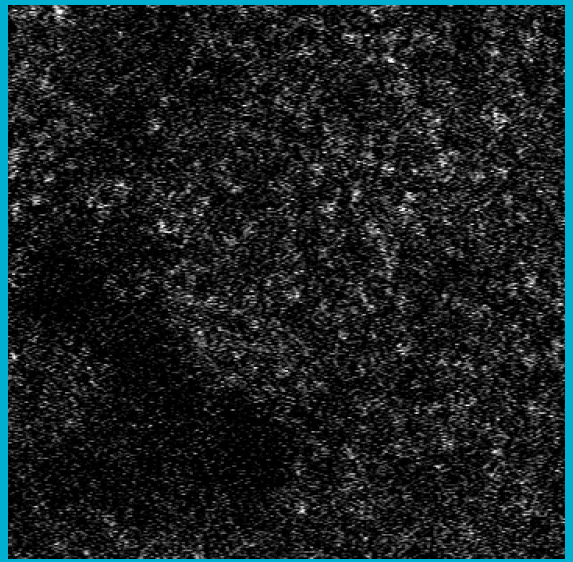
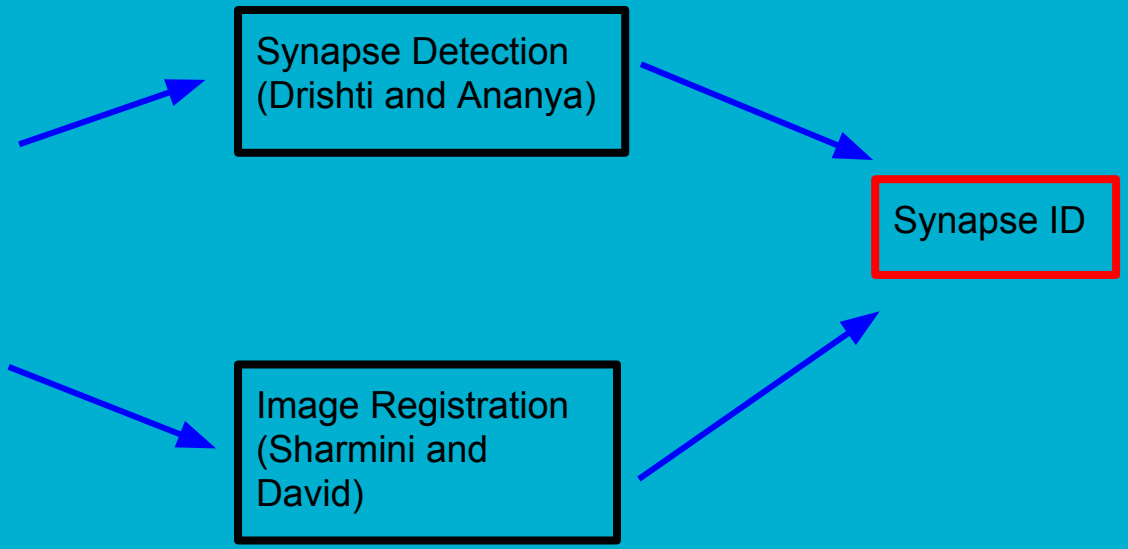
LIDS

Week 3/11: Sprint 3 Final Deliverables

The Idea




Synapse Detection
(Drishti and Ananya)
Image Registration
(Sharmini and
David)
Synapse ID

