CS230 Project: Nuclear Segmentation with Deep Learning

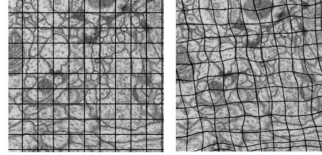## Antoine Bargé, abarge@stanford.edu
03/20/2019

Introduction

- The project is based on the ISBI 2012 Challenge and aims to perform **segmentation of cell images** .

- There are initially **30 512x512 images** both in the training and testing sets.

- The **metric of success** is accuracy of the classifier.

Models

- **U-Net:**

- **SegNet:**

Data Augmentation

- Used **Image Data Generator** in Keras to generate new training images.

- Since the training set has a generated infinite size, the **number of steps per epoch** is fixed to 2000.
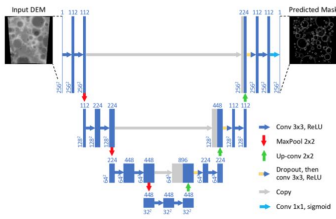

Results

Model	Optimizer	Learning Rate	Accuracy
U-Net	SGD	0.0001	0.885
U-Net	Adagrad	0.0001	0.878
U-Net	**Adam**	**0.0001**	**0.967**
U-Net	Adam	0.001	0.958
SegNet	SGD	0.0001	0.782
SegNet	Adam	0.0001	0.810
SegNet	Adam	0.001	0.814

Predictions: Left (U-Net), Right (SegNet)
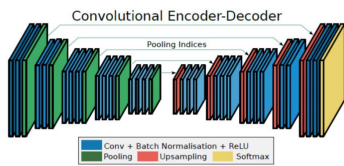

Discussion

- Best score for a **U-Net** with **Adam** and a **learning rate of 0,0001.**

- **Data augmentation** is essential, otherwise scores are very low.

- SegNet **misses the finer details**, unlike U-Net, especially at the **boundaries**.

- U-Net is not very efficient when one class is **present in abundance** and there is some random noise.

- **Future works**:
    - Transfer Learning
    - Tiramisu
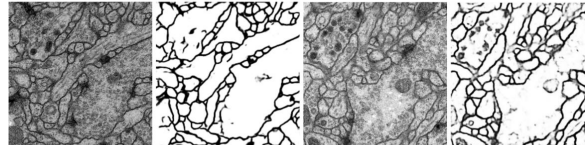   - U-SegNet (combinaison of U-Net and SegNet).

References

- Ronneberger,Fischer,Brox:**U-Net: Convolutional Networks for Biomedical Image Segmentation**.

- Badrinarayanan,Kendall,Cipolla:**Seg Net, a deep convolutional encoder decoder architecture for image segmentation.**

- Ciresan, Gambardella: **Deep neural networks segment neuronal membranes.**