Flycircuit Final Project Introduction

NTHU PHYS591000 2022 Final Presentation Part I

Team name: sudo model.fit

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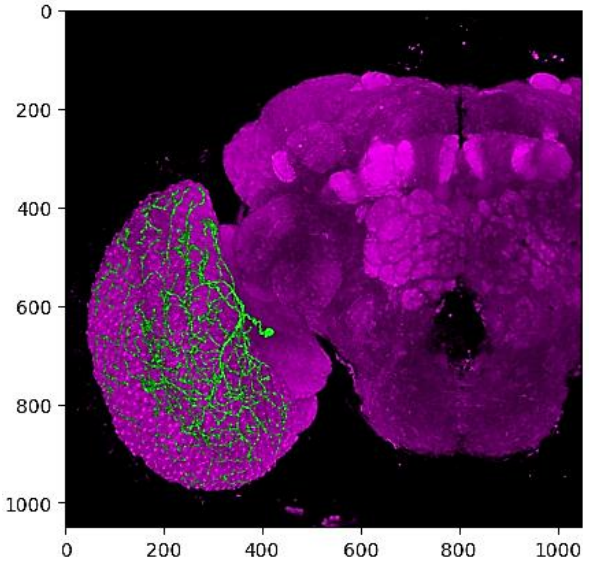
Outline

- Goal of Flycircuit project
- Data Description
- Version 1.0
  - Data Preprocess (I) - More training images
  - **CNN** Model
- Version 2.0
  - Data Preprocess (II) - More features
  - **XGBoost** model

Goal – Classify Neurons

Local neuron

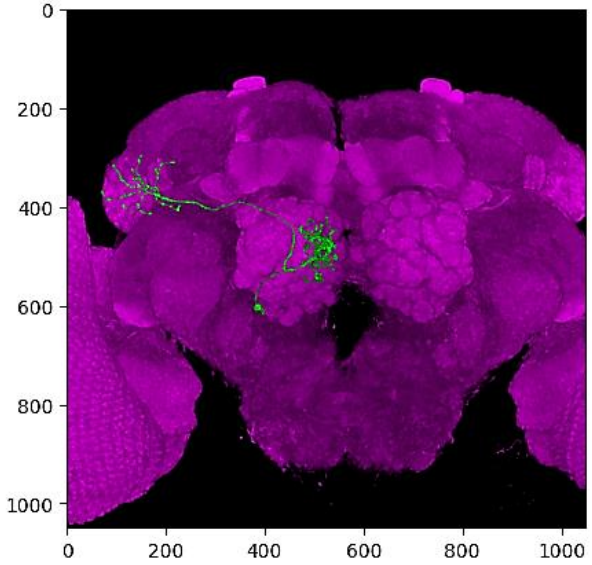
Label = 0



Trh-M-000067.png

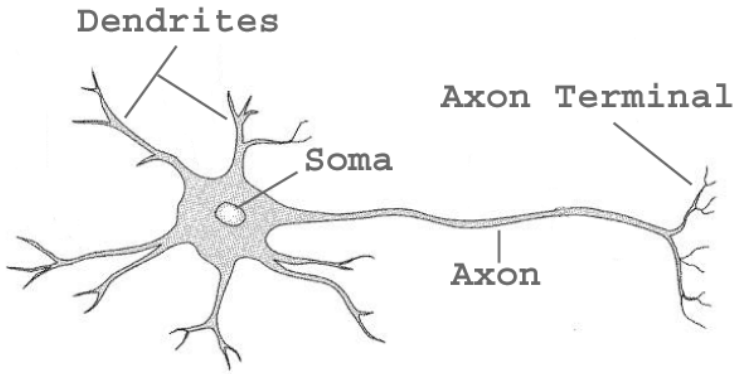
Projection neuron

Label = 1



Trh-F-500059.png

The structure of a Neuron cell



https://www.researchgate.net/figure/The-main-structur-of-a-neuron-consists-of-soma-dendrites-and-axon_fig3_220856618

Data Description – 2D .png / 3D .swc

Train data (1500)