Ananya/Drishti

Sprint 3

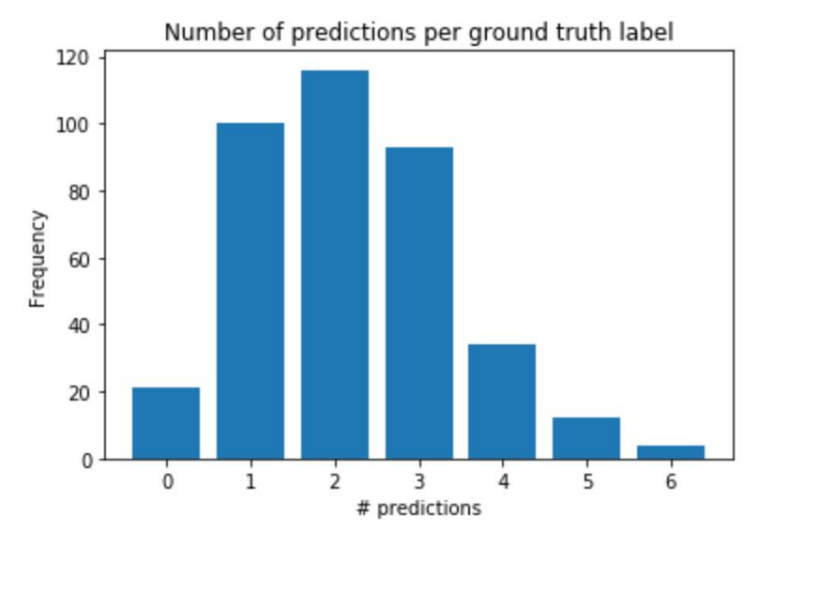
- Calculate Qualitative and Quantitative metric Performance of Bloby and NOMADS (LDA)
  - DoD: Explain how each algorithm works, generate plots for quantitative metric and overlays for qualitative metric

Ananya/Drishti

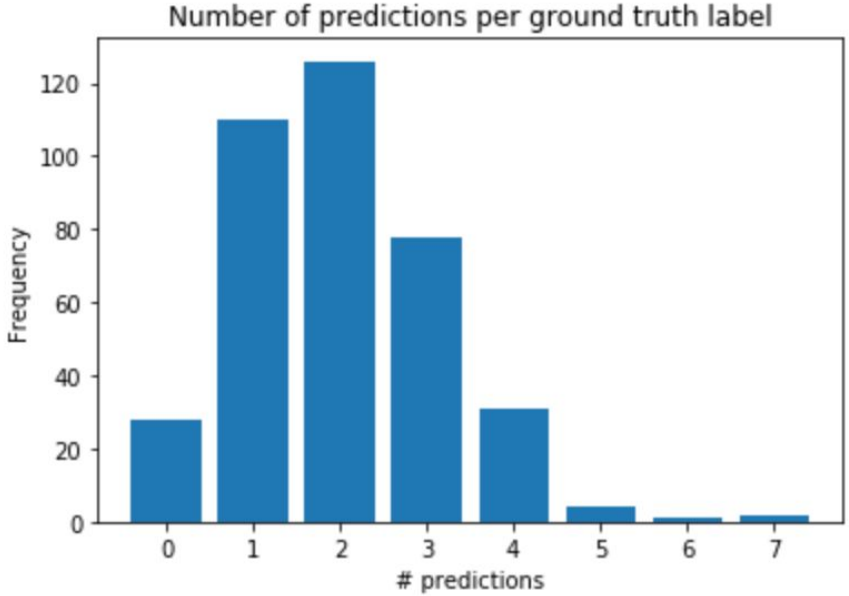
Bloby performance: round 2

- *Bloby* re-ran on a smaller sub-substack of 200x200x16 voxels. Sub-substack mostly labelled

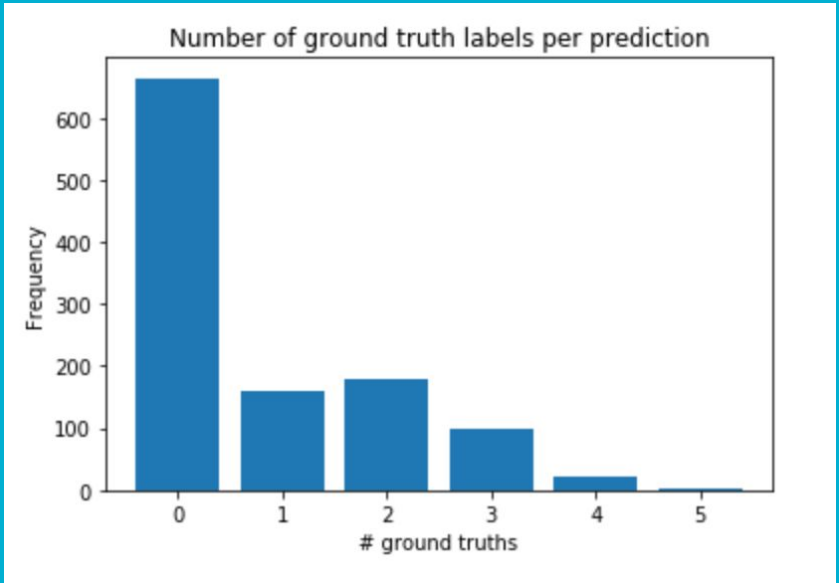
Last week's performance on ¼ marked substack



