This is my research log for the ERSP 2017-2018 program under the CSE SEE lab at UCSD.

Contents:

Week template

Spring 2018

Week 6: 5/7 - 5/13

Goals:

1. Truly finish semi-supervised classifier
    a. Aditi can help ?
2. Get feedback on what to keep/add to our poster

Accomplished:

day /: (hrs)

-

day /: (hrs)

-

day /: (hrs)

-

day /: (hrs)

Week 5: 4/30 - 5/6

Goals:

1. Finish the semi-supervised encoding
2. Give a summary of our results to Mohsen
3. ~~Meet as a group and draft poster~~

Accomplished:

Monday 4/30: (2.5hrs)

- Met with Mohsen. He asked about our results for the semi-supervised and we told him we only got as far as coding how to get fair training data.
- Mohsen said we shouldn't take long to finish and to report back to him as soon as we do.
- We worked on finishing the semi-supervised HD. We made our code able to iterate in building a model. However, we saw weird results where the first model was the best and continuing to retrain it made it slightly worse.

Tuesday /: (1.25hrs)

- Meeting with Aditi. We inspected our code trying to figure out why retraining was making the model worse. We started to segment it to check every section was doing what we expected.
- We changed things around and then noticed that our accuracies were the same every two iterations. So we suspect something was being passed by reference and not by value.
- As a group we discussed when we could meet over the weekend to work on the poster.

Friday /: (2hrs)

- Robert and I tried to figure out the pass by reference issue. We went over our code beginning to end and caught a few things we were doing wrong.
- We were still getting the same accuracy pattern for multiple runs. So there's still something being called by reference and we couldn't figure out where :(
- We're hoping we can have Aditi look over our issue next Tuesday because we're not sure where else to look in our code.

Sunday /: (1.50hrs)

- Met with group and started drafting the poster. We added text for every section to get feedback on.
- Robert and I realized we're not sure what our section should include. Most of the things we tried didn't work and not everything we worked on was related.
- We wrote down everything we did and plan to get some feedback on what would be good to keep (and what results to add) next week

Week 4: 4/23 - 4/29

Goals:

1. ~~Clear up with Mohsen if we're still working on GPU~~ ??? (need to have clear direction for poster)

Accomplished:

Monday 4/23: (1hrs)

- We met with Prof. Alvarado caught up on our quarter progress. Robert and I mentioned how we are unclear about our direction having received a new task unrelated to GPU.
- We met with Mohsen and let him know that we haven't yet ran the last method for encoding with permutations.
    - He asked us if we read up on semi-supervised training and then went ahead to explain an basic semi-supervised algorithm we can implement on our dataset.
    - He wants us to get it done in a week.
    - We asked if this was going to be our new direction and how we can talk about all we do for the poster. He said he wants us to work on this now so we can learn more about it, and it could possibly something he continues to pursue. He said we can still talk about GPU for the poster since that's something they may still use, but we are likely not working on that again.

Tuesday 2/24: (1hrs)

- Met with Aditi. Robert and I reviewed the semi-supervised method Mohsen talked about. We started to come up with ways we can divided the data equally so we have equal representation of each class for the 'training data'. We drafted an algorithm to code up next time we meet.
- We changed our Wednesday meeting times to Thurs 11-12 starting this week.

Thursday 4/26: (1hrs)

- Met with Robert. We worked on how to separate our data for training such that it is always random but equal representation of each class.
- We coded how to get the training data and started to talk about how we should rewrite our code so we can iterate building the model several times

Note: Weren't able to meet more this week for pair-programming because we had big assignments and midterms

Week 3: 4/16 - 4/22

Goals:

1. Debrief with Mohsen about sub-permutations implementation
2. ~~Check orthogonality of feature vectors (determine if method doesn't work or if our implementation is wrong)~~
3. Come up with our own method to make feature vectors orthogonal

Accomplished:

Monday 4/16: (0.5hrs)

- Met with Mohsen. We let Mohsen know about our success with the permutation encoding.

- We let Mohsen know that our implementation of his altered permutation algorithm didn't work. Mohsen explained what we should check to verify if the method doesn't work or if it was something wrong with our code.
    - Basically, check orthogonality between feature HVs
    - If they're **not** orthogonal, then his method doesn't work → come up with our own
    - If they're orthogonal, then there's a bug in our code, it should work
- Robert and I briefly discussed what could be an issue in our code and agreed we could start debugging when we meet with Aditi tomorrow

Tuesday 4/17: (1.50 hrs)

- Met with Aditi. Robert and I picked up where we left off: fixing the error we had caught yesterday. It didn't improve the accuracy so we had to do what Mohsen said about checking feature vector orthogonality.
- We checked the orthogonality of the feature vectors and got they were orthogonal → something else is up with our code and we haven't caught it.
- We discussed as a group the best fitting layout for our poster. We agreed on a 'tree-like' layout. We started going over what we would fill in for each section.
    - Motivation and Background: use presentation slides
    - Methods: Robert and I discuss item memory spectrum, GPU attempts, and permutations (check in with Mohsen)
    - Results: Need to discuss with Mohsen what this can look like now that we are working on permutations (and not GPU anymore)

Wednesday 4/18: (2hrs)

- Worked with Robert trying to figure out if the proposed algorithm still kept feature vectors orthogonal (that is, we can distinguish between feature measurements)
- We found out that they're cosine angle was too similar (at 0.6-0,7 when previous method was 0.06 - 0.1) → permuting in the sections is not randomizing them enough
- We tried a different algorithm, alternating between permuting CW and CCW and still saw around the same accuracy (40%)
- We emailed Mohsen about it, and asked if our next idea to try would still be hardware efficient.
- He emailed back saying to go for it and also gave us a topic to read on to learn more about a possible new direction for HD *("Semi-supervised learning" vs supervised learning. "If you understand how it works, we can try to see HD potential to do semi-supervised learning.")*

Friday 4/20: (0.25hrs)

- Got an email from Yeseong saying they had to clean up the servers and to back-up our files in case he wasn't able to recover all the work
- Robert let me know he backed up all our work
- Server wouldn't be ready to use again until some time Sunday

Sunday 4/22: (1hrs)

- Robert and I talked about moving our pair-programming hours from Monday to a different time for week 4 since we both had assignments due/midterms early in the week.
- We agreed to figure out a time after we meet Tuesday morning with Aditi, that way after talking to Mohsen monday we also have a better idea of our direction and work we have to do.

