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Data Exploration Proposal
Dataset PVC-7

Overarching goal

Neurons in the visual cortex are generally selective to direction of movement of a stimulus. In laboratory settings, the stimulus used to assess neurons' response to moving direction is sinusoidal drifting gratings. Visual neurons are also selective to spatial frequency and temporal frequency. Spatial frequency depicts the ability of eyes to respond to fine line spacings, while temporal frequency reflect the eyes to capture the fast changes. Studies showed the visual neuron respond differently to spatial/temporal frequencies under different states of animal (anesthetized vs alert) and in different layers. In addition, the preferred frequencies varies among primary and higher-order visual cortex. There is no studies looking into the relationships among direction selectivity temporal frequency selectivity and spatial frequency selectivity. The overarching goal of my data exploration is to explore how spatial and temporal frequency affect direction tuning.

Hypothesis

1. Direction tuning intensity is stronger under a specific spatial and/or temporal frequency.
2. Preferred direction is consistent across spatial frequency and temporal frequency.

Specific aim / First steps to test the hypothesis

1. Choose 10 neurons.
2. Calculate the response in each trial for a certain direction under each combination of spatial and temporal frequencies.
3. For each neuron, average the response across 8 trials, and then create a dataframe for later calculation of direction selective index (DSI).
4. For each neuron, calculate the DSI under different combination of spatial and temporal frequencies.
5. Statistical analysis: two-way ANOVA, with spatial frequency and temporal frequency as the two factors.
6. Visualize the results. Visualize an example cell in the form of polar map of 5sf * 5tf subplots.