This week's performance

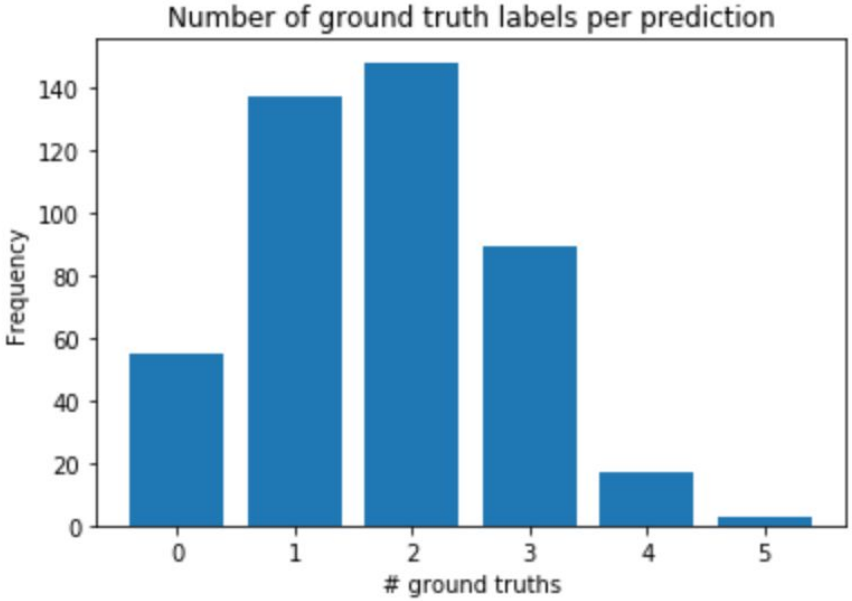


Last week's performance

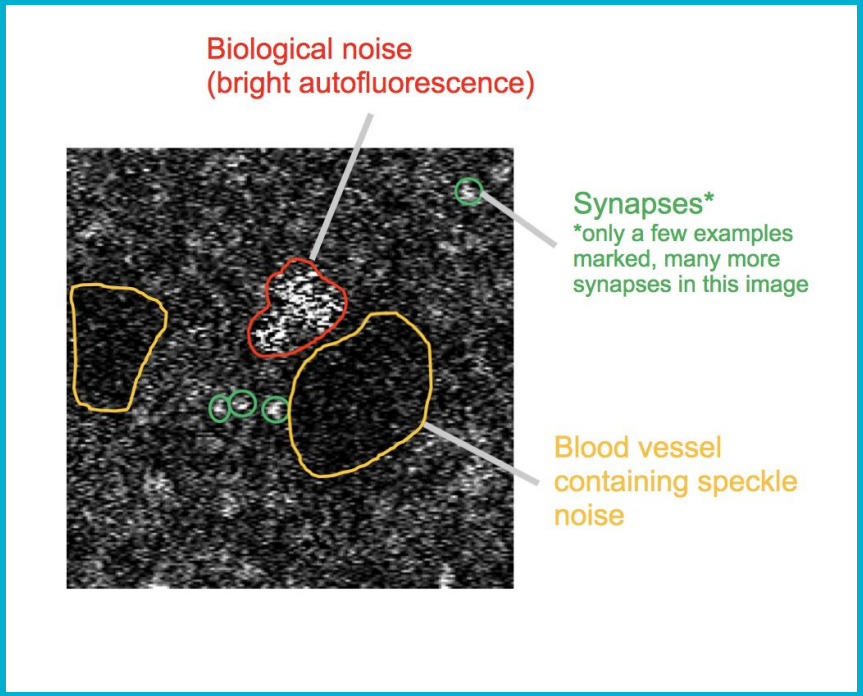


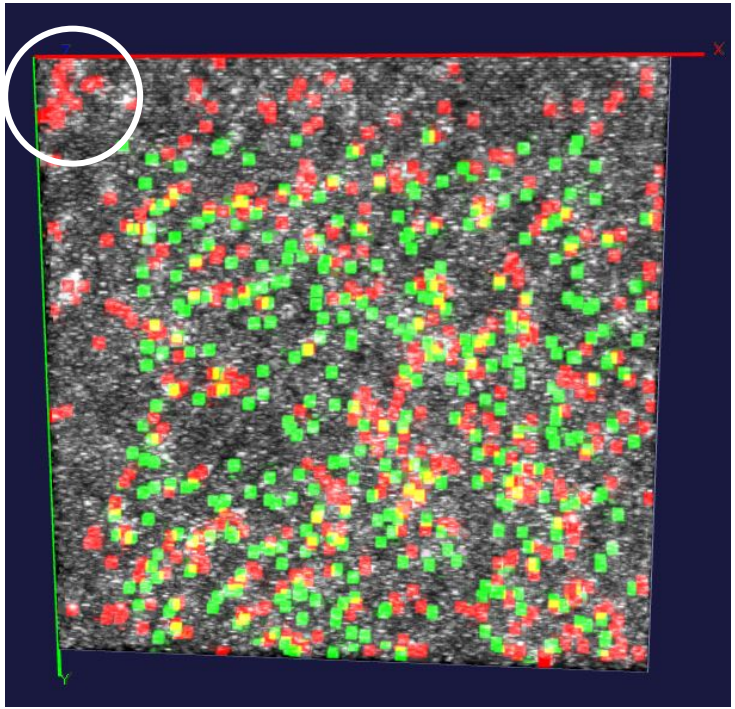

```
Precision: 0.206
Recall: 0.237
```

This week's performance




```
Precision: 0.477
Recall: 0.756