- We talked about doing some of the reading Mohsen talked about before meeting with him tomorrow since we have to do some prepping on the server before working on the code again.
- Read about semi-supervised learning, and supervised learning. Here are some of the articles I looked at:
    - https://towardsdatascience.com/simple-explanation-of-semi-supervised-learning-and-pseudo-labeling-c2218e8c769b
    - https://en.wikipedia.org/wiki/Semi-supervised_learning
    - http://pages.cs.wisc.edu/~jerryzhu/pub/ssl_survey.pdf
    - Short summary:

Supervised Learning	Semi-supervised Learning	Notes:
Data is labeled, data analysis is essentially training the program to recognize the patterns between labeled groups to build a model that can predict label of unlabeled data (+) straightforward, lots of algorithms and built-in functions to build model (-) you need a LOT of labeled data to build a good training model and you often don't have enough/it's costly to obtain.	(+) overcomes supervised learning problem of not having enough labeled data. It uses BOTH labeled and unlabeled data to train a model. (-) Hard to tell what approach is best to try given your data. Doesn't always work/help. (?) one method is to create 'pseudo-labels' from training model, predict labels of ¼-⅓ of data, give them pseudolabels. Then retrain model with training set + pseudo-labeled set. This sounds like something we can easily do with our current dataset. My question is, how would this improve accuracy if you are not validating/correcting the training model for wrong predictions?	Unsupervised Learning: not having any labels and data analysis is basically finding clusters/groups of data.

How might semi-supervised/supervised ML help our project?
→ It seems all the difference is in how we train the model. In terms of how this affects energy efficiency, our sub-team focus, it seems unrelated. Mohsen has expressed how unimportant costly training is because that is done offline, so we can be as excessive as we want and not worry about efficiency. It seems to me that bringing this into our project is more about improving accuracy than speed/energy efficiency. So I'm wondering if we are letting go of that part of the project if our permutation algorithms don't work.

Week 2: 4/9 - 4/15

Goals:

1. ~~Figure out encoding for GPU (draft it, get feedback from Aditi, Mohsen)~~
2. If we get here, time encoding on CPU vs GPU

Accomplished:

Monday 4/9: (3hrs)

- Met with Prof. Alvarado. We debriefed on our progress and let her know how we were struggling with finding good GPU documentation examples.
- We talked about our poster, how we can put a poster together having two subteams.

- Robert and I picked up where we left off last week: how can we alter our encoding algorithm to take advantage of parallelization on GPU.
- We started looking into how to even call a function as a matrix operation. We were struggling to find good resources/examples online.
- We met with Mohsen. We told him how we were struggling with figuring out GPU encoding. We asked if there was anyone from the lab that could help us. He said he would find someone and in the meantime he gave us a new assignment... !!
- Permutations. To make encoding more efficient, we can get ditch multiplying and replace it with shifting using permutations.
- Mohsen sat with us and explained the math behind permutations. Why it works. He then explained the shortcomings of it, and a method that could circumvent this. He explained his method and instructed us to implement it after implementing the basic permutation.
- We started looking into permutation built-in functions. We talked through what Mohsen explained identifying what we had to change and making sure we both understood the new direction.
- We got the basic permutation working and let Mohsen know on our way out :)

Thursday 4/12: (1.5hrs)

- Robert and I met to work on the basic permutation.
- We spent a good time going over the motivation behind this. How the original encoding worked (having orthogonal HVs for each feature). And how doing permutations could replace that and still have our encoding work.
- We started drafting an implementation on the spyder terminal on a dummy array of 1-100.
- **Friday 4/13: (1.5hrs)**
- We picked up on drafting our implementation on the terminal. We got it working on our dummy array.
- We transferred the code to our server file and ran it.
- We got about 7% accuracy. It took longer to run ~5mins (which is expected).

Week 1: 4/2 - 4/8

Goals:

1. ~~Figure out when we can meet Mohsen~~
2. ~~Figure out when Robert and I can code together~~
3. ~~Figure out when Lab meetings are (who can make it)~~
4. ~~Start to debug GPU implementation,~~ get a successful run ?

Accomplished:

Monday 4/2: (0.5hrs)

- Met with Prof. Alvarado. Talked about where we left off, what work we have moving forward, and got advice to be mindful of having time to work on the poster.
- Met as a group briefly to figure out who can make it to lab meeting and if we were sure it was at the same time.
- We caught one of the PhD lab members but he wasn't sure what time the meeting was.

Tuesday 4/3: (0.5hrs)

- We discussed who can make it to the weekly lab meetings, turns out only Helen could make it.
- We gave all our availability to figure out what times we can give to Mohsen to set up our weekly meetings.
- Robert and I figured out a time we can meet this week to start coding.
- Met with Aditi. Was running late, and had to leave early, but sent Robert the digitize code to move to the GPU file.

Thursday 4/5: (3.25hrs)

- Finalized our meetings with Mohsen to be Mondays 2:30-3pm.
- Met with Robert at the library to work on debugging on GPU code.
- We unfortunately wasted a lot of time thinking our program was having an infinite runtime error, but it turns out our GPU implementation was making it slower, but it still worked.
- We moved on to debug errors with gpu array creation and setting values into gpu arrays for the mapping of our test samples to HV bins. (Apparently you can't directly assign values to a gpu array index, so we had to figure out a way to go around that).
- When we moved on to debugging encoding, test HV creation, we realized we weren't taking advantage of the parallelization of GPU programming. The code we were trying to translate was to do one sample at a time through 2 nested for loops.
- We were tired from our coding session and ended our meeting with a goal for our next meeting: rewrite encoding for GPU, how to parallelize HV creation.
  Which poses the challenges of creating a separate bin for GPU (is this worth it/makes sense?)

Winter 2018

Week 10: 3/12 - 3/18

Goals:

1. ~~Meet Mohsen, let him know we have cpu and gpu implementation~~
2. ~~Ask Mohsen what our next steps are (we can work until week 5 next quarter)~~

Accomplished:

Wednesday 3/13: (2hrs)

- Lab meeting. Had our last meeting for the quarter! Prof. Rosing reminded us that next quarters meetings will run shorter, from 1-2 as she will be teaching a seminar class on alternative computing from 2-3 in the same room.
- We talked to Mohsen. He gave us a rundown of what the rest of the project will look like. Basically, he wants us to run as much as we can on GPU, like encoding, and compare that to being run on CPU. If it's not beneficial enough or not possible, then he said just

keeping what we can on GPU should be fine. Once we have this finalized we will start working on the paper to be published.