Label Table (.csv file)

id	label
Trh-F-900008	1
Trh-F-500171	1
Cha-F-200374	0
5HT1A-F-100011	1

Projection Label = 1 (1207)

Local Label = 0 (293)

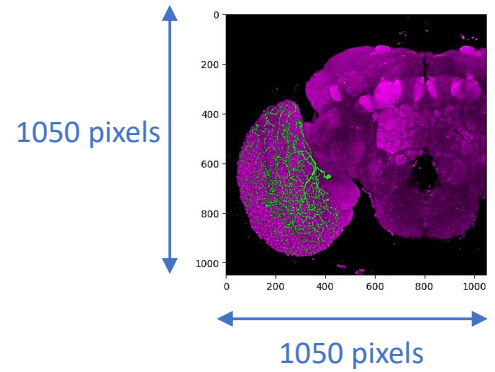
Test data (473)

Models

Prediction

2D-png

1050 * 1050 pixels

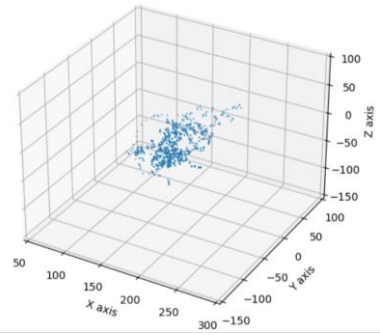


3D-swc

Each neuron has different node's numbers

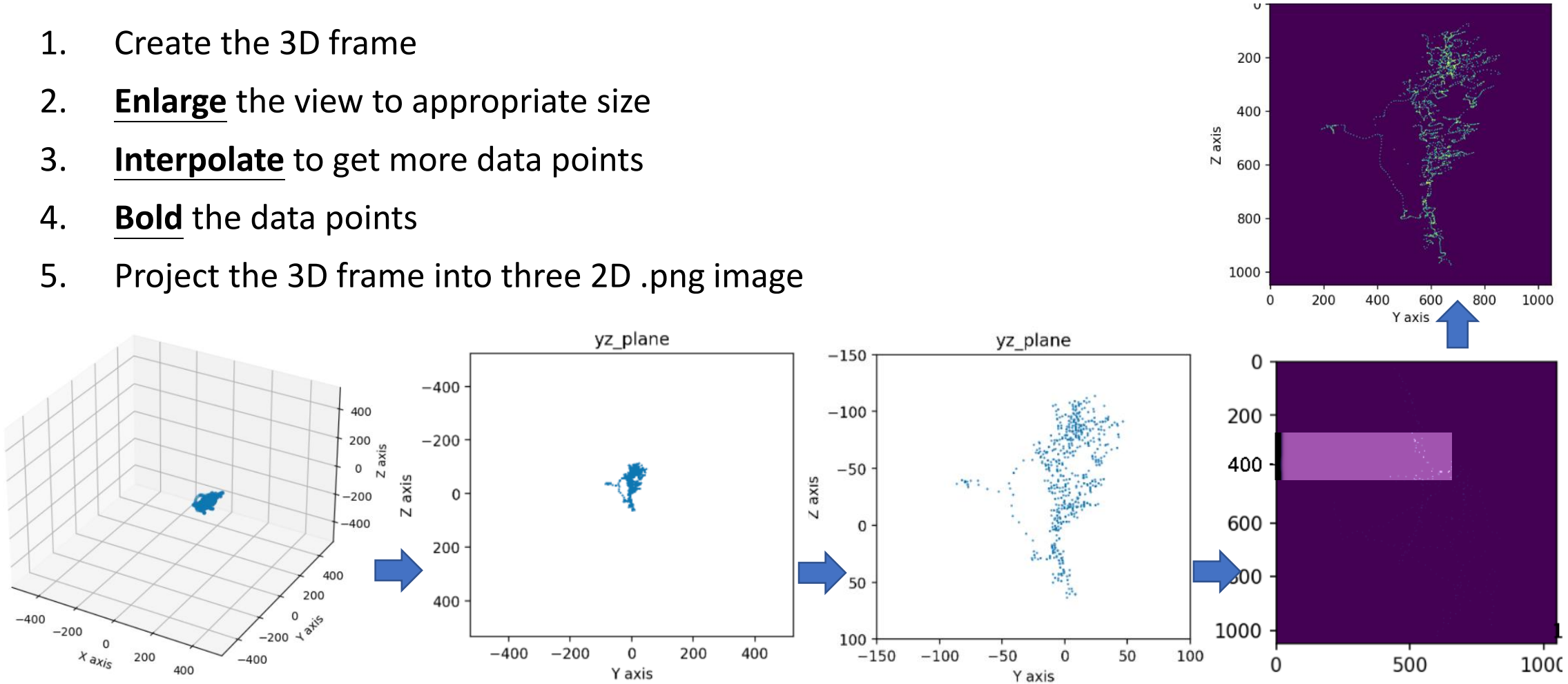
```
# inode R X Y Z D/2 idpar
1 1 -76.10000000 -118.27000000 84.92000000 0.00000000 -1
2 0 -77.85000000 -118.13000000 83.49000000 0.00000000 1
3 0 -78.09000000 -117.89000000 80.84000000 0.00000000 2
4 0 -77.06000000 -117.34000000 78.30000000 0.00000000 3
```