```

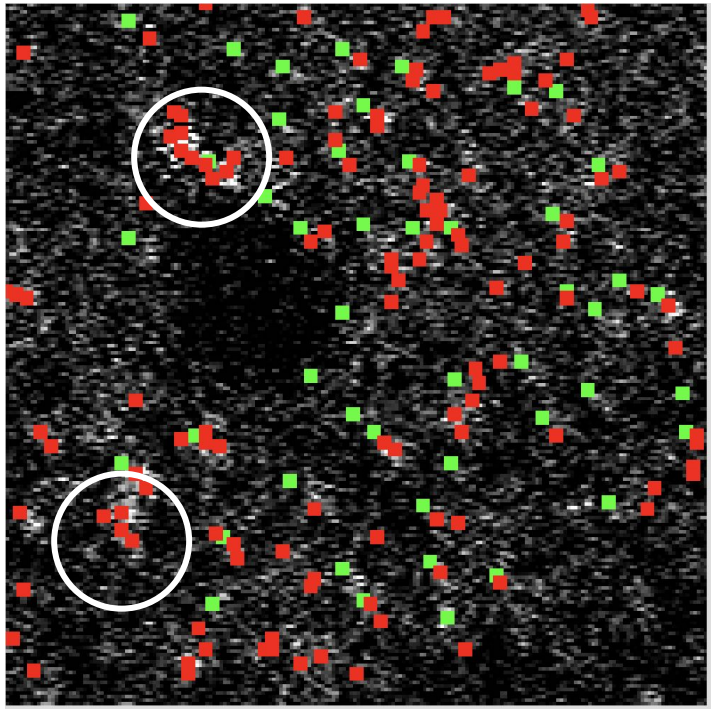




ground truth, predictions, ground truth+predictions, circles = noise

Bloby overlap with ground truth on z=0

Bloby intensity threshold and erosion unable to separate noise from signal, therefore, higher false positive rate.