Thursday 3/14: (2hrs)

- Met with Aditi. We updated Aditi about our meeting with Mohsen and what he wanted us to work on for the rest of the year.
- We also asked Aditi if she knew how int literals were stored or retrieved when coding on GPU.
- We worked on duplicating all our code, to also run on GPU. Every CPU step for training, was written as a GPU training step for GPU.
- We also asked Aditi how np.digitize works, because we were having a hard time rewritting the function without calling the np function (to work on GPU).
- Once we understood Aditi's explanation, we wrote out and confirmed it worked the same as our accuracy was the same with our digitize implementation.

Week 9: 3/5 - 3/11

Goals:

1. ~~Debug testing encoding in pycuda~~
2. ~~Get code to run~~
3. **Check in with Mohsen about design choice**

Accomplished:

Wednesday 3/7: (2 hrs)

- Lab meeting. One PhD student presented their thesis in preparation for getting it approved by a CSE panel.
- We had to give feedback on their presentation details and style
- Another PhD student presented their research in preparation for a conference they were attending and we were asked to give feedback as well.
- We checked in with Prof. Rosing about our progress. Found out that Mohsen was out for the day attending a conference, so unfortunately we couldn't check in with him about some design choices we wanted to verify with him

Thursday 3/8: (2hrs)

- Lab meeting with Aditi. We told Aditi we were debugging our encoding for testing and we would reach out to her during our meeting if we needed help.
- We asked Aditi about the last error we had to work out: moving our item memory to PYCUDA for both training and testing
    - (We had to do this because our program was slowing down referring back and forth from our CPU item-memory to our GPU testing hypervectors)
- The issue was with our 'binning' the way we digitized our continuous measurement values to discrete values. Previously we were calling numpy.digitize() which handled the mapping for us, but now we had to write the code out ourselves as we couldn't find a gpu.digitize().
- Aditi mentioned we could just divide every value by the size of each bin, which was very simple and made a lot sense.

- When we did this however, we saw a 15% drop in accuracy. We were told by Mohsen we shouldn't care about accuracy anymore but we tried to figure out what the reason was for this just to make sure it wasn't another problem we weren't catching.

Friday 3/9: (1hrs)

- Still uncomfortable about the 15% drop in accuracy, I went back to figure out what exactly was causing this. It still didn't make a lot of sense to me to see such a drop when we used the same slightly-modified mapping for our training and testing hypervectors.
- I printed out pieces of the original measurements, the values from np.digitize() and the values from our digitize code.
- The shortcoming of our digitize code became clear this way. It turns out numpy.digitize() rounds our values to the closest bin representation while OUR digitize code always rounded the value down.
    - For example, with np.digitize() a measurement of 3.99 would be assigned to the bin that represents 4.0. While our code would send it to the bin that represents 3.0.
    - This was causing a skewed translation from 'continuous' values to 'discrete' values that was significant enough to make our mapping less accurate.
- With this, we have a running version we can show to Mohsen, and be able to explain our drop in accuracy if it's something he wants us to fix.

Sunday 3/11: (0.25hrs)

- We had a quick check-in about figuring out when we could draft our Winter quarter progress slides for our next meeting with Prof. Alvarado

Week 8: 2/26 - 3/4

Goals:

1. ~~Add code and documentation to lab google drive~~
2. ~~Get clarification on next step for pycuda~~
    - ~~Implement linalg.norm again ?~~
    - ~~Query vector ?~~
3. ~~Implement [encoding] in pycuda~~
4. Add new implementation and documentation to lab google drive

Accomplished:

Monday 2/26: (2hrs)

- Met with Prof. Alvarado. Gave her an update on our pycuda progress now that we have the server.
- Robert and I briefly discussed the layout of our files. We decided to keep all our code (function definitions + script in one file) and to create new files for every new change we make to be able to gather data on our progress later.
- Mohsen asked us to add our code to the lab google drive so Patrick can use it. So I created a README to go along with it to breakdown the use of it.
- Spent too much time trying to scp from server to my local machine to be able to add it to the google drive. Turns out I didn't have to be ssh'd to make scp work.

Wednesday 2/28: (1 hrs)

- Lab meeting, short meeting! It was a research topic presentation by Rui. He's working on a recommender system with HD.
- Prof Rosing asked for updates. We let her know how we were doing. She asked what I wanted to learn next and said machine learning. She let mohsen know we wanted to learn ML. Wonder what that means moving forward...!
- Robert and I talked to Mohsen about what our next step is. He explained our next task is to do pycuda for encoding.

Thursday /: (2.5hrs)

- Meeting with Aditi. We caught up Aditi with our next task, which is to translate our encoding into pycuda.
- Robert and I discussed what that should look like exactly. We talked about the different ways we could do it and discussed each to see what we both agreed made the most sense.
- We decided having our program be run on both CPU-ONLY and PYCUDA (as in, run anything with training data on CPU-only, and anything with testing data on PYCUDA). The reason for this was that we know training will be done 'offline', so keeping CPU-only is fine. Having both implementations would also allows us to time each to compare them.
- We started translating our encoding code to PYCUDA, also organizing it as we went and writing TODO comments for things we could 'clean-up' later, or that we might want to double check for a faster implementation.

Friday /: (0.5hrs)

- After we translated the encoding for testing into PYCUDA, I went back to figure out some of the bugs we were getting. They were mostly to do with having numpy arrays as type float before converting to GPU arrays.

Week 7: 2/19 - 2/25

Goals:

~~1. Run pycuda implementation on server~~
~~2. Compare time elapsed between CPU-only and pycuda assisted~~
~~3. Implement EFFICIENT pycuda implementation~~
~~4. Report results to Mohsen.~~ Is it good enough?

Accomplished:

Wednesday 2/21: (2hrs)

- Lab meeting. Someone gave a tutorial talk on graph algorithms (CSE100 topics).
- We talked to Mohsen, we reported having some issues with calling numpy methods on gpu_arrays but we were sure we could figure them out (google errors)
- We got an implementation running!
- Unfortunately it was not efficient. CPU-only implementation was clocking 3secs while pycuda implementation ran at 10s.
- We asked Mohsen if this could be due to not having a large enough data set to offset the cost of trasferring arrays to GPU. He said it was a possibility.