x y z

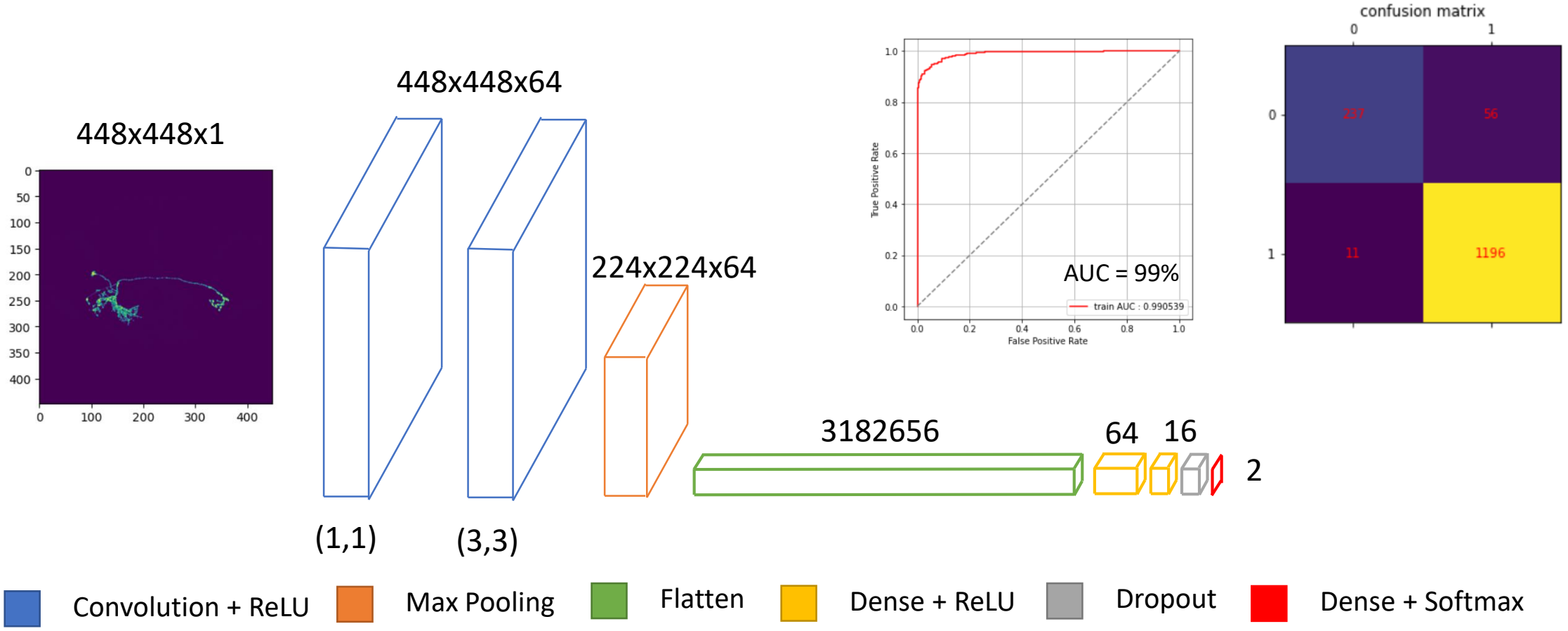


Data Preprocess (I) - More images from 3D!!!