ground truth, predictions, circles = noise

Ananya/Drishti

Linear Discriminant Analysis (LDA) performance on 200x200x16 voxels

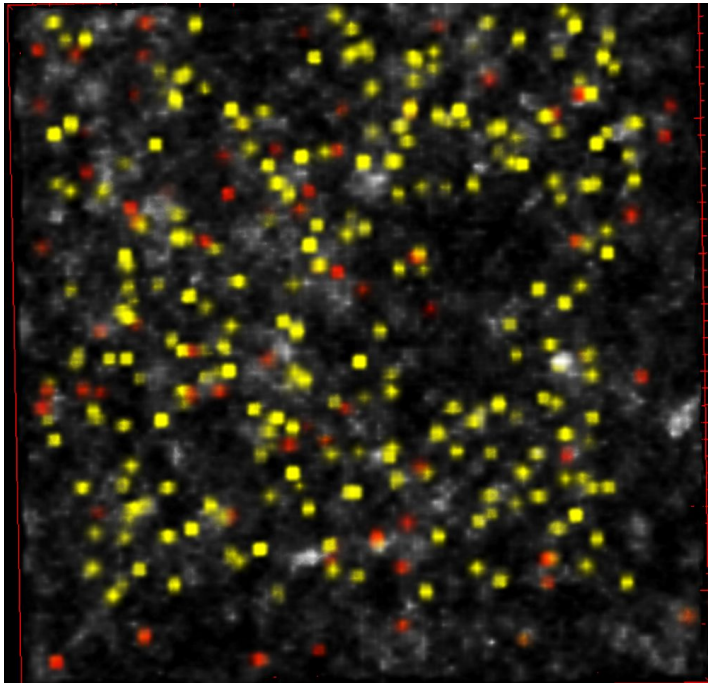
Linear Discriminant Analysis (LDA) Overview:

- Linear combinations of features used to separate output variables into classes
- Uses probability distribution of training classes and decision boundary to separate data into classes

LDA synapse prediction

Feature = mean intensity of a 1um^3 cube
Trained on 120 synapses + 120 non-synapses
Tested on 240 synapses + 240 non-synapses

All synapses correctly labelled

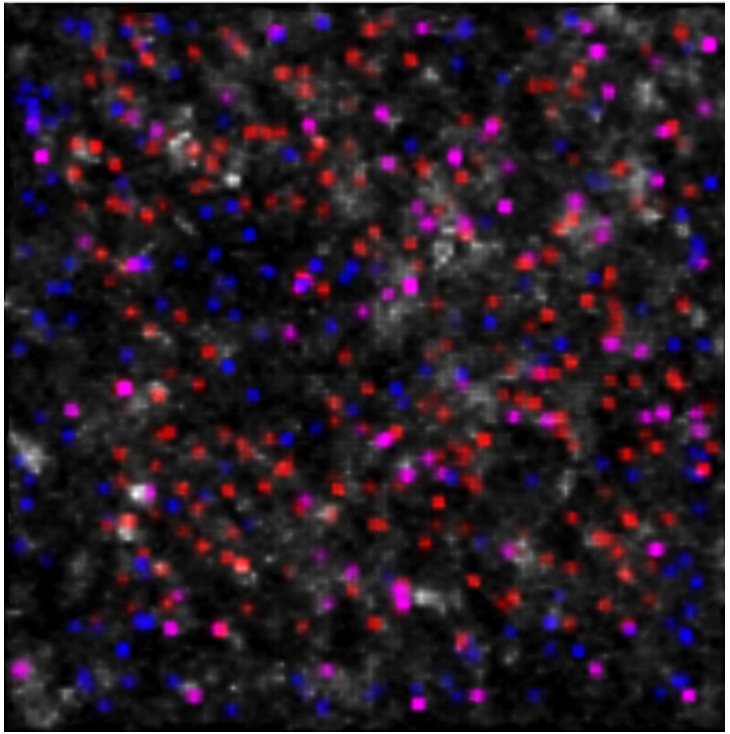


predicted synapse, true synapse, predicted+true

LDA synapse prediction

Feature = mean intensity of a 1um^3 cube
Trained on 120 synapses + 120 non-synapses
Tested on 240 synapses + 240 non-synapses

