Pucho Life Sciences Inc. Data Science Internship Task

Semantic Image Segmentation of Nuclei using U-Net Architecture in Python.

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Introduction

This project is an implementation of the U-net Architecture presented in the research paper titled 'U-Net: Convolutional Networks for Biomedical Image Segmentation' (2015) authored by Olaf Ronneberger, Philipp Fischer, Thomas Brox.

Link for the original research paper : https://arxiv.org/abs/1505.04597

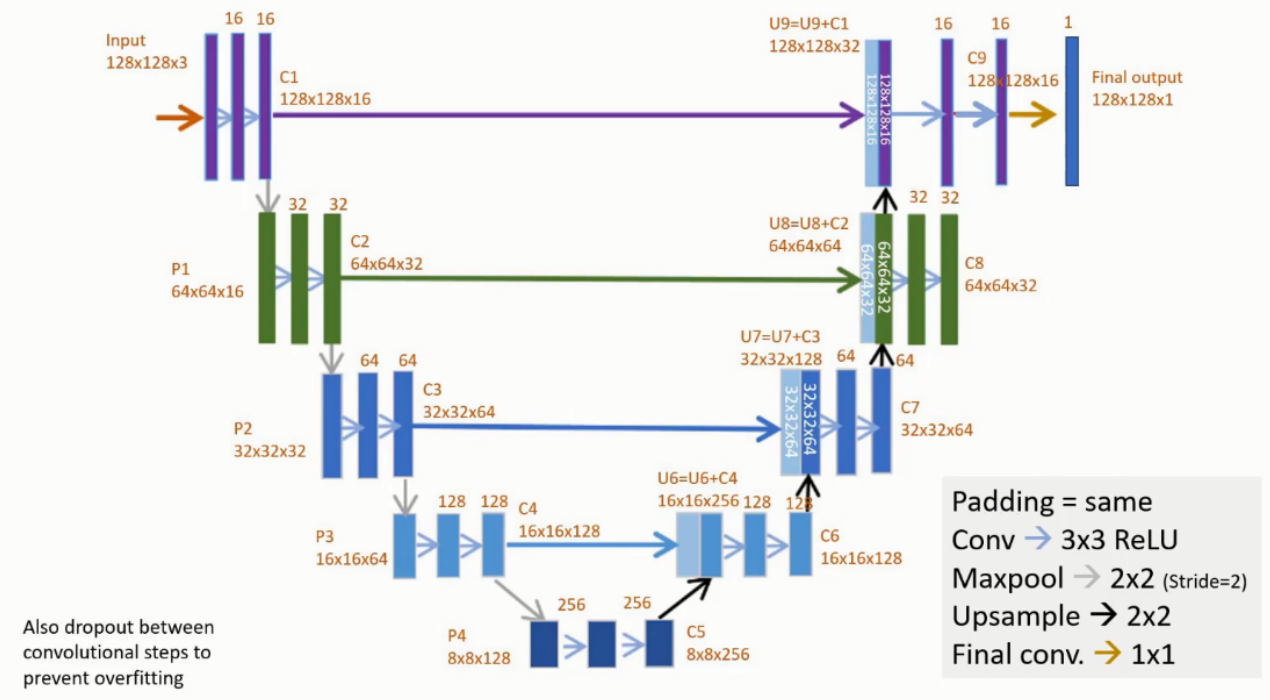
The dataset of divergent images of nuclei is taken from : https://www.kaggle.com/c/data-science-bowl-2018/data

The main objective of this project is to build a model that performs accurate semantic segmentation of the nuclei images and compute the evaluation metrics.

Data Preprocessing

In the zipped training folder, training images and masks are given in separate folders with unique ids. Each unique folder further contains an 'images' folder containing a .png image with the same id and a 'masks' folder containing the segmented masks of each nucleus. Each mask contains one nucleus. Hence it was important to combine all the different masks for different nuclei into a single image. Moreover, since images and masks are of different sizes, they have been resized to a standard size of 128 X 128 pixels, and the pixel values have been normalized. The test folder only contains an 'images' folder and has been preprocessed in the same way.

