its existing functionality and how it can be used for our project.
    - Implement additional methods or tweak existing methods as needed
    - Determine how this will integrate into the existing computer vision module and android application
    - Prepare the wrapper for integration with CV branch
  - Merge master branch into computer vision branch
- Parker Bibus
  - Testing realistic parameters for viewing board with current setup
    - Taking images and trying to figure out where our current setup fails
  - Implement a loop for scanning sequential inputs
    - Allow video inputs so we can start catching changes between inputs like the final loop will be.

- Jake Aunan:
  - Updating Check Cell Method to Detect Chess Piece Color
    - We can currently detect if a square is occupied, but now need to determine which color piece is there for the scenario where a piece is captured.
- Jamie Peterson:
  - Combining Image Capture and Display Move Activities
  - Activities for setting the engine difficulty (ELO)
    - Easy, Medium, Hard, Grandmaster Difficulties based on an ELO System
  - Look into ways to cut down on the battery usage
    - Explore brightness and camera usage changes
- Aidan Sherburne
  - Cell state determination
    - Determine whether a cell is occupied by a piece or not without spot dots
- Brett Santema
  - Testing Plan and Unit Tests
    - Give a lot more detail to the testing plan, consult with the team to further refine acceptance criteria, establish more of a plan for unit testing and get started with some basic unit tests for the android side.

**Summary of weekly advisor meeting** We met with Dr. Zambreno on 2/1 from 1:00-2:00 to kickoff 492. We used this meeting to discuss our progress during the first week of the semester and over winter break. Only Dillon, Parker, and Aidan, had updates to share at this meeting. Of these updates, the major one was the computer vision restart. Parker reached out to a faculty member who had published various computer vision paper's over winter break asking for advice, and this faculty member recommended that we start over and try to develop an end to end approach rather than continuing with what we had. Aidan and Parker agreed with the recommendation as they were at the point where it was difficult to make CV progress as they did not fully understand the codebase. Upon expressing this to Dr. Zambreno, he was extremely concerned as he is not only our advisor, but also our client and he felt the restart would greatly impact the timeline and what we can deliver by semester's end. In restarting, we had no intention of changing the end deliverables or the timeline. He was skeptical, and requested to see substantial progress for our meeting Monday.