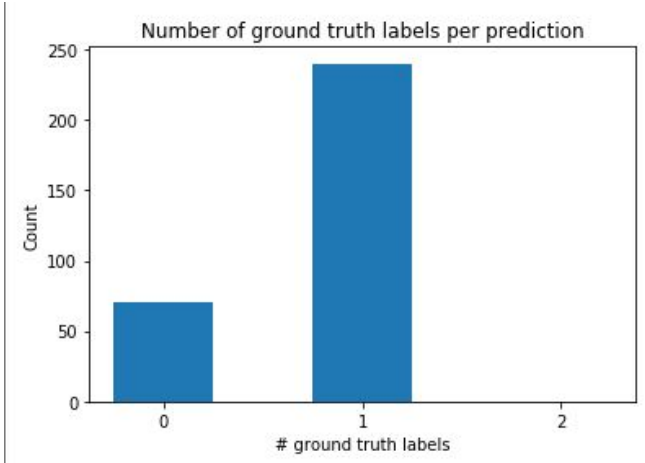
71 non-synapses mislabelled

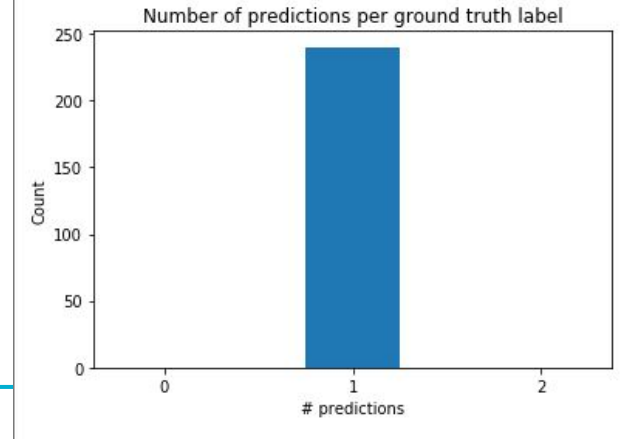


predicted synapse, non synapse, predicted+false

Quantitative Measures

Non-synapse class shown (71 mislabelled out of 240)





Quantitative Measures

For non-synapse class (71 mislabelled out of 240)

Precision: 240/311 ~ 0.772

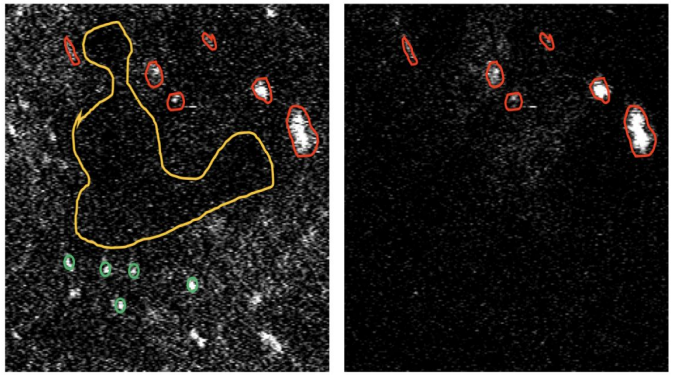
Recall: 240/240 = 1

F1 score: 2*(0.772*1)/1.772 = 0.871

Ananya/Drishti

Sprint 4

- Factor noise size to improve *Bloby*
- Set an upper bound for mean intensity?
- Any suggestions..???



Channel 1 / Green / Synapse Marker (SEP-GluA1)

Channel 2 / Red / Mostly noise

Sharmini

Sprint 3

- Match 3D points across time using Hungarian Algorithm
  - DoD: Jupyter notebook detailing python implementation of Hungarian Algorithm

Sharmini

Hungarian Algorithm

- Solves the linear assignment problem (akin to row reduction in linear algebra)
- In relation to LIDS:
  - Need it obtain the permutation matrix Y such that euclidean distances between points in A and points in B is minimized
  - arg min y ‖A - yB‖

Sharmini

Deliverables: Really annoying SNAGS!

- Existing python implementations of the Hungarian Alg don't actually give you the least cost matrix!
  - They assume an unweighted, bipartite boolean graph i.e. that the cost matrix is comprised of 0s and 1s
- Demo of Snag

Sharmini

Next Week/Sprint 4

- Continuing working on Hungarian algorithm implementation to register 3D points; find y (Next Week)
- Apply Hungarian algorithm to Huganir data set (Sprint 4) if possible (base decision off of synapse detection results)

David

Sprint 3

- Incorporate n-way registration into ndreg
  - DoD: GitHub PR and demo notebook

David

Deliverables

- Pull Request with function: https://github.com/neurodata/ndreg/pull/13

David

Demo!

- N-way registration Notebook Demo
- Image normalization and clipping notebook (time permitting)

David

Sprint 4 Goals

- Verify robustness of n-way on images with larger differences
- Synapse tracking