Progress Review : Detection & Localization of Rabies Neurons

Keshava Prasad Gubbi

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The Story so far .....

- Developed the *classifier*: CNN as a binary classifier with two classes (background and single Neuron). Classifier Works!
- Processing images for training data : Crop tiles of size (50 * 50) based on landmarks file ; stride length of 10 microns.

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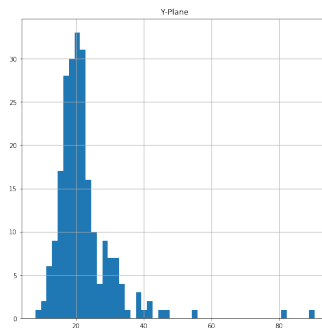- Included a third class in the classifier : Partial Neuron
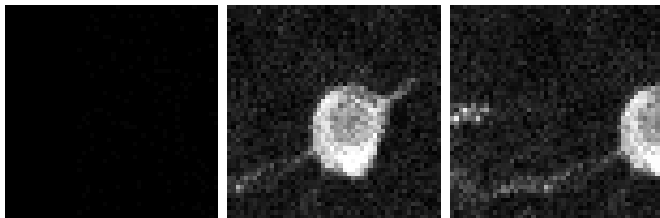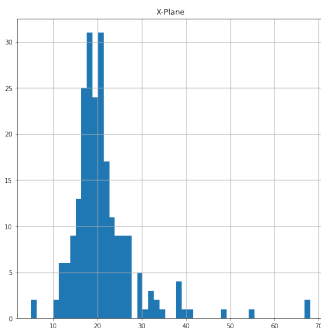

- Train on 367 samples, validate on 41 samples;
  Accuracy: 98.64%, Validation Accuracy: 92.68%

Determining Radius

Brainstem - mean values of neuron radii: 22 microns

Shape	X-Plane(microns)	Y-Plane(microns)
Circular	19.96	19.96
Elliptical	19.96	22.73
Irregular	26.14	24.89

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- Run classifer and sort tiles into 3 classes:
  - Class 0 : Background
  - Class 1 : Single Neuron
  - Class 2 : Partial Neuron
  - Class 3 : Mutiple Neurons (to be added later!)
- Collect tiles of each class into separate list.

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- Collect tiles of each class into separate list.
- Testing : 56 out of 60 tiles accurately classified! ✓
- Training and Testing data done with small quantity of data; can run with large data on cluster.
- Fixed issues with script for running on cluster. ✓

Generating Landmarks

- For single neuron tiles: central location of tile, based on image moment (weighted average of pixel intensities): (local_x, local_y).
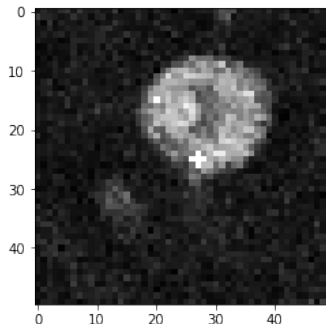
- Landmarks : local coordinates known; global coordinates of tiles are known. Landmarks for neuron obtained ✓.

- compare for accuracy with pre-existing landmark file (currently working on it).

Work in Progress....

- For every tile with partial neuron:
  - Further sub-divide the tile in 4 quadrants.
  - Determine the quadrant wherein partial neuron exists!
  - Based on quadrant, divide neighboring tiles into quadrants and stitch them together $\implies$ obtain full neuron.
  - Generate landmarks (after resizing!) like earlier.
  - Run iteratively until all partials are transformed into full neurons.
- Run full pipeline for many images.

Conclusion

- Neuron Classifier developed and successfully detects rabies neurons.
- Cropping strategy implemented and large image can now be cropped into tiles.
- Testing successfully carried out on small number of images.
- Landmarks of neurons obtained (for single neurons).
- Next steps:
    - Working on stitching together partial neuron tiles and generating landmarks
    - Working on improving accuracy of obtaining landmarks.
    - Running full pipeline on cluster with large quantities of (training and testing) data.