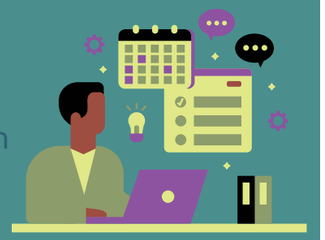
Ahmedabad University

CSE - 523 Machine Learning
Faculty: Prof. Mehul Raval

Nuclei Image Segmentation

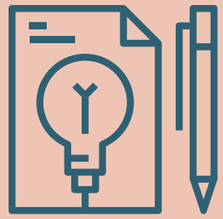
Motivation

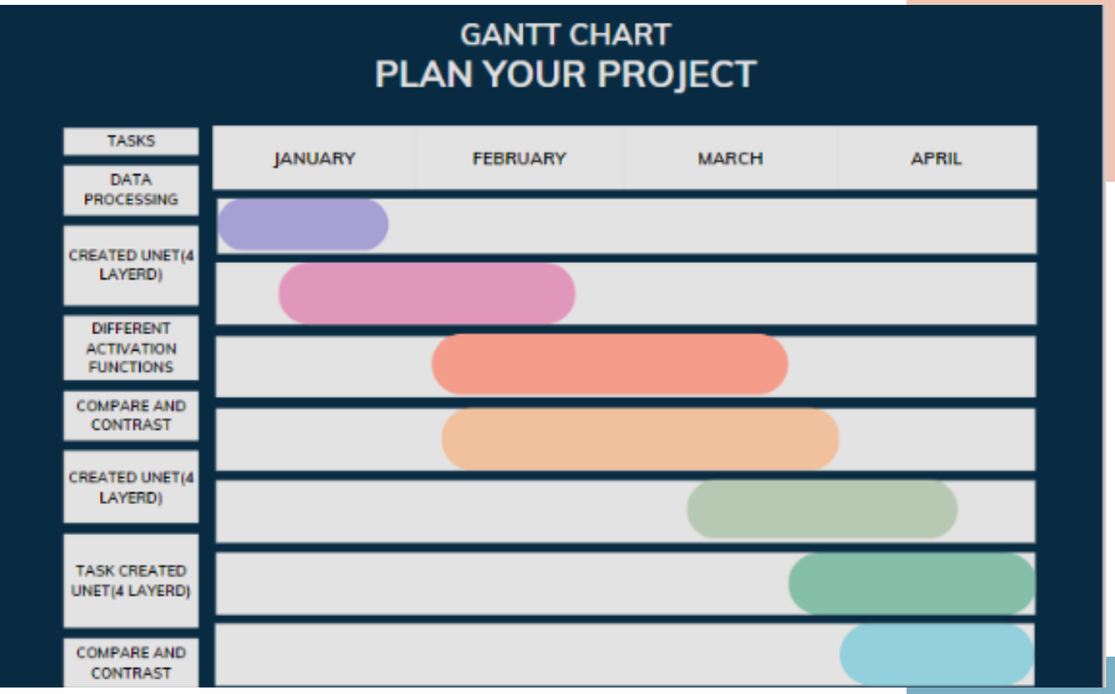
Our academic project aims to develop an algorithm for automating nucleus detection, which could speed up research for diseases, from cancer to rare disorders. This could lead to faster cures and transform many lives.



Problem Statement

Our academic project aims to develop an accurate cell segmentation model using UNet architecture and multiple activation functions for micrograph analysis.



