**Author**: Su Kara

**Subject**: Project Log Book

Please note that I’ve always taken notes on my computer rather than handwriting in a log book.

**9/1/2020 – Discuss Project Ideas**

* Discussed several project ideas and decided on the following:  
  Assessment of breast density using unsupervised variational autoencoders.

**9/8/2020 – Research breast cancer statistics**

* https://www.breastcancer.org/symptoms/understand\_bc/statistics

**9/15/2020 – Research breast density types**

* https://www.mayoclinic.org/tests-procedures/mammogram/in-depth/dense-breast-tissue/art-20123968

**9/22/2020 – Research breast density as a cancer indicator**

* https://academic.oup.com/jnci/article/92/13/1081/2909528

**9/29/2020 – Research similar studies**

* https://pubs.rsna.org/doi/full/10.1148/radiol.2018180694
* https://pubmed.ncbi.nlm.nih.gov/29159811/
* https://www.spandidos-publications.com/10.3892/or.2019.7312
* https://christian-igel.github.io/paper/UDLAtBDSaMRS.pdf
* http://stmi12.rutgers.edu/papers/Breast%20Density%20Scoring%20with%20Multiscale%20Denoising%20Autoencoders.pdf

**10/13/2020 – Image Preprocessing**

* Convert 734 3D MRI images of 734 patients to 128x256x256
* Convert 6,987 2D mammograms of 734 patients to 512x512

**10/20/2020 – Connect to the new CAIDM lab at UCI remotely**

* Connect to the new GPU servers through a gateway server

**10/27/2020 – Train U-Net on 238 patient MRIs for FGT/breast segmentation**

* https://arxiv.org/abs/1505.04597
* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6669125/
* Identify the FGT and breast regions on MRIs

**11/10/2020 – Run U-Net on 734 patient MRIs to generate ground-truth ratios**

* Save these ratios to correlate with the single values generated from the unsupervised model

**11/17/2020 – Develop a VAE algorithm**

* https://www.jeremyjordan.me/variational-autoencoders/

**12/1/2020 – Check decoder model predictions**

* Inspect decoder predictions visually for different latent dimensions to see what features it’s learning

**12/8/2020 - Check encoder model predictions**

* Generate a 16x16 latent matrix by running the encoder model prediction on each mammogram

**12/15/2020 – Remove the surroundings of breast programmatically**

* Clean up the area around the breast by removing the irrelevant cells by setting a threshold value as the mode of the image

**12/22/2020 – Get the mean, median, 25th percentile, 75th percentile, and weighted mean**

* Calculate different statistical parameters to use for correlation with ratios

**12/29/2020 – Check correlation with ground-truth ratios**

* Weighted mean provided the best correlation value of 0.66, but this could be improved by using a better approach to clean up the surroundings

**1/5/2021 – Train U-Net on mammograms for pectoralis muscle**

* https://pubmed.ncbi.nlm.nih.gov/22078258/

**1/19/2021 – Run U-Net to mask the surroundings of breast**

* Clean up the area around the breast by applying the mask

**1/26/2021 – Get the mean, median, 25th percentile, 75th percentile, and weighted mean**

* Calculate different statistical parameters to use for correlation with ratios

**2/2/2021 – Check correlation with ground-truth ratios**

* Mean provided the best correlation value of 0.68
* Highest latent dimensions performed better

**2/12/2021 – Write the report**

* Write a summary report for the project

**2/25/2021 – Prepare the slides**

* Create PowerPoint slides by using the template provided by OCSEF