- We made 'fake data' 3 times larger than our data to see if this was the reason.
- Unfortunately, it wasn't. We now had CPU-only running 10secs and GPU running 40secs.
- We asked Yeseong if he could spot design flaws. He pointed out we were converting samples (numpy_arrays) to gpu_arrays one at a time. Based on how CPU memory and GPU memory are separate, he mentioned this was taking too much time. He recommended we instead convert our samples all at once to gpu arrays.

Thursday 2/22: (2hrs)

- We had our meeting with Aditi. We started working on how to do all-in-one conversion.
- We were getting shape Errors as we tried to do linalg.dot and linalg.norm.
- We tried coming up with workarounds and with Aditi's help we figured out how to do linalg.dot.
- We continued to come up with a way to do linalg.norm all-at-once
- **Friday 2/23: (2.5hrs)**
- With all the changes, the code was getting really messy.
- Put some time into cleaning it up and adding a user prompt to be able to execute the code CPU-only, GPU, and different data sizes.
- Went to talk to Mohsen again. Told him about our problem with linalg.norm.
- Mohsen said we could take that out of the calculation (cosine similarity) because it didn't matter for what we were trying to show.
- Did so, and finally got a GPU implementation faster than CPU-only. Not by much, 1-2sec faster.
- Sent an email to Mohsen and Robert with results for different data sizes.

**Note: if needed, we need to change np.array type conversion. Currently getting a memoryError for size 45,000 or greater*

- Waiting for Mohsen's opinion on the results we have so far.

Week 6: 2/12 - 2/18

Goals:

1. ~~Setup our server account~~
2. ~~Copy files via ssh~~
3. Install necessary toolkits (such as pycuda toolkit ?)
4. ~~Run pycuda examples by Yeseong~~

Accomplished:

Thursday 2/15: (1 hr)

- Meeting with Aditi. Individual work time. Changed the password to Robert's and I's shared server account.
- Figured out how to copy over our pycuda file. (scp command) Took a while to figure out how to do it for a specific server account. Got Aditi to help me figure it out.
- Cleaned up our file (got rid of any colaboratory functions/calls we don't need anymore)

Friday 2/16: (1hrs)

- Read over the pycuda examples Yeseong included in the server (mnist and matrix multiplication)

- Tried figuring out how to run python scripts on the server. Was used to running on Anaconda - spyder or jupyter notebooks.
- Turned out we need to do some setup for pycuda and wasn't sure how to do it. Robert took care of getting it done.

Notes: This week was very light for me because I was very overwhelmed with my other classes and things outside of school.
Moving forward, I will have more time for our research.

Week 5: 2/5 - 2/11

Goals:

1. Sort out where we can run pyCuda
    - Try lab computers
    - If not talk to Mohsen about this issue
2. Implement dot product in pyCuda
3. Implement li.norm (from numpy) in pyCuda
4. Put 2 and 3 together to get cosAngle() in pyCuda
5. Figure out how to translate GPU array back to python hypervector

Accomplished:

Tuesday 2/7: (1hr)

- Had our meeting with Aditi.
- We got confirmation to change our meeting to Thursdays, same time.
- We filled in Aditi on our situation of not being able to run pycuda on colaboratory because we couldn't install cuda-toolkit.
- She recommended we let Mohsen know about really needing a server.
- We spent the rest of the meeting coding up the cosAngle() pycuda implementation so we could test running it as soon as we got a working environment. This surprisingly took very little time. (We just had to call built-in functions from scikit linalg for the calculations. And built-in functions for the gpu_array conversion)
- We also kept searching for any other workaround to using pycuda on Macs.

Wednesday 2/8: (2hrs)

- Lab meeting. At the end we had a check-in with Prof. Rosing. We told her we still couldn't find somewhere to run pycuda.
- We tried colaboratory but we couldn't configure the GPU to add cuda-toolkits
- Mohsen talked to Yeseong and they said they would have it set it up for us by the end of the week.
- We let them know we had our pycuda implementation ready to go.
- Mohsen explained how now that we were only looking at efficiency, the cosAngle similarity could be simplified aka sacrifice accuracy because the best implementation would have those calculations happen during 'training/offline'

Friday 2/10: (1hrs)

- We got Yesong's email that the server was setup!

- He included a reference doc with more information.
- And instructions on how to login.
- I replied to him asking if we could stop by on Monday so he could help up run our code on the server (really, I was just trying make time on his schedule in case we ran into problems so we wouldn't have to wait until Weds to get help)

Sunday 2/11: (0.75hrs)

- Read through the reference manual Yeseong attached. Where to see our process is running. How to login. How to change password. etc.
- We didn't need to meet with him after all. The doc on how to use the server was very well documented.

Week 4: 1/29 - 2/4

Goals:

Figure out where we can run pycuda
Determine what code snippet should be in cuda

Accomplished:

Tuesday 1/30: (1hrs)

- Met with Aditi. Robert and I shared with her how we were stuck not knowing where we could run cuda code. The server Mohsen wanted to setup isn't going to be ready soon, but he wants us to do the cuda code anyways. Luckily, Aditi told us about google colaboratory which can be changed to run on GPU that happens to be a Nividia (what we need) :)
- We moved all our code to colaboratory. And started trying to figure out how we could open our data files from a colaboratory notebook.

Wednesday 1/31: (2hrs)

- Lab meeting. We heard a talk on different memory architectures. The meeting didn't run the full two hours so we met with Mohsen earlier and told him about how we were going to use Colaboratory to run on GPU. Robert and I then spent some more time looking at examples and the manual on how to read files.
- Prof Rosing mentioned next quarter our meetings will run shorter (~1hr) since she'll be facilitating a class that is set to start during our meeting time, 2pm, in the same room. We are welcome to stay for the seminars. I think it's on advanced computing ?

Friday 2/2: (0.25hrs)

- We were going to meet Friday night, but decided to move our meeting as it was very late already. We talked through messenger and agreed on sending an email to Aditi to see if she could help us figure out how to read files into Colaboratory.
- Aditi got back to us saying she'll try to help us figure it out.

Sunday 2/4: (2.5hrs)

- Figured out how to read files into colaboratory!
- Started looking into how to calculate dot product using pycuda built-in functions.
- If we are not able to, there is another thing called google cloud data that can let you run on Nividia GPU. [This article talks about the setup.]

