**Senior Project Weekly Status Report**

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**Project Title: Computer Vision Boggle Solver**

**Team Members (if applicable): N/A**

**Project Description: A software which takes a camera feed of a boggle board and returns all possible combinations of words it could find.**

**Technologies Used: TenorFlow, Python, OpenCV, NumPy**

**GITHub URL: https://github.com/Jordan-m-jarvis/BoggleSolver**

**(Add MountainDad as collaborator)**

**Week 1: 9/19/20**

Overall Status (on-schedule, behind, ahead): On Schedule

Number of hours worked this week: 9

Total number of hours worked on the project thus far: 9

Number of total hours anticipated at completion: 130

Accomplishments: Generated Idea, Researched technical challenges, started planning out documents.

Challenges: Taking brainstormed ideas and selecting one that fits the criteria of the course.

Identifying which language to use.

Identifying which libraries to use.

Identifying the potential algorithms and techniques to use.

Plans / Goals for next week: Finish my proposal and come up with enough data to get started on the project.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): No SPED talk available.

Other comments for the instructor:

**Week 2: 9/26/20**

Overall Status (on-schedule, behind, ahead): On Schedule

Number of hours worked this week: 9

Total number of hours worked on the project thus far: 18

Number of total hours anticipated at completion: 130

Accomplishments: Proposal completed, brainstorming completed, technology and library research and choice completed.

Challenges: Trying to understand what will work well with other systems and APIs is very difficult when the project you plan to implement has so many moving parts.

Plans / Goals for next week: Get GitHub running and the initial steps going with design documents and class setup.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): No Sped talks on the SPED talk board. Please notify me if they are posted elsewhere.

Other comments for the instructor:

**Week 3: 10/03/20**

Overall Status (on-schedule, behind, ahead):

Number of hours worked this week: 12

Total number of hours worked on the project thus far:30

Number of total hours anticipated at completion:130

Accomplishments: Created colab notebook on google to power the object recognition model. Created a data-set of boggle boards with pictures and annotations on them. No GitHub yet, just experiments on the data-sets and attempting to get custom object recognition libraries running.

Challenges: Object recognition training takes around 25-40gb of ram when running. My laptop only has 16gb. I needed to tap into google colab to get enough ram and processing power to train the network. The problem is that sessions are only 1 hour long then you lose progress and have to restart. So I ruin the model for 55 min then download the partially trained model, then upload and continue training for another 55 min.

Plans / Goals for next week: Get gitHub up, put annotations and training data on github along with the trained or partially trained model and the code used to train the model. Get warp-affine working and a few filtering steps on the images taken from the webcam. Apply a grid and crop feature which takes the largest polygon and crops to it.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): I always struggled with grid layout not looking how I liked it. The SPED talk actually helped me understand why. Whenever I would make the grid I never added it to a smaller grid. Effectively I never figured out how to get it to automatically arrange in a way that I wanted it to

Other comments for the instructor:

**Week 4: 10/10/20**

Overall Status (on-schedule, behind, ahead): On-schedule

Number of hours worked this week:13

Total number of hours worked on the project thus far:43

Number of total hours anticipated at completion:130

Accomplishments:Data set created for boggle training and alphabet detection. May need more data, but a good start exists. Created boggle alphabet filtering and cropping algorithm to create data-set.

Challenges: Cropping and Gaussian blur work differently in python 3.8 than 3.7. I had to make a check and ensure it worked for both versions as TensorFlow works in 3.7 but the multiprocessing features I use are in 3.8.

Plans / Goals for next week: Create an alphabet recognition TensorFlow model and train the second model to recognize the letters instead of the board.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): I liked the fact that it went over Angular. I didn’t know what angular was before. I always heard it is difficult to learn, but makes awesome interfaces. Now I understand why it may be difficult to learn. It also is nice that it can make single page interfaces which are so flexible.

Other comments for the instructor:

**Week 5: 10/17/20**

Overall Status (on-schedule, behind, ahead):on-schedule

Number of hours worked this week:10

Total number of hours worked on the project thus far:53

Number of total hours anticipated at completion:130

Accomplishments: Created basic path-finding algorithm for searching for words in a matrix of chars. Ran training and created a custom architecture for the neural network being used for the letter orientation and recognition system.

Challenges: Ram. I am running out of ram all the time. Object recognition models are large when training.

Plans / Goals for next week: Modify the system I have to use more objects, add error reporting and correction to a lot of areas of the code. It is extremely buggy and I need to spend a while fixing various bugs before continuing.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): I like that John went over Q-Learning. I have wanted to use it in the past, but I didn’t quite understand the concept behind it. Now that I understand it more I know that it would not have been a good option for this project, but definitely something I will have to use for other projects in the future.

Other comments for the instructor: N/A

**Week 6: 10/24/20**

Overall Status (on-schedule, behind, ahead):on-schedule

Number of hours worked this week:12

Total number of hours worked on the project thus far: 65

Number of total hours anticipated at completion:130

Accomplishments: Neural network architecture achieves a 99.94% accuracy when detecting characters and runs in less than 40 MB of ram. It also does 16 characters in under 40 ms.

Challenges: Tensor-flow can be a pain to work with. Training the model uses almost the entire GPU’s memory.

Plans / Goals for next week: Connect the neural network to a queue thread and feed it test data from a live feed.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): LSTM is an interesting concept. I like that Abdias went over short term memory in neural networks. It is a weak point for me and I am actually thinking about adding some short term memory in my project because of the presentation.