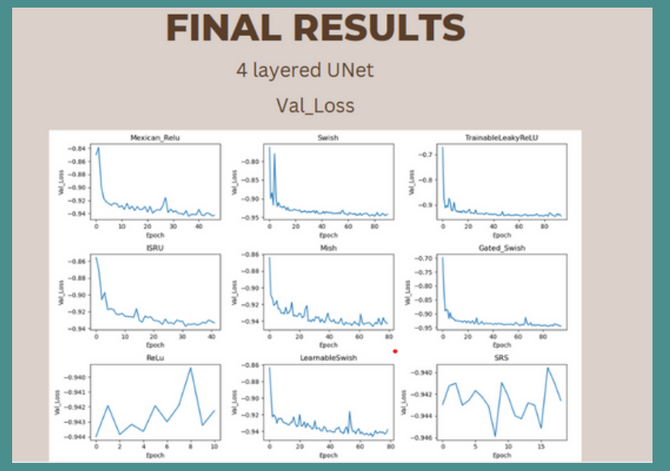


FINAL RESULTS

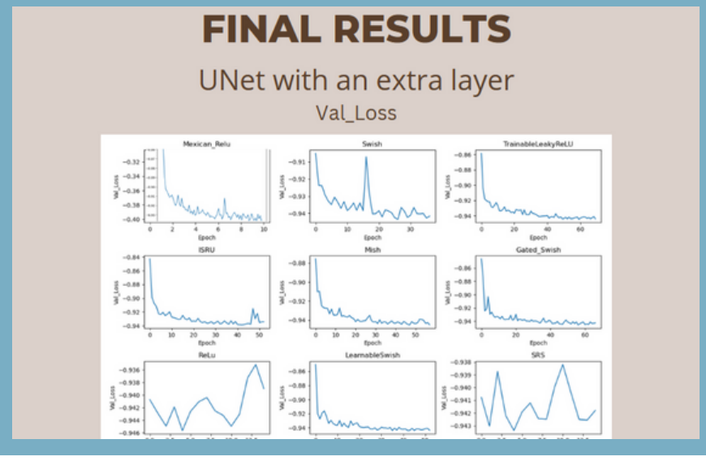
UNet with an extra layer

on Function	Top-1 Accuracy	Epochs Till Convergence	Training Time(s)
Functions	0.8819	80	230
	0.8834	64	11(
eLeakyRelu	0.8751	35	8(
quareUnit	0.8648	37	8:
	0.674	20	6(
vish	0.8808	47	12
eLine)	0.8688	14	40.
leSwish	0.8799	43	118.
ReluShifted	0.8819	5	2(

Results



Results



Our Approach

In our academic project, we trained our model with ReLU activation function and the UNet architecture, and later experimented with several other activation functions such as MexicanReLU, TrainableLeakyReLU, ISRU, Mish, Swish, Gated Swish, LearnableSwish, and SRS.

Group 9 - Innovators

Abhishu Oza-AU2040027
Nihar Jani-AU2040205
Razin Karimi-AU2040230
Aadya Chinubhai-AU2040232

Results

FINAL RESULTS

4 layered UNet

Activations	*Top-1 Accuracy*	*Epochs till Convergence*	*Training time (s)*
Mexican ReLU	90.08	71	125.46
Swish	89.88	79	82.74
Trainable LeakyReLU	87.59	27	32.94
InverseSquareRootUnit	89.11	61	79.65
Mish	89.93	60	65.71
GatedSwish	90.01	67	78.63
ReLU (Baseline)	89.81	21	22.24
Learnable Swish	90.11	63	75.78
SigmoidReLUShifted (SRS)	90.15	24	27.584

References

- *[1]*Nanni, L. (2021, March 29). Comparison of different convolutional neural network activation functions and methods for building ensembles. arXiv.org. *https://arxiv.org/abs/2103.15898*
- *[2]*Ronneberger, O., Fischer, P., & Brox, T. (2015). U-Net: Convolutional Networks for Biomedical Image Segmentation. Lecture Notes in Computer Science, 234–241. *https://doi.org/10.1007/978-3-319-24574-4_28*
- *[3]*Team, T. A., & Team, T. A. (2023, January 7). Medical Image Segmentation: 2018 Data Science Bowl. Towards AI.

https://towardsai.net/p/l/medical-image-segmentation-2018-data-science-bowl

- *[4]Ronneberger, O. (2015, May 18). U-Net: Convolutional Networks for Biomedical Image Segmentation. arXiv.org.*

https://arxiv.org/abs/1505.04597