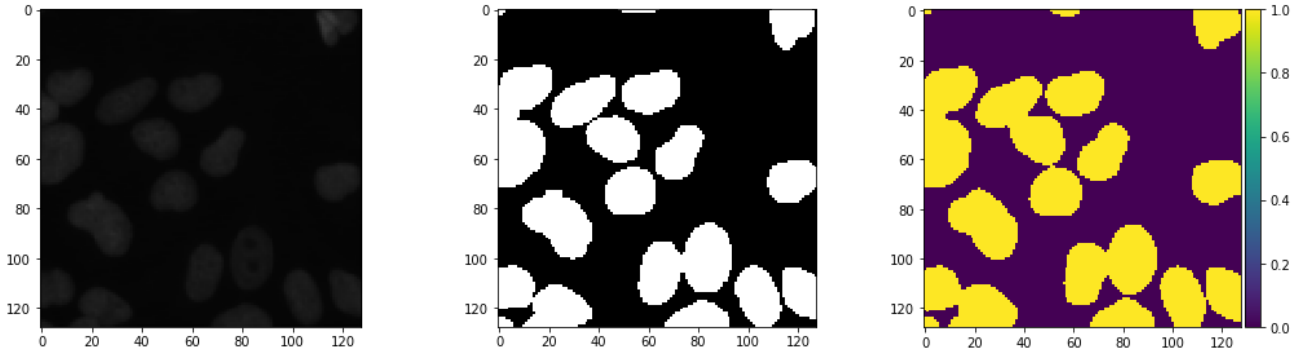
U-Net Architecture Implemented



Results

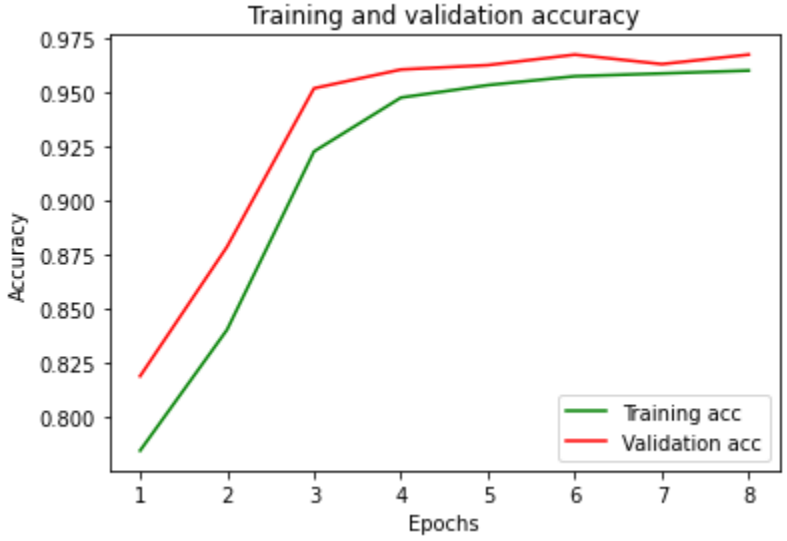
1. Test Dataset Results

Original Image | **True Mask** | **Predicted Mask**



2. Training and Validation Loss

3. Training and Validation Accuracy



References

- ‘U-Net: Convolutional Networks for Biomedical Image Segmentation’ (2015) authored by Olaf Ronneberger, Philipp Fischer, Thomas Brox https://arxiv.org/abs/1505.04597
- Paper Summary: U-Net: Convolutional Networks for Biomedical Image Segmentation (2019) by Gerald Muriuki https://towardsdatascience.com/paper-summary-u-net-convolutional-networks-for-biomedical-image-segmentation-13f4851ccc5e
- https://lmb.informatik.uni-freiburg.de/people/ronneber/u-net/
- https://www.kaggle.com/c/data-science-bowl-2018/overview