## Sep 18, 2024 | [CAPSTONE KICKOFF](https://www.google.com/calendar/event?eid=XzYwcTMwYzFnNjBvMzBlMWk2MG80YWMxZzYwcmo4Z3BsODhyajJjMWg4NHMzNGg5ZzYwczMwYzFnNjBvMzBjMWc3MTFqOGMyMTZvczNjY3ExNjBzazhnaGc2NG8zMGMxZzYwbzMwYzFnNjBvMzBjMWc2MG8zMmMxZzYwbzMwYzFnOHAwajRkaTU4NHBqY2NwcDhncTNhY3BrNmQwamVkMW04Y29rYWhobzZrczQ2aDloNnAzMCBpdHAyMTA5QGNvbHVtYmlhLmVkdQ)

Attendees: [Abhik Biswas](mailto:ab5640@columbia.edu) [Adam S. Kelleher](mailto:ak4063@columbia.edu) [Harinder Singh Mashiana](mailto:hm3008@columbia.edu) [Isaac Tucker Peabody](mailto:itp2109@columbia.edu) [Kanisha Arpit Shah](mailto:ks4175@columbia.edu) [Mohini Mangesh Bhave](mailto:mb5157@columbia.edu) [rk3213@columbia.edu](mailto:rk3213@columbia.edu) [Shrinjay Kaushik](mailto:sk5288@columbia.edu) [Tina Cao](mailto:tc3334@columbia.edu) [David Oren Kessler](mailto:dk2592@cumc.columbia.edu)

Notes:

* **Primary Objective**: make something fast that can be used in a clinical environment
  + Want to detect safe vs. unsafe by detecting fluid and spinal cord in ultrasound images
  + **First goal**: is image even good or should the physician try again?
  + **Second goal**: Detect fluid with the highest possible accuracy on new images
    - Also want to figure out why existing models didn’t work well on the old videos
    - Videos have a temporal component - if we could add this temporal component into the model that would be great
    - Hyperparameter we could tune would be number of sequential frames that we choose to analyze (and number of skips between frames)
      * This idea feeds into the prospect of using siamese networks for our CV models
  + **Third goal**: combine with the object-detection model for spinal cord detection to create a final model / pipeline
* Ideas for data visualization:
  + Average number of frames per patient / per video
  + Check for existence of multiple images / videos for a single patient
  + Distribution of “good” images / other labels
* Techniques to consider:
  + CNNs
  + RNNs
  + Siamese Networks
* Link to [intro slides](https://docs.google.com/presentation/d/1mNFQcpqPx8YdYfq_5eYCiNCBTwuA3eulkgrQecsHTmk/edit#slide=id.p)

Action items

* Figure out meeting times with Ritvik: will likely be weekdays between 1pm and 2pm, starting with 2x per week

## Sep 27, 2024 | Meeting with Elsevier

Notes:

* **Goal for next week:** find a way to generalize the pre-processing techniques on input videos
  + Ideally, want a standard way to pre-process input images that is optimal: should look into literature on processing ultrasound images
  + Should also look into making the old images “more similar” to the new images
    - Not sure what this exactly means yet, but a suggested first step brought up during the meeting would be to investigate exactly how **dissimilar** the two sets of images are
    - Can use a process like PCA or something similar to do this easily
  + The raw videos are uploaded in the drive: should look into possible frame-rates for splitting the videos, and decide on a standard way to do this in order to produce images for our model
    - Again, look at literature and see if there is a decided upon methodology for US images
* Also want to look into data imbalances before we build models: can use the EDAV uploaded in the old report or do our own (which we eventually need to do anyways)

Action items for coming week

* Read up on literature for US image pre-processing and US video splitting into frames - use to decide on a standard image processing methodology
* Look at dissimilarity between old videos and new videos - potentially use to make images more similar across the two groups
* Review data imbalances from report

## Sep 30, 2024 | Weekly Planning Meeting

Notes:

**General Rule: Make sure that we communicate what we are working on, when we work on it, and what progress we make**

* <https://docs.google.com/document/d/1gfp6W_vUasyykK5z_-s5k0NeEJZuJjXwZMxfeirJWpY/edit>
* Above is a doc to track everything - please use it as it will make our lives much easier this semester!

## Oct 3, 2024 | Meeting with Ritvik / Elsevier

Notes:

* Our primary goal for the next week is to work on adding normalization to the image processing pipeline, in order to increase model consistency. The proposed process for doing so is as follows:
  + **First step:** check that the model works well on the old images even after we normalise
  + **Second step:** check how the model works on the new images with normalization from above
  + **Third step:** compare results and use to optimize normalization process
    - Should use literature to help optimize the normalization process: explore different techniques based on what seems to be SOTA
  + **Additional:** compare image quality and characteristics pre-and post-normalization
* We should also reach out to the TAs/CAs about getting GCP credits. I know I (Isaac) need it because when I’m currently running the ResNet18 pipeline it takes super long.

## Oct 23, 2024 | Meeting with Ritvik / Dr. Kessler

Notes:

* Work on building models that first classify good vs. bad, and then classify fluid and spinal cord presence
* Want to focus on the new image subset for now, since that is our area of main concern
* Try the existing models on the new images and see what happens
* Try overfitting on the old images: run for a bunch of epochs and see what happens
* Can mix the old and new images: if we do, we’d want to drop all of the bad-quality images from the old set of images in order to make the image sets as similar as possible off the bat
* Remember: main goal is to detect fluid as well as possible
  + Can make this the primary goal for our various models
* Do a literature review into existing fluid identification tools: according to Dr. Kessler models like that exist
  + Divide up the models we find and keep experimenting
* Can use siamese networks to analyze intensity: fluid is typically the darkest part of the image
  + Can even think about simpler analysis techniques like looking at pixel intensity
* Use fly-augmentation and open-source datasets
* **Once we decide what our division of labor is for the coming week, send Ritvik an email so he knows what’s up**