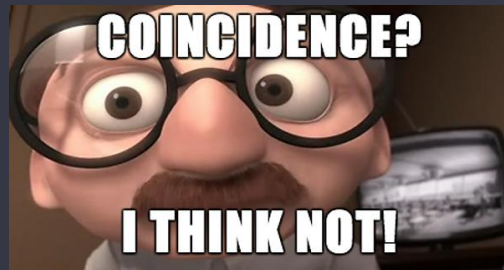


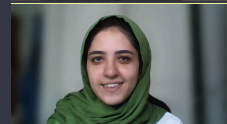
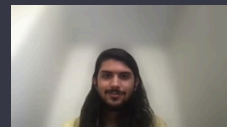
Decision-making process in visual cortex: Is there a coincidence?



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Outline

- Aim

Understanding the role of the visual cortex in decision-making

- Hypothesis

Some visual cortex neurons have a role in the decision-making process.

- Conclusion

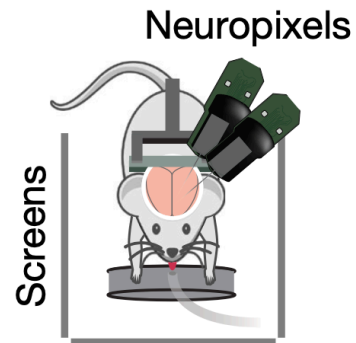
Some visual cortex neurons contribute to decision-making information.

- Steinmetz Dataset

