Project 4

Crumpler

Strategy

- Pre-processing
  - NMF
  - Other strategies
- Convolutional Neural Network (UNET)
- Grid Search
- Post-processing

Pre-Processing with NMF

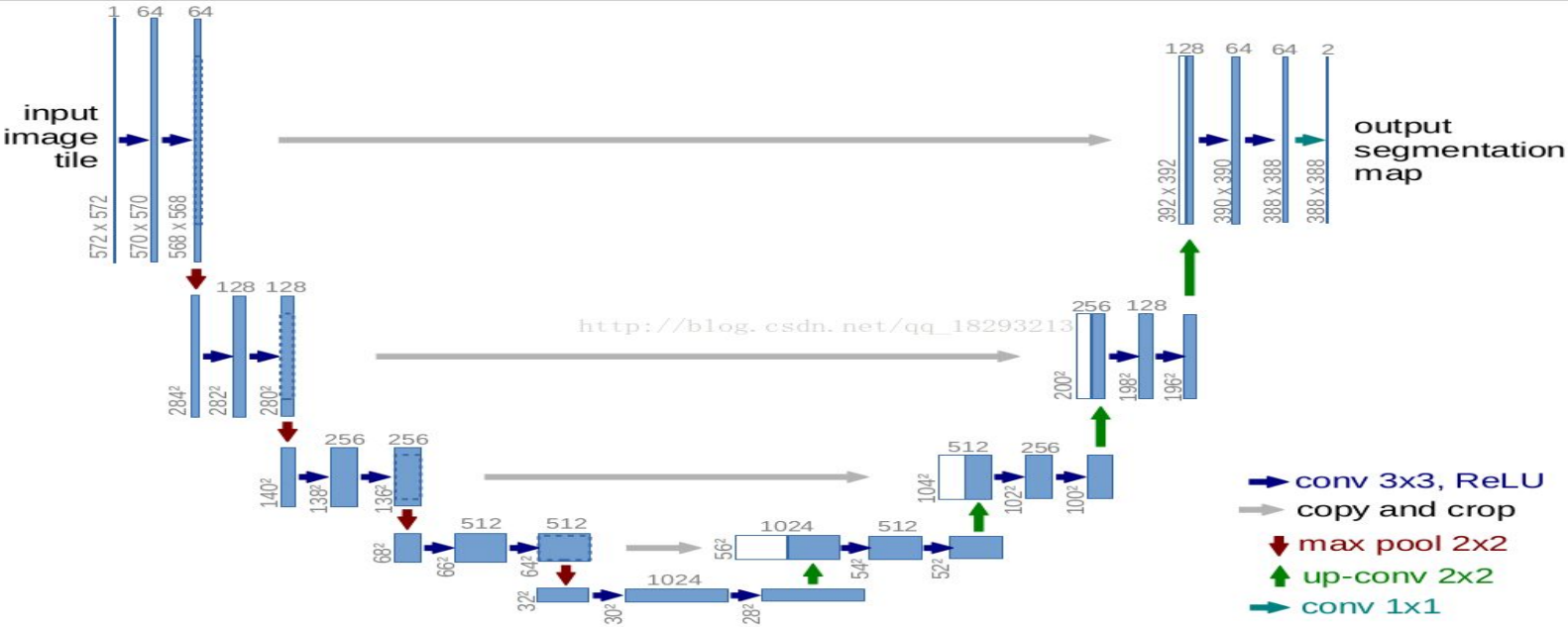
- Dataset: *m* many images, each *512 x 512*
- Flatten and stack to get one *m x 512*512*
- NMF_k returns two matrices:
  - W is *m x k*
  - H is *k x 512*512*
- The *H* matrix may be used to directly estimate the ROIs
  - Thunder Extraction is particularly useful
- It also provides a “feature space” for the pixels
  - Each pixel now has k many features that describe it

Pre-Processing with Other Strategies

- **Average**
  - Calculate the average value for each pixel across the time series
  - Gives you one new image to use
- **Displacement**
  - Calculate the difference between the max and min value for each pixel across the time series
  - Gives you another new image to use
- **Random**
  - Snag random images across the time series to use as your training data

- The average, displacement, and random images for each time series may be used as input into a CNN for training data (probably best to use all…)

UNET Architecture(credits: http://blog.csdn.net)



Ensemble vs Individual

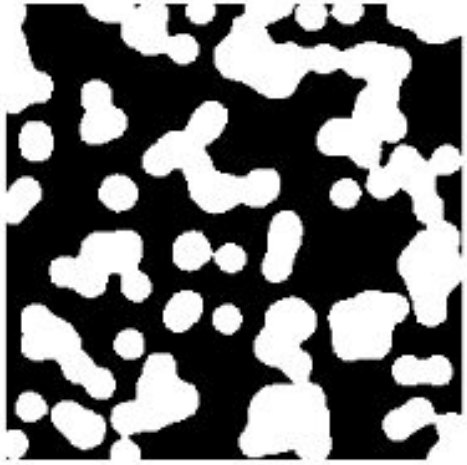
- Trained a separate UNET model on each cluster from NMF
- Combined output with simple voting to label pixels
- Also trained a single UNET model with all clusters stacked
- Individual had superior performance

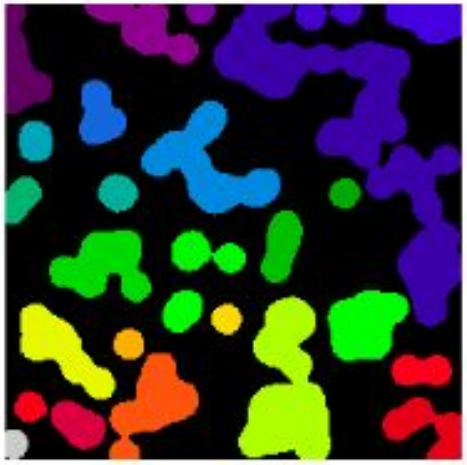
Hyperparameter Tuning

- Model contains many parameters that affect training
  - learning rate, optimizer, batch size
  - weight of positives labels vs negatives
  - type / combination of preprocessing
- Configured training script to accept arguments for these
- Wrote bash script to run with different combinations of arguments
- Checkpointed each model and saved metrics to CSV
  - enables easy comparison of different models

Segmentation

- UNET outputs an image of 1s and 0s, representing neurons and non-neurons
- We need individual regions
- Scikit-image connected components algorithm
- Works well, but fails on overlapping regions





Limitations