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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