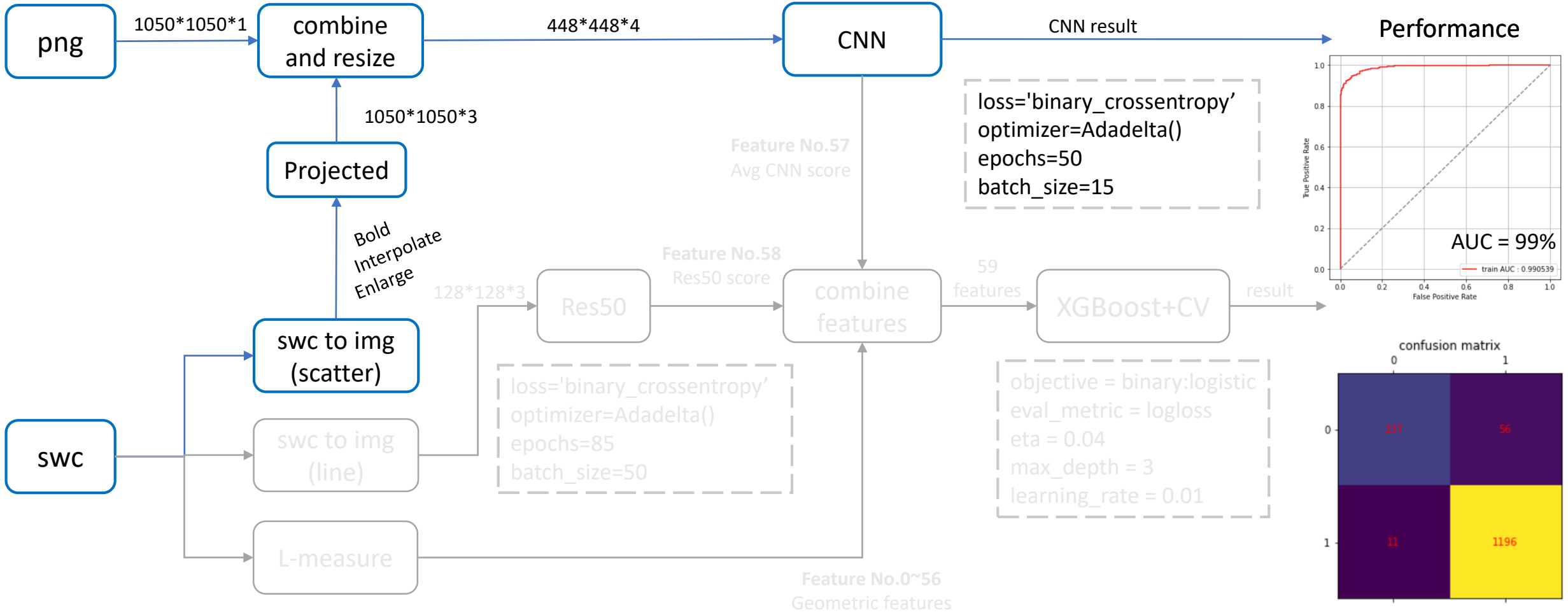
1. Create the 3D frame
2. **Enlarge** the view to appropriate size
3. **Interpolate** to get more data points
4. **Bold** the data points
5. Project the 3D frame into three 2D .png image



