Building the Functional Map of the Fruit Fly Brain

An Introduction to BrainMapsViz Gene Expression Datasets

BrainMapsViz Gene Expression Datasets (FFBO) provide a way to (i) visualize 3D neuron morphology and light sheet microscopy data in the same space, (ii) find individual neurons given light sheet microscopy data, (ii) get light sheet microscopy data in which a given neuron can be found, and (iii) find matching light sheet microscopy data given a group of neurons.

To get started first access with your preferred browser the BrainMapsViz website at https://www.fruitflybrain.org/#/brainmapsviz which hosts the datasets.

Accessing the NeuroNLP.FlyCircuit Gene Dataset

In this section, we will specifically use the NeuroNLP.FlyCircuit website at https://gene.neuronlp.fruitflybrain.org/ which serves the FlyCircuit dataset and FlyLight GAL4 data [1,2]; you will be met with the screen in Figure 1. You can click the "Try Demos" button on the left panel to get started



Figure 1: The startup screen for NeuroNLP.FlyCircuit Gene. Follow the links on the left information panel to learn more about it!.

with some demos that are of interest to you. In addition to NLP queries in NeuroNLP.FlyCircuit, this version of NeuroNLP allows you to perform a "load line" query with the following rule

load line {linename}:
load line R15F02 (See Figure 3(a))

NeuroNLP.FlyCircuit Gene has some additional features: (i) Clicking on the "Genetic Viewer" button on the top right corner brings the information on available lines. (See Figure 3(b)) (ii) Clicking on the "Load" button brings a 3D visualization of the expression pattern (See Figure 3(c)), (See Figure 3(c)), (iii) Clicking on the name of the line shows the information panel for a line, which includes the behavioral correlates of activating the neuron [4] (See Figure 3(d)), (See Figure 3(c)), and (iv) using "Retrieve Associated Genetic Lines" button retrieves a list of lines sorted by similarity to the neurons in the workspace. (See Figure 3(e)).



Figure 2: (a) Result of the query *load line R15F02.* (b) Clicking on the "Genetic Viewer" button on the top right corner brings the information on available lines. (c) You can click on the "Load" button to bring the expression pattern to the workspace. (d) Clicking on the name of the line brings its information, in which you can see the behaviors associated with this line and the associated neurons. (e) After querying "show glutamatergic neurons with axons in eb and dendrites in eb", We can click the "Get Matches for Workspace" button to get a list of lines sorted by similarity to the neurons in the workspace on the left info panel. We can do this for any query.

Accessing the NeuroNLP.Hemibrain Gene Dataset

In this section, we will specifically use the NeuroNLP.Hemibrain Gene website at https://hemibraingene.neuronlp.fruitflybrain.org/ which serves the Hemibrain dataset as well as FlyLight Split-GAL4 data and FlyLight Generation 1 MCFO data from NeuronBridge at https://neuronbridge.janelia. org/about; you will be met with the screen in Figure 3.

NeuroNLP.Hemibrain Gene has the following features: (i) Clicking on a neuron, let's say the neuron retrieved by the query "show \$2065197353\$", shows associated lines in the information panel on the left (See Figure 4(b)). (ii) Hovering over the "?" button in the Associated Lines menu shows a 2D visualization



Figure 3: The startup screen for NeuroNLP.Hemibrain Gene. Follow the links on the left information panel to learn more about it!

of the line, and clicking on the "?" button will open the information menu about this line in NeuronBridge (See Figure 4(c)). (iii) Clicking on the name of the line (in yellow) brings information about it in the info panel, in which you can see the associated neurons and the microscopy image (See Figure 4(d)). (iv) After querying for a set of neurons, for example "show VP3", we can get the best matches for the aggregate set of neurons by clicking the "Get Matches for Workspace" button on the top right corner (See Figure 4(e)).

References

- A GAL4-Driver Line Resource for Drosophila Neurobiology, doi: https://doi.org/10.1016/j.celrep.2012.09.011
- Bridging Registrations, url: http://flybrain.mrc-lmb.cam.ac.uk/si/bridging/www/brains/
- Mapping the Neural Substrates of Behavior, doi: https://doi.org/10.1016/j.cell.2017.06.032
- 4. NeuronBridge, doi: https://doi.org/10.25378/janelia.12159378.v1





Figure 4: (a) Querying the name of a specific image, for example, "load line R44B02 2711777342463672331", brings information about it in the info panel, in which you can see the associated neurons and the microscopy image. (b) Clicking on a neuron, let's say the neuron retrieved by the query "show \$2065197353\$", shows associated lines in the information panel on the left. (c) Hovering over the "?" button in the Associated Lines menu shows a 2D visualization of the line, and clicking on the "?" button will lead you to the information menu about this line in NeuronBridge. (d) Clicking on the name of the line (in yellow) brings information about it in the info panel, in which you can see the associated neurons and the microscopy image. (e) After querying for a set of neurons, for example "show \$VP3\$", we can get the best matches for the aggregate set of neurons by clicking the "Get Matches for Workspace" button on the top right corner.