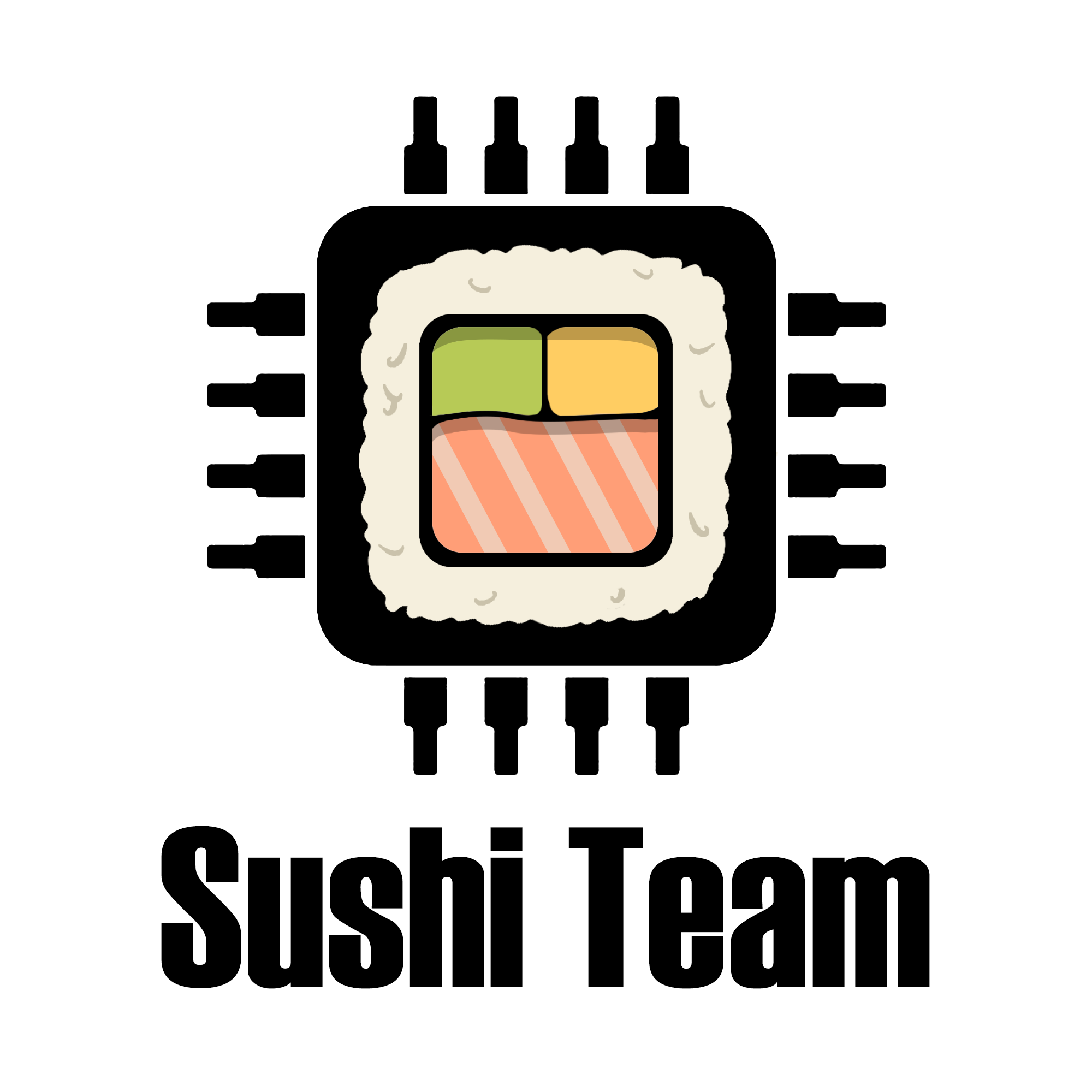
**Prototype #2 Meeting Agenda**

When & Where: April 21st, 2022 ~ 1:00pm - 2:00pm @ Zoom

Attendees: Dr. Jared Macshane, Dr. Shaunn-inn Wu, Sushi Team



\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Beginning/Formal Greetings (Noah - Team/Scrum Leader)**

**Current Requirements / Network Diagram (Jordan - Documentation/Training)**

* Develop a system to receive and process Google Street images from a user (the Web App team).
  + Google Cloud/ML-Server Instance | TCP connection
* Develop a Machine Learning algorithm that must be able to detect instances of litter in the received Google Street images.
  + fixIT Dataset | Roboflow | Newly Annotated Dataset | YOLOv5 ML-Algorithm
  + *Newly Provided Google Street Images | Dr. Schultz’s Students Assistance*
* Once the litter instances have been identified, the system must then process and output the results into a suitable format, like JSON, for the user (Web App Team).
  + Processed Google Street image results
* Once the results have been made, the system must then return the processed data to the user (Web App Team).
  + TCP connection
* *Train the final algorithm to categorize different kinds of litter (Contingent on the completion of other requirements)*
  + *Newly Provided Google Street Images | Dr. Schultz’s Students Assistance | Newly Annotated Dataset*