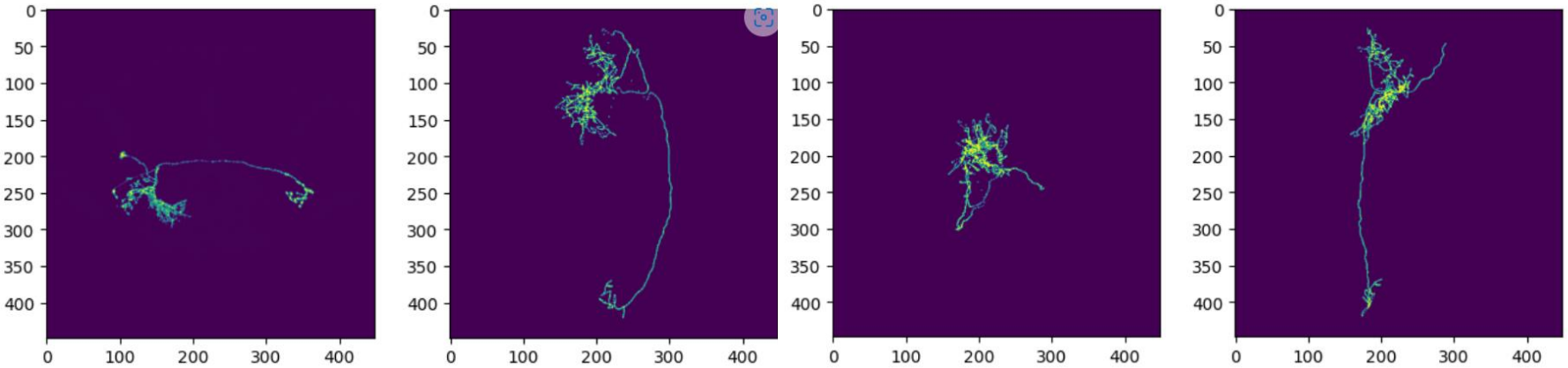
CNN Model


448x448x1
448x448x64
224x224x64
(1,1)
(3,3)
3182656
64
16
2
AUC = 99%
train AUC : 0.990539
True Positive Rate
False Positive Rate
confusion matrix
237
56
11
1196
Convolution + ReLU
Max Pooling
Flatten
Dense + ReLU
Dropout
Dense + Softmax

Model Flow Diagram – Version 1



Difficulties

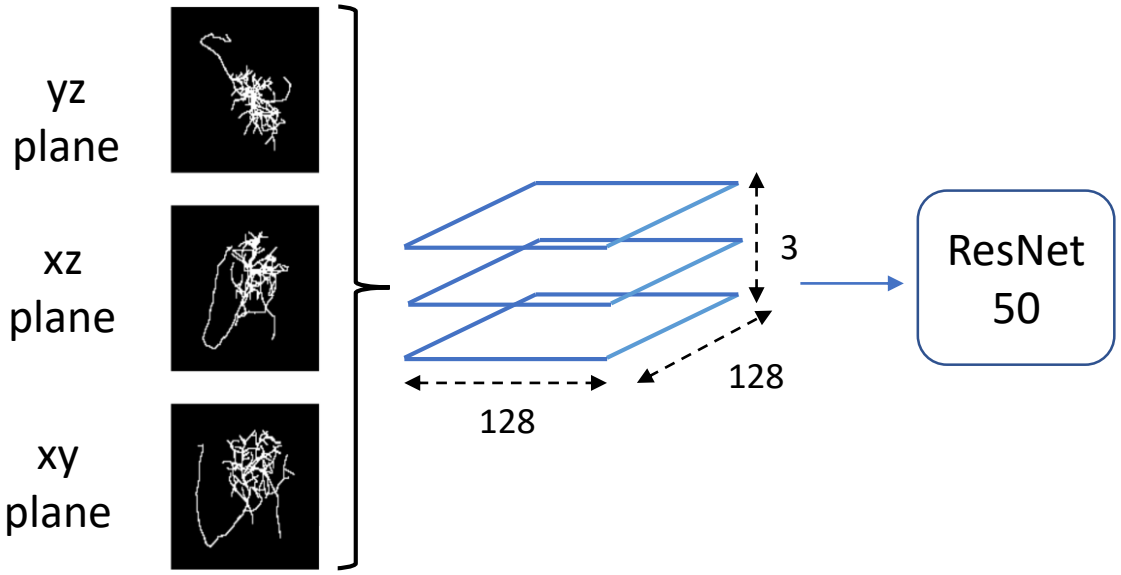


What if we consider this average prediction as a feature?