Week 3: 1/22 - 1/28

Goals:

1. ~~Finish implementing JH code~~
2. ~~Start Cuda on Tuesday (get questions to ask Aditi)~~
3. ~~Finish Cuda by Friday~~
4. New 2, 3 ⇒ LEARN PYCUDA! *(refer to reflection)*

Accomplished:

Monday /: (2.25hrs)

- Met with Alvarado. Got approved for having a gant chart that only looks 3 weeks ahead. Got reminded to complete logs!
- Coded with Robert again after the meeting. We were able to attach labels to data lists. Yay. Now got stuck on out of bounds error (possibly our numpy array conversion is the culprit)

Tuesday /: (2hrs)

- Met with Aditi. Both of our teams updated her with our code errors.
- This was the last day Robert and I tried making Joyaan's and Helen's code work with our data.
  We were very stuck on understanding how they created the bin hypervectors. Aditi even stayed over time trying to help us.
  (For some reason their code accessed the values stored in the array --which was hard to understand why-- since our values are sometimes larger than the dimension of our bins array, it would go out of bounds and crash)
  At the end we agreed it was best to move on and stick with our 93% accuracy to start on the pyCuda code Mohsen is expecting ASAP.

Wednesday /: (2hrs)

- We had our lab meeting.
  Both groups gave Prof. Rosing an update on our progress. Robert and I explained our situation and how we were deciding to move on to the next task, and waited for Prof. Rosing's comments on it....
  Prof. Rosing agreed that was the best option since we were spending too much time. Mohsen agreed too.
- Met with Mohsen.
  He commented that if we can get the Cuda stuff working in time for the paper submission, our code would be able with the paper. It was exciting to hear that but also scary since we don't know Cuda.
- Mohsen stated the most important thing is to optimize the similarity check. So that's what we're focusing on now.

Thursday /: (1.5hrs)

- I searched for video tutorials on using pyCuda, and started putting together a playlist.
- We were gonna start on the hr tutorial, but talking about what we had to do we realized we were sitting on a lot of assumptions on what we had to do.
- We knew Mohsen was in his office so we compiled a list of the questions we had.
  1. Can we start off using built-in pyCuda functions?
  2. What did he want us to parallelize?
  3. Was the server to run our cuda programs ready?

4. What was the goal of implementing pyCuda?
- We visited Mohsen and got out answers.
    1. Yes, we can start off with that b/c any use of pyCuda will be faster than CPU. Eventually we may want to switch to writing our own cuda coda, but not now.
    2. The element-wise operations of the cosAngle function!!! 10,000 divided into 5 parallelizations of 2,000 (b/c GPU has 2,000 cores)
    3. Not ready yet, but we can ssh into our own ucsd accounts that run on NVIDIA
    4. The goal is to show we can do the similarity check on GPU which will be an improvement as it's innately faster than relying solely on the CPU

REFLECTION:
The goals for this week, specially on PyCuda were unrealistic. We didn't expect to spend so much time trying to use Joyaan's and Helen's code, which at the end of the day we didn't use. We also didn't take into account how unfamiliar we are with PyCuda and if we want to get this right, we need to dedicate time to learning about it first.

<u>Some important lessons learned:</u>
1. Set a time budget for how much time we are able to afford before we just take a loss
→ learn how to move on
2. At the end we found out his priority was getting Cuda to work for a section of the code and not so much having a better accuracy.
→ Be transparent with Mohsen about our issues and discuss assumptions
3. Mohsen is expecting us to have Cuda code that is publishable, allocate time to learn it well but refer to (lesson 1)
→ Time spent on getting familiar with new software is important

Week 2: 1/15 - 1/21

Goals:

1. **Get our data formatted to run on JH code**
2. **Run our data on JH code to see effect of clustering and subclasses**

Accomplished:

Tuesday /: (2.5hrs)

- Met with Aditi. We talked to her about how we were working on getting out data formatted to run on JH code. Explained it was a small hiccup with python we could likely figure out on our own.
- Robert and I worked on understanding how to split our data to match the format of JH's
- We figured it out! Our data was able to read by JH's functions

Wednesday /: (2.5 hrs)

- Lab meeting. Gave Prof. Rosing an update on our progress. Told her we had a small hiccup with reformatting our data and had just figured it out. We next focus on running the code to see if we get better accuracy with JH's code.
- Met with Mohsen. Told him we really wanted to try clustering and subclasses one last time using JH's code. He said ok, but to not fret if it didn't work. To move on to cuda ASAP.

Week 1: 1/8 - 1/14

Goals:

~~Meet with Mohsen, and set time for WI 18 meetings~~
~~Figure out what we should focus on next in the project~~
Look into what kuda is (how to work it with Python)
~~Meet with Prof Alvarado~~
Meet with Robert, give clustering&subclasses one last go!

Accomplished:

Monday /: (0.5hrs)

- Met with Prof. Alvarado. Got an overview of what our meetings with her will focus on. We were asked to identify a team leader.
- We caught up as a team after the meeting. Came up with questions to ask Mohsen after our lab meeting, such as setting up a new meeting time with him.

Wednesday /: (2.5hrs)

- 1st Lab meeting of the quarter. Checked in super-quick with Prof. Rosing. Got my CSE199 form signed, last step: turn into CSE dept.
- Met with Mohsen and he let us know what our teams should be working on moving forward. Robert and I will work on having our code run kuda, but first we will spend Friday giving subclasses and clustering one last shot. CUDA IS TO BE DONE ASAP.
- Meetings with Mohsen will now be after the lab meeting.
- Robert and I agreed to code together Fridays.

Friday /: (2hrs)

- Worked with Robert on picking back up on the code.
- Had Helen explain their code as we plan to use their code (last chance to get clustering and subclasses to work)
- Found out we weren't looking at their latest code, so we asked Joyaan to send us their latest code

Fall 2017

Week 10: 12/1 - 12/08

Goals:

~~Implement feedback changes~~
~~Create diagrams~~
~~Add citations~~
~~Transfer to overleaf, submit!~~
~~Let Mohsen know we will not be able to work on research this week or finals week~~

Accomplished:

Sunday 12/3: (2.5hrs)

- Met with group, we went over every slide Robert and Helen made
- We refined the slides a little and created diagrams that could be used in both our presentation and proposal
- We discussed the proposal draft again and laid out a plan before meeting with Aditi: what changes we would make to get feedback on/ what questions did we still have
- Stayed with Robert to work on the clustering of subclasses, and model adjustment.
- We went through Helen's code but were unsuccessful in identifying what was missing in our code from theirs. It was also hard to follow as they used a lot of functions so we decided to ask Helen to walk us through it after Aditi's meeting

Monday 12/4: (0.75hrs)

