Neuron Specificity

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Project 1

The goal of this project was to look for a relation between neuron firing and the head angle of a mouse. The dataset consists of finished data from tetrodes in a mouse brain and has been preprocessed to extract the activations of individual neurons. To constrain the data amount the following subset of data was used:

- Session 131213 on mouse 24
- Session 140124 on mouse 25
- Session 140318 on mouse 28

The mouse head angle was binned into 40 bins giving bins of length 9. To find neurons with HD cell properties the firing rate at different angles was calculated for all recorded cells. Cells with minimum firing rates above 10 were filtered out. For the remaining data the binned angle was plotted against the corresponding average firing rate. Then, manually, any neurons that seemed to have a bump in activity that clearly stood out among the firing activity noise was noted. An example of the plots used to find the HD cells can be seen in figure 1.

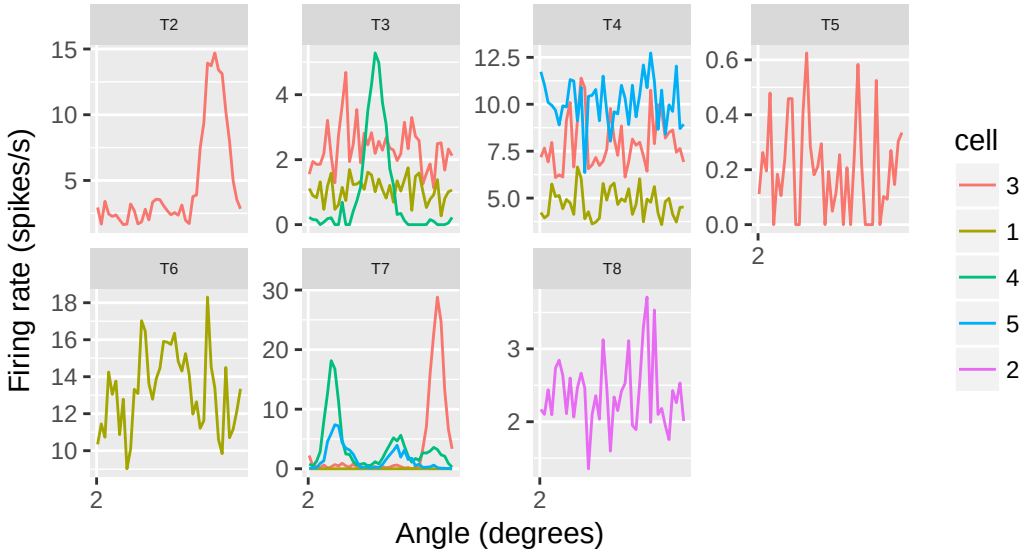

Figure 1: **Tuning curves from session 131213 on mouse 24.** Tuning curves with a minimum firing rate of less than 10 have been filtered out. T stands for tetrode number.

The cells seen in figure 2 are cells from the thalamus and cortex that match HD cell behaviour the most.

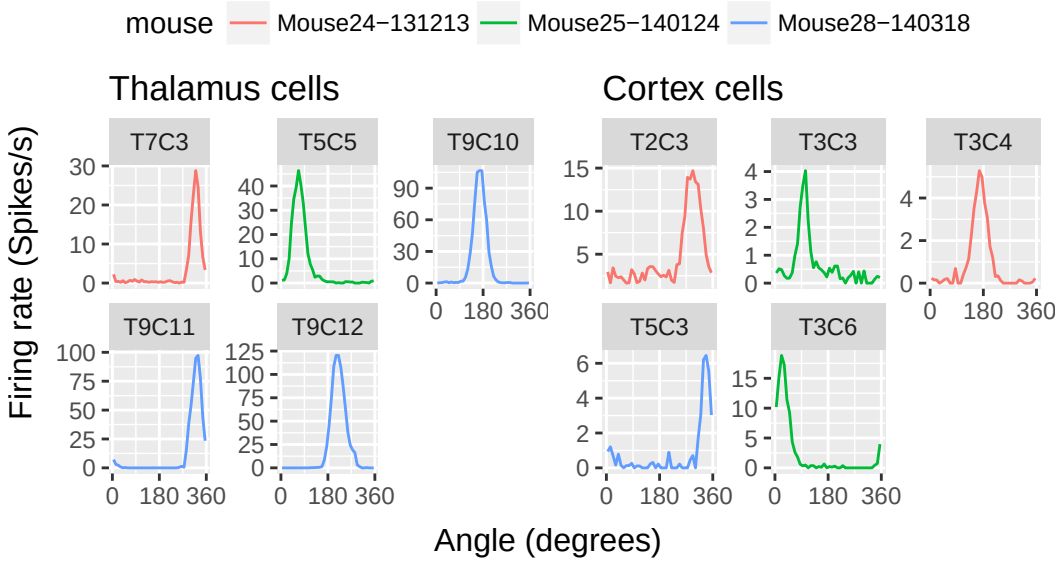

Figure 2: **Selection of head cells with good properties**

In the thalamus there were relatively many neurons with distinct peaks. This is to be expected as the thalamus is an area known to have head direction cells and head direction cells are known to have distinct peaks. The subiculum is also supposed to have head direction cells but in general these had more background noise, sharper peaks and lower firing rates.

In addition to finding cells displaying the regular head cell properties there were some cells that displayed multipeak tuning which can be seen in figure 3.

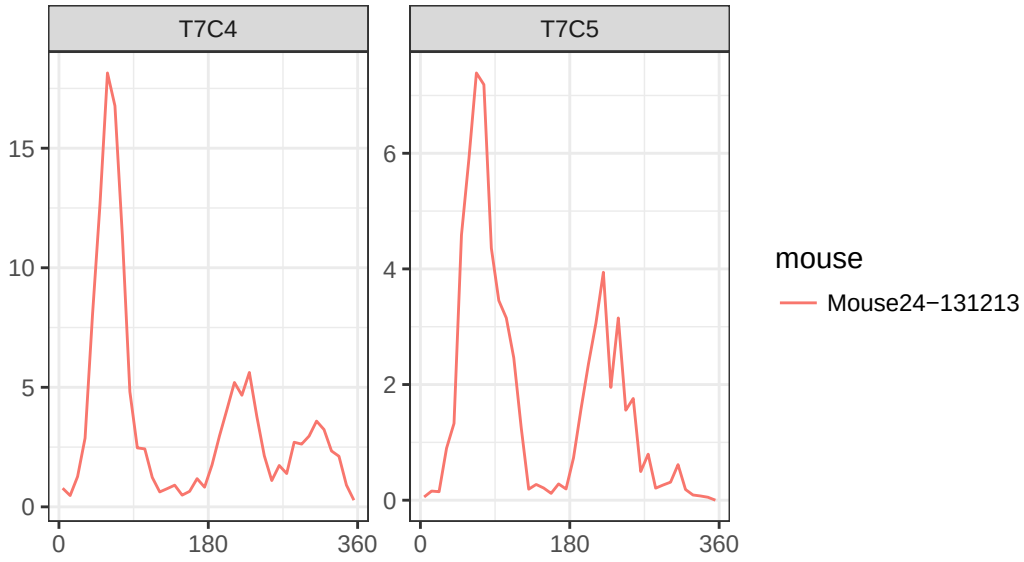

Figure 3: **Cells with multipeak tuning**