Data Preprocess (II) - More features !!!

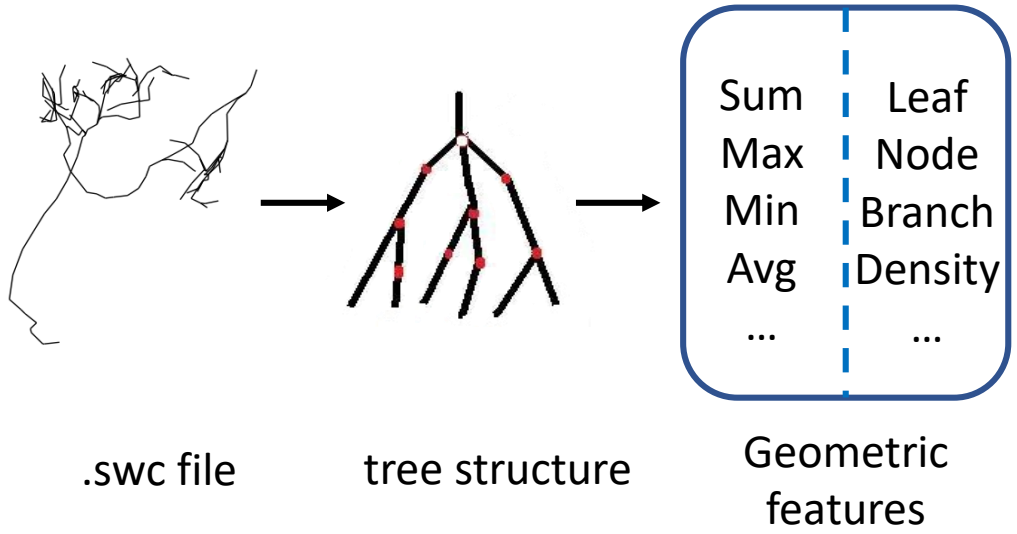
1. ***nGauge*** package (ResNet 50 model)

   https://github.com/Cai-Lab-at-University-of-Michigan/nGauge



2. ***L-Measure*** package (Geometric features)

   Scorcioni, R. et.al *Nature protocols*, *3*(5), 866–876, 2008.
   https://github.com/JustasB/pylmeasure