- Met with Aditi and got more insight on feedback and if the changes we were thinking of making addressed the feedback
- Met as a group, briefly, and discussed what changes we should make. Came up with a plan and divided up tasks before we met again

Wednesday 12/6: (4.4hrs)

- Met as a group and read section by section and resolved any suggestions, and agreed on diagrams to add.
- We divided tasks to, I would finish citing the paper and transfer it to overleaf, and we would update each other throughout the day to let everyone know if we were looking for feedback

Week 9: 11/25 - 11/30

Goals:

~~Finalize edits for proposal draft for Tuesday submission~~
~~Reach out to Daril to schedule grad student interview~~
~~Complete grad student interview~~
Pair programming with Robert on model adjustment

Accomplished:

Monday /: (1.5hrs)

- Met with Aditit and got feedback on our proposal draft. We met afterwards as a group to discuss comments/suggestions from round-robin editing. We each got tasked with finalizing certain edits.
- Asked Daril if he was able to meet with me to talk about grad school

Tuesday /: (0.5hrs)

- Met with Daril and completed the questions

Wenesday /: (1hrs)

- Wrote up Daril's answers and added my reflection: Grad student interview

day /: (hrs)

-

Week 8: 11/17 - 11/24

Thanksgiving break

Goals:

~~Change clustering classification from max score to majority score~~
~~Do one round of round robin~~

Accomplished:

Friday 11/24: (3hrs)

- Changed classification to majority score, meaning instead of getting the single max cosAngle of all subclasses, it's the
-

Week 7: 11/9 - 11/16

Goals:

~~Finish 3rd section of proposal (evaluation/implementation plan)~~
~~Send Joyaan my outline of proposal~~
~~Edit proposal before Writing Center appt~~
Edit proposal after Writing Center appt
~~Lab meeting- report accuracy for our subclass method~~

Accomplished:

Friday /: (1hrs)

- Met with group. Started working on third section of proposal
- Met with Mohsen. Talked about poor results with first try using clustering for subclasses. Mohsen said we can switch our focus to doing our own method. Clustering may not be promising since different clusters may have different number of members creating a bias.

Monday /: (2.5hrs)

- Met with Aditi. Talked about the problems we had with clustering and what we went over with Mohsen on Friday.
- Met with group. Split the work on proposal part 3, and fixing proposed solution. Wrote the section for Evaluation plan.
- Scheduled Writing Center workshop for Thursday at 2:30pm

Tuesday /: (2.5hrs)

- After doing the peer review during class, we realized our proposal needs a lot of work. The flow of our proposal was not smooth and we did not have a clear proposed problem.
- We decided to each write an outline of what we envision the point our proposal should get across to help with improving it before Thursday.
- I spent time relooking for references and redoing the flow of our proposed solution so it forecasts better what we will be discussing in the proposed solution.
- Started working on our subclass method implementation

Wednesday /: (2hrs)

- Lab meeting. Prof Rosing checked in with us about our progress and how classes are going.
- Post-doc, Nikolais Attanov ?, presented on ML and robotics from their previous research at Penn
- We met briefly as a group to finalize draft before Writing Center appt

Thursday /: (0.5hrs)

- Writing Center appointment. Tutor went over section 1 and 2. From their non-technical perspective, our second section had a structure of problem-solution, problem-solution, which is not what we want according to the prompt.
- Holding off on editing until we get ERSP peer reviews

Week 6: 11/2 - 11/8

Goals:

~~Complete second part of proposal~~
~~Figure out Writing Center appointment~~
Apply kmeans clustering to all data

Accomplished:

Friday /: (2hrs)

- Met with group, wrote my part for the second part of the proposal
- Met with Mohsen, reported our new 92-93% accuracies. We got a glimpse at future work with making the code hardware friendly
- We cleared up the focus of our project. We won't be implementing a 2nd layer of HD computing

Monday /: (0.75hrs)

- Met with Aditi, talked about second part of proposal and showed our latest accuracies and focus for the week
- I created a group log and added the link to the group page

Tuesday /: (0.75hrs)

- Finalized proposal draft, switched over to proposal template and added pdf link to group page
- Communicated with group about splitting work evenly since we have had a few of us do less than others and not be aware of assignment prompts and deadlines

Wednesday /: (2hrs)

- Lab meeting: Visitors from ECE dept presented. Anthony gave a talk on computer architecture. Second presenter gave a talk on computability.

Week 5: 10/27 - 11/7

Goals:

~~Submit 1st part of proposal draft~~
~~Clean up code~~
Implement the changes Mohsen proposed (email)

~~Work on 2nd part of proposal draft~~

Accomplished:

Friday /: (4hrs)

- Finished getting the accuracy for the activity monitoring.
    - Best accuracy was 90%
    - Emailed Mohsen our accuracy and a sketch of the approach we implemented
    - Mohsen gave us new tasks (probably to be done by next Friday)

Sunday /: (0.75hrs)

- Expanded on the proposal draft Helen started for us.
    - Wrote about HD computing and what the problem we are addressing is

Monday /: (1.0hrs)

- Met with Aditi and got her to read over the first part of our proposal draft
    - She said we were going in the right direction with it :)
    - Aditi also asked us to explain her our research project again since it's a little confusing we will be dealing with little dataset projects instead of one big project
    - I think we cleared things up, or at least for our group we know how to navigate our proposal now
- Met with Robert to discuss how we could implement the changes Mohsen wants to improve our accuracy. We have a good idea of how we'll test it, came up with how to do the new encoding, but have some questions regarding edge cases

Wednesday /: (3.5hrs)

- Lab meeting. Mohsen gave a presentation on Hyperdimensional computing (voice recognition paper). We got to hear more of the inspiration behind HD computing, and future directions we will explore in the future: layers, new encoding to group similarity between features.
- Worked with Robert trying to implement the new item memory setup. We weren't sucessful dropping down to 37% accuracy. I spent another hour trying to figure out the bug in our code but haven't found it yet. Next step is to ask Joyaan or Tarek if they can spot our mistake.

day /: (hrs)

-

day /: (hrs)

-

Week 4: 10/20 - 10/26

Goals:

~~Meeting with Mohsen. Get details for proposal.~~

Apply HD encoding to Activity Monitoring Data. Results by Friday

- ~~Create hypervector range for each feature~~
- Create hypervector for each sample
- Create hypervector for each class
- Encode testing data

- Get at least 90% accuracy with testing data

Literature research Part 1
Literature research Part 2

Accomplished:

Friday 10/20: (0.75hrs)

- Met with Mohsen and got the big overview of HD encoding. He went over the encoding process again on the whiteboard and divided us into two groups to analyze a data set by Friday.