**Project Management (Juan - Project Manager)**

* Recap estimates vs actuals, for both Hours & Costs. Costs based on a $23 hourly wage.
  + Phase 1 - Going over Mask R-CNN Model and gaining a better understanding of machine learning concepts.
  + Phase 2 - Looked into the YOLOR model and switched to a new approach of a 2 phase model, where we first detect the litter in Google Street images, then, conditional, categorize that litter.
  + Phase 3 - Begin the construction of our system to receive, process, and detect litter in Google Street images from a user, for our Machine Learning project.
* Recap main tasks within Prototype #2.
  + Compile Annotation Documentation
  + Refinement - ML Training
  + Prototype 2 - ML Testing & Algorithm Processing
  + Build pipeline to Web App Team
  + Collate Litter Metrics
  + (Conditional: Categorize Litter) Initial - ML Training
  + (Conditional: Categorize Litter) ML Testing & Algorithm Processing

**List of Deliverables (Miguel - Programmer)**

* Provide a functional litter detection algorithm that consists of:
  + Getting an input of Google Street images
  + Processing them through the litter detection
  + Output the data, consisting of images with bounding boxes, and a JSON file, signifying the total amount of litter detected in the picture.
  + Schedule a hook by which the Web App team can use the algorithm.
  + Send the output data to the Web App.
* To achieve this, we are using the YOLOv5 model as the engine for litter detection.
* Also, our repository, which will contain the code, documentation, and eventually the fully functional, modified YOLOv5 model.
* Conditional litter detection feature:
  + Categorize the litter (e.g. Plastic, Paper, Organics,...).

**Analysis & Design (Keith - Programmer)**

* Transitioned from the YOLOR model to the YOLOv5 model, based on the results we were seeing.
  + YOLOv5 design rundown.
    - Divides each Image into a grid.
    - Multiple model configurations
  + YOLOv5 process rundown.
    - A Cross Stage Partial Network
    - A PANet Feature Pyramid Network
    - The Model Head
  + YOLOv5 benefits rundown.
    - Utilizes PyTorch machine learning framework
    - Training optimization using SGD or ADAM
* Utilizing a previous semester’s pre annotated dataset. This allowed us to refine our training techniques while waiting for the WEB APP group to provide a new set of images.

**Prototype #2 Functionality (Noah - Team/Scrum Leader)**

* The general functionality of our ML algorithm has more or less stayed the same within this Prototype 2 phase, as it was deemed acceptable, with no need for changes, by our ML supervisor & client.
  + TCP pipeline, from the Client (Web App team) to the Server (ML Algorithm), through Socket Programming.
    - Start sending multiple images/files to Server.
    - Receive and Process images.
    - Save and Send results back to the Client.
    - Client receives results and Saves them.
* Minor changes have been made, in order to accommodate for the slight hiccup of newer versions of YOLOv5, and to work better with our newly produced weights within this Phase.
  + Newer versions of YOLOv5.
  + Represent better confidence levels for litter detection.
* Additionally, minor changes can be made to our script, in order to accommodate for different types of Google Street images.
  + (Low resolution) Street View Static API vs (High resolution) Screenshots

**Analysis & Design - Issues/Solutions (Keith - Programmer)**

* YOLOv5:
  + Actively being worked on, versus YOLOR, which is causing conflicts to our code.
  + Faster image processing results in lower precision when detecting objects.
  + Mosaic training - speeds up the training process, results in poor average precision when trying to detect small objects.
* fixIT Dataset:
  + Poorly annotated, and poor resolutions, Google Street image dataset.
* Solutions/Bringing it all together:
  + Based on the knowledge we gained through hundreds of iterations and training we were able to increase the accuracy of our model.
    - Hyperparameter Evolution training
    - Modified the YOLOv5 code to reject tiny bounding boxes that encompassed objects to not be verified as littler.
    - Utilized test time augmentations to modify aspects of an entire image, or just the bounding box.

**Final Thoughts/Goals (Miguel - Programmer)**

* Roboflow/Dr. Schultz’s students:
  + Students were added to the project and were given specific instructions on how to annotate.
  + However, issues arised:
    - Students are assigning themself “Jobs”.
    - Approving their own work & more.
    - Using the wrong tool for annotations.
    - Poor annotation quality.
    - Creating the new class “litter” among provided classes
  + Resulting in slowing down our progress.
* Merged Dataset, instead of a solely New Dataset
  + In order to get some use out of the small, new dataset we have right now, we are merging it with our old dataset.
  + We collapsed all the classes into just “litter”, and have begun training with the merged dataset. We’re hoping we can get some better results on our current litter detection.
* Moving forward:
  + In this next coming Phase, we’ll try our best, and hopefully Dr. Schultz’s students can do better too, to work towards categorizing litter, but we’ll have to see how things go these next couple of days.
  + If things don’t look well for litter categorization, we’ll commit to just litter detection for our final product.

Confirm and agree our current direction, and next direction for the coming phase:

* Most likely stuck with Litter Detection, refining our results.
* Will still aim for Litter Categorization.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**As a team - communicate with Jared on further requirements.**

**Summary**

**Meeting adjourned!**