XGBoost Model

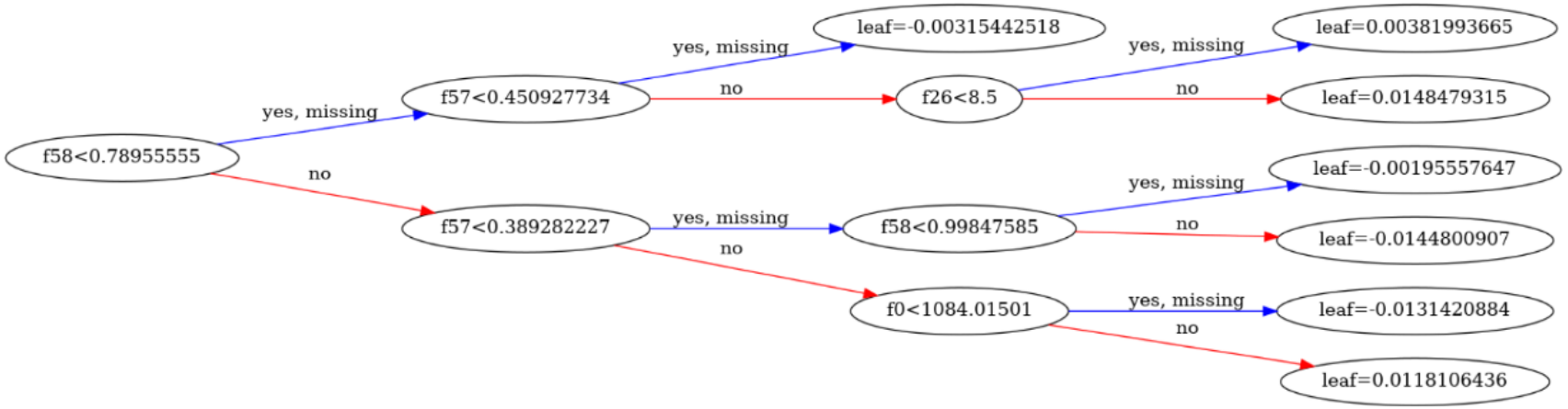
Feature No.0~56
Geometric features

Feature No.57
Avg CNN score

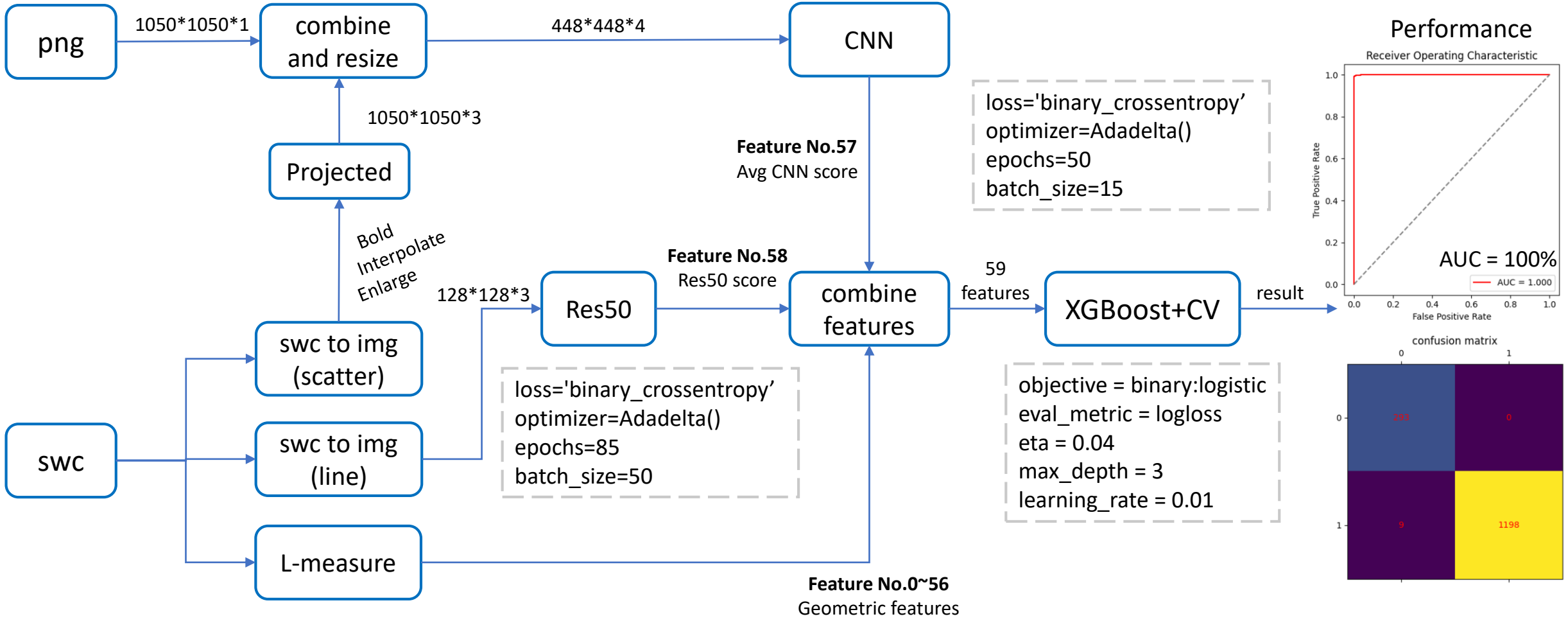
Feature No.58
ResNet 50 score

Decision tree structure

determine the weight of each feature



Model Flow Diagram – Version 2



Discussion time