Sunday 10/22: (3.50hrs)

- Group meeting. Met in CSE building to get started with data set analysis. Robert and I had trouble opening the .dat file so we met with Tarek to figure it out. It was a python 3-2 issue. We didn't get very far, we just got to figure out the min and max of every feature to create our range of hypervector for the features.

Monday 10/23: (3hrs)

- Met with Aditi and talked about our progress and questions about the proposal since we don't have a long term project.
- We also talked as a group afterwards and Joyaan went over parts of the encoding process Robert and I were not sure how to apply.
- Cleaned up the code, created hypervectors for each feature, saved data into a pandas data framework.
- Literature Research Part 1

Wednesday 10/25: (2hrs)

- Lab meeting. Michael did a tutorial talk on security. Prof. Rosing checked in on our progress. Short lab meeting.
- Met with Robert to work on code.
  - We figured out how to create a spectrum for the bin hypervectors. First one is random, next one has 10 bits from the first one, next one has 10 bits of previous & 2 bits from previous's previous, repeats until last one.
- Literature Research Part 2

Week 3: 10/13 - 10/19

Goals:

~~Read second research paper (sent by Mohsen)~~
~~Read third research paper (sent by Mohsen)~~
~~Organize questions for Friday meeting with Mohsen~~
Read over source code
-Apply to iris dataset
~~Clarify project topic with Mohsen to start on proposal (need for Thursday assignment)~~
~~Prepare 20' teaching session (for Tuesday)~~

Accomplished:

Friday 10/13: (3hrs)

- Read 2nd and 3rd research papers. Annotated (saved on laptop, cannot share)
- Met with group and we figured out our teaching topics. Mine: hypervector operations

- Met with Mohsen and Tarek.
    - Mohsen did an overview of the hyperdimensional model for the mnist set on the board
    - He mentioned we could start by jumping into one of two priority projects:
        - Classification of activity data based on activity trackers
        - Help Tarek with bio dataset (how to get high accuracy given small set of samples with a large number of features)
    - Mohsen said we will use week 3 to get familiar with the code
    - Tarek gave us a walk-through of the source code on jupyter notebook
    - Tarek mentioned after possibly helping with the afore-mentioned projects, our group project will most likely be improving the image recognition model
        - the current model does not take into account the relation of pixel locations. We want to store the relation between neighboring pixels, their location, as a feature. This is said to improve accuracy.

Monday 10/16: (2hrs)

- Preparing teaching session: hypervector operations
    - Resources used:
        - **Computing with hypervectors (video lecture)**
        - **Computing with hypervectors (slides)**
        - https://www.academia.edu/30684411/Exploring_Hyperdimensional_Associative_Memory
    - Slides for teaching session
    - Reviewing hypervector operations helped me understand the encoding process of our project better. The math to the high-level description started to piece together. I was also able to spot where some of the operations were applied in the code and get a better sense of the minor steps in the process.

Tuessday /: (1.5hrs)

- Figured out how to create a python 3.6 environment while keeping python 2.7. Went over a python tutorial on data analysis for the Iris dataset. I'm doing this to have a simple dataset and analysis I can reference to apply the HD encoding on and better understand the source code. I will analyze the iris dataset using the HD encoding algorithms on Thursday.

Wenesday /: (3hrs)

- Lab meeting
    - Joonseop presented on Efficient Systems Using Vertical Nanowires. As a lab we gave him feedback on his 20' presentation.
    - Kazim and Jason did a short presentation on software based radio for drone communication.
    - Spoke to Mohsen about our proposal assignment due tomorrow. He sent us more background info and motivation for our project. He said we can explain in broad terms we will be programming HD encoding algorithms to analyze different datasets. Gave us a reminder to be comfortable with the source code by Friday's meeting.
- *Identifying general research problems and technical challenges*
    - Current encoding and data analysis algorithms are computationally intensive requiring off-device data analysis
    - Current encoding and data analysis algorithms lose accuracy from noise

    - Current image recognition through HD encoding does not take into account pixel location, which can be an important feature to keep track of as neighboring pixels may have similar colors
    - Current source code is tailored to analyzing DNA data.
    - Some of the current python source code needs to be checked against original matlab code.
- ***ERSP Week 3 Reflection:***
    - *What I like the most about our project is that it's about data analysis and that's actually an area I have been getting interested in. Lately I have been considering pursuing data analysis as a career or for grad school. Out of all the programming languages I have learned, Python is my favorite one and it is a very popular language for data science. I am very thankful this experience will directly help me develop skills I want to build to apply for data science related internships.*
    - *What I like the least is that our project is more fast paced than I expected. Having to meet paper submission deadlines puts priority on getting results over producing easy to read code. This makes it somewhat harder to understand the source code since it's not very detailed and scattered through a few files.*
    - *My biggest concern is producing models that give good results but actually violate some concept of statistics or data analysis I am not aware about. I remember in my COGS 109 class we were trying to predict temperature based on attributes like humidity, wind mph, rain, etc. We worked for a long time on finding good models and later found out that our 'best models' were not good because temperature is heavily dependent on the time of year which we were not taking into account and thus required a time series analysis which we did not know how to do.*

Notes:
How to find more related work:* ***Goal: Find 20-30 papers on different approaches/applications*
1) look at references (be wary of having too many self-citations)
2) look through top publication venues: IEEE Xplore or ACM
3) Google Scholar (look at # of citations)
4) Visiting author's personal web pages
**How to go over related work:*
Read abstracts, take notes on how they all relate
Do this regularly

Week 2: 10/6 - 10/12

Goals:

~~Reading research paper Part 1~~
    - ~~First read~~
    - ~~Take notes/questions~~
~~Reading research paper Part 2~~
    - ~~Research confusing topics~~
    - ~~Read a second time~~
    - ~~Pick my teaching topic~~

Accomplished:

Monday 10/9: (1.75hrs)

- Part 1: Reading a Research Paper
  - Reading Notes

Wednesay /: (2.25 hrs)

- Lab meeting (led by Mohsen)
  - Yeseong Kim presented on 'Power Performance Prediction via Neural Networks for IoT Devices' (copy of slides printout)
    - Some of the concepts he applied and went over (like K-means clustering) were things I learned in COGS 109. Being familiar with those concepts allowed me to better understand the solution to the problem he presented.
    - He applies Neural Networks over hyperdimensional computing to be able to perform linear regression (best-fit line)
  - Yeseong also gave us a presentation on the basics of Machine Learning (slides in seeLab google drive)
    - Learned about 'reinforcement learning'. Basically, it can be thought of as a feedback mechanism:
      environment/state → agent → action → reward (loops)
      f(state) = action
      and 'reward' for a program is:
      reward = f(state, action) **how it can know what's winning*
- Part 2.1: Reading a Research Paper (gathering resources for confusing topics)
- My topic for week 3 will be on the encoding process used for training and testing. From what we have discussed with Mohsen and Tarek, the encoding process seems to be the 'mold' of the research we will do. The encoding is always the same, we just have to tweak it a little depending on the data set. If I am able to understand that well, then I should be able to have a better idea on how to code it.