Other comments for the instructor: N/A

**Week 7: 10/31/20**

Overall Status (on-schedule, behind, ahead):on-schedule

Number of hours worked this week:14

Total number of hours worked on the project thus far:79

Number of total hours anticipated at completion:130

Accomplishments: Added multiprocessing support and queues. Created a display thread, a set of workers, and a NN thread along with the main program.

Challenges: Threading has all kinds of issues, ensuring one thread does not bottleneck the others is important, by moving more work to one thread instead of others it can help a lot.

Plans / Goals for next week:Add a boggle solving thread for the solver. Convert data to something the solver can recognize.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): MVC is really interesting, It looks like a great way to organize code. While I feel there are better ways to do this, I think this is a great way to get started if you struggle with organizing your code.

Other comments for the instructor: N/A

**Week 8: 11/07/20**

Overall Status (on-schedule, behind, ahead):on-schedule

Number of hours worked this week:14

Total number of hours worked on the project thus far:93

Number of total hours anticipated at completion:130

Accomplishments:Weeded out many multiprocessing issues. Turned the boggle solving algorithm into an object and debugged a ton of that. Load balanced and created a way to launch the NN on GPU instead of CPU making it need much less processing power.

Challenges: Multiprocessing, file locks with the NN model, and random bugs all over the place all gave me a run for my money this week.

Plans / Goals for next week: Data transformation and error detection in the video feed to put the data into the boggle solver object thread.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): I am not a fan of front end development. Anything which helps with front end development is sometihng I am a huge fan of. When considering the time investment in front end work versus the reward I just don’t find it to be rewarding enough.

Other comments for the instructor:N/A

**Week 9: 11/14/20**

Overall Status (on-schedule, behind, ahead):On-schedule

Number of hours worked this week:10

Total number of hours worked on the project thus far:103

Number of total hours anticipated at completion:130

Accomplishments: First boggle board was successfully solved by copying data from one function to the next. The process is not automatic though and still needs a lot of error correction and needs to know how to deal with non ideal data. Accomplished all goals for this week.

Challenges: Once again, the biggest issue is the integration of the different components and managing all the bugs that come from integration.

Plans / Goals for next week: Automate the connection between different components and processes. All sub processes are mostly complete, connecting them together is the big push now.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week):

x11 is interesting, I use it all the time and I am a linux user as well. I didn’t realize how easy it could be to code for. I always assumed it was something that was just operating system level so I have never used it aside from using GUI builders. It looks like it could be pretty interesting to develop for.

Other comments for the instructor:

**Week 10: 11/21/20**

Overall Status (on-schedule, behind, ahead):Ahead

Number of hours worked this week:10

Total number of hours worked on the project thus far:113

Number of total hours anticipated at completion:130

Accomplishments: Successfully connected parts together. The back-end is mostly complete aside from a few bugs. Gui development and a few tests still need to be completed.

Challenges: Testing has been neglected for a while. Developing tests this late is not good practice and has made it more difficult.

Plans / Goals for next week: Have GUI for boggle solving output mostly developed. Make a handful more tests.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week):Azure is mostly an extension of windows server in a data-center. I used to work in IT and I love Azure. I personally have used it to automate installation of software and update systems to be compliant with HIPAA for medical services. I never used the database in the past though as I didn’t know SQL. Now that I know more SQL I am curious how the experience would be.

Other comments for the instructor:N/A

**Week 11: 11/28/20**

Overall Status (on-schedule, behind, ahead):on-schedule

Number of hours worked this week:9

Total number of hours worked on the project thus far:122

Number of total hours anticipated at completion:130

Accomplishments:GUI shows all four windows and updates images on the fly.

Challenges: GUI elements all have their own objects. Getting data into the objects is difficult sometimes. I had to re-write a bit of code to get it up and running. I also had to choose between QT and Tkinter for the library for the gui.

Plans / Goals for next week: Polish everything as best as I can. Everything is at least to a basic degree working.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week):none this week, but I will do one from the ESP32 from last week. I learned a lot about ESP chips. I have used them once or twice and I own an arduino. I have various esp32 devices built into smart light bulbs, smart locks and other smart home products and now I know how to re-program them. Or at least how to start.

Other comments for the instructor:N/A

**Week 12: 12/05/20**

Overall Status (on-schedule, behind, ahead):behind

Number of hours worked this week:12

Total number of hours worked on the project thus far:134

Number of total hours anticipated at completion: 130

Accomplishments: Finished enough to be ready to present.

Challenges: Still has a rough GUI and does not exit gracefully.

Plans / Goals for next week: Potentially work on GUI and refine the UX.

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week): Kotlin looks like a language that would be very good. The problem I see with it is that it is so specific. I did find it easier to learn than java, but I feel like Java has a lot more flexibility when it comes to the platforms it can run on. Kotlin is mostly for android development and that makes it difficult for me to want to learn. Overall I think he did a good job at explaining Kotlin though.

Other comments for the instructor: N/A

**Week 13: 12/12/20**

Overall Status (on-schedule, behind, ahead):

Number of hours worked this week:

Total number of hours worked on the project thus far:

Number of total hours anticipated at completion:

Accomplishments:

Challenges:

Plans / Goals for next week:

SPED Talk Insight (Briefly describe an insight or something interesting you learned from the SPED talks this week):

Other comments for the instructor: