Explore the role of the orientation preference of neurons in the partnerships formed among a specific interneuron & pyramidal neurons.

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Example 1

Phase 1 on Edges

- Find the **significant edges** between neurons, consider different time lags (e.g., sync, 600ms, 300 ms)

A) Explore **patterns** in these pairs with respect to the orientation preference.

- Consider all **features of the edges**, e.g., its ***type*** (i.e., I->P, P->I, P-P, I-I), ***lag***, the pair of the ***orientation preference*** of the two neurons

- What **types of clusters** do you discover?

B) Let us now focus on the following **lags**, and examine how things change:

- Pyramidal to pyramidal: **synchronous**
- Pyramidal to interneuron: lag [t, t+600ms]
- Interneuron to pyramidal: **synchronous**

Phase 2 – on Partnerships

- Form partnerships for each interneuron (I): find all pyramidal neurons (P) connected with it via a significant edge. Specifically, consider the I-->P (sync).

A) For each partnership (I), find all the **significant edges P->I** (with lag 600ms) & **I->P** (sync), where P pyramidal neuron of that partnership.

Discover patterns with respect to the **orientation preference of the reference interneuron &** all Ps of the above significant edges.

B) Distinguish now all the **significant sync edges between pyramidals Ps** of the same interneuronal partnership.

Discover patterns in those edges with respect to orientation preference, considering the **orientation preference of the reference interneuron**.

Explore whether or not there are nodes that are more essential/influential than others.

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Example 2

Influence and Centrality

- Important" nodes called "hubs" often:
  i. highly or densely connected to the rest of the network
  ii. facilitate global integrative processes

- Connector hubs – nodes likely to facilitate intermodular communication & integration

Influence and Centrality (cont.)

- Measures of centrality are based on the notion of **shortest paths**
- A **node is central** if
  i. It has great control over the flow of information within the network
  ii. This control results from its participation **in many of the network's short paths**
- **Closeness centrality** of an individual node: **inverse of** the **average path length between that node & all other nodes in the network**
- **Betweenness centrality** of an individual node: **fraction of all shortest paths** in the network that **pass through the node**

Influence and Centrality (cont.)

- A node with **high betweenness centrality can control information flow** because it is at the intersection of many short paths
- Centrality **measures identify elements that are highly interactive** and/or carry a **significant proportion of signal traffic**
- A highly central node in a structural network has the potential to participate in a large number of functional interactions
- A node that is not central is unlikely to be important in network-wide integrative processes
- **Loss of highly central nodes have a larger impact on the functioning of the remaining network**