Thursday /: (1.25 hr)

- Part 2.2: Reading a Research Paper (Griswold's Questions)
-

day /: (hrs)

-

Week 1: 9/29 - 10/5

Goals:

1. ~~Set up research log~~
2. ~~Record *ERSP preliminary thoughts*[1] (hopes & worries)~~
3. ~~*Reflect on past research logs*[2]~~
4. ~~Read recent research paper sent my Mohsen~~
5. ~~Attend Weds 10/4 lab meeting in CSE 2109, 1-3pm~~
6. Assignment: Research paper prep due Thurs
7. Schedule 2hr weekly group meetings

8. ~~Schedule 0.5hr weekly meetings with Mohsen~~

Accomplished:

Friday 9/29: (0.5 hrs)

- Read past research logs, browsed previous ERSP pages
- Read over assignment 1

Sunday 10/2: (2 hrs)

- [goal 1] Set up research log
- [goal 2] Recorded *ERSP preliminary thoughts*[1]
- [goal 3] *Reflected on past logs*[2]
- Asked Mohsen for research literature

Wednesday 10/4: (2.75 hrs)

- Attended first lab meeting!! :}
    - Got to hear presentations on two of the major projects in the lab: emerging computing (Mohsen) and approximate computing (Michael). Heard about the new center AIHL (AI for Healthy Living).
    - Prof. Rosing expressed she would like us to complete our proposals by the end of this month and get started on our research immediately after. She hopes we will have the chance to publish a paper with Mohsen! (if time allows)
    - Talked to Tarek who has been working in the brain-inspired HTC project about what to expect and his experience on learning the HTC theory. He said it wouldn't be too hard if we read the literature, understand Mohsen's explanations and follow the code implementations. He also suggested we write all the code in Python, not MATLAB.
- Established weekly 0.5hr meetings w/ Mohsen starting week 2. Fridays at 1pm in 2148. Mohsen emailed us 3 papers we should read by first meeting.
- Tried to find a mutual 2hr gap for our group meeting over messenger. We will most likely finalize the time tomorrow before/after class.
- Updated group webpage: added link to my log, updated lab meeting time.
- Read Prof. Griswold's *How to Read an Engineering Research Paper*[3]

Notes:

- No laptop this week. Under repair.

[1] *What are you most excited about in ERSP, and why?*
I am really looking forward to developing my programming skills by doing CS based research. I hope that after I overcome the learning curve of whatever language/software we have to use I will feel more competent and confident in my skills and be more proactive in starting my own projects. I am really excited that this research relates to brain mechanisms. I hope that what I work on in this project is experience I can use to apply to places like Neuralink and Kernel. I am excited that it is part of the program to present our research at the end of the year. This means that I will be able to apply to present at conferences like the SACNAS conference.
One thing I am very appreciative of is that this program is meant to help us get started in research. Thus, it is my understanding and hope that the professors who signed up to be mentors are all people who genuinely care to help us learn and succeed. I am looking forward to working with peers and joining a lab who will be motivating and push us while acknowledging we are also there to learn.
What are you most nervous about in ERSP, and why?
I am nervous about feeling like I am struggling more than I should when getting started with the project. I am especially nervous about being too dependent on getting help to accomplish the tasks we are assigned. Feeling

clueless on how to do something while having deadlines makes me really anxious. Although that's a reality of research, I am nervous it is something I will feel too often and prevent me from enjoying and appreciating the opportunity I have. I am also concerned about not making enough progress that I don't have substantial results to show by the end of the program. I've been there before and it's disappointing to have to present 'expected results' along with an explanation on why you couldn't actually get results. Lastly, I am nervous that I won't like what I work on, or that it'll be too far off from what I'm interested in because I don't want it to be something I feel I have *to do. I really want to enjoy what I work on.*

[2] *Past log reflections*

After reading Miranda's logs and Jiani's logs I personally had more of a liking to Miranda's style. I thought Miranda's small additions of an intro, notes, a teehees, and emojis made it more appealing to read. To me it almost read like a blog, and I believe if I created something with a similar style I would be more easily invested in writing my logs and even enjoy looking back at them to review my progress. I find that I appreciate being more detailed on what was accomplished. From a reader's point of view, it gives you a slight better idea of what the person is working on and an even bigger insight as to how the person felt doing it. I imagine that reading it as your own, it would make it easier to remember what you did exactly and be able to appreciate your progress: accomplishments and obstacles encountered.

I think the logs are useful by providing yourself and your peers with a record of your progress. Tracking what you work on especially how you have overcome obstacles helps prevent the same obstacles from happening again, or taking as much effort to resolve. Most importantly, it's a good way to organize how you will accomplish what you need since with research the progress you need to make is very open-ended and that can be overwhelming. This is a way to communicate to yourself and your teammates how you will work towards the goals.

One thing that stood out to me from reading their logs is that you have to be flexible. Sometimes they started the week with certain specific goals and often things turned out differently, or took more time to get done; especially after the first initial weeks of getting familiar with the project. I feel like as much as you try to get rid of ambiguity there's only so much you can do and you have to be willing to change your plans as you go.

Lastly , I would like to add that I see logs as a great way to motivate yourself when you feel really stuck because you get to see what you have accomplished and remember how you probably felt you couldn't have done it that time either.

[3] *Try to answer these analytical questions for the papers Mohsen sent. (Taken from Prof. Griswold's How to Read an Engineering Research Paper).*

Week : / - /

Goals:

Accomplished:

day /: (hrs)

-

day /: (hrs)

-

day /: (hrs)

-

day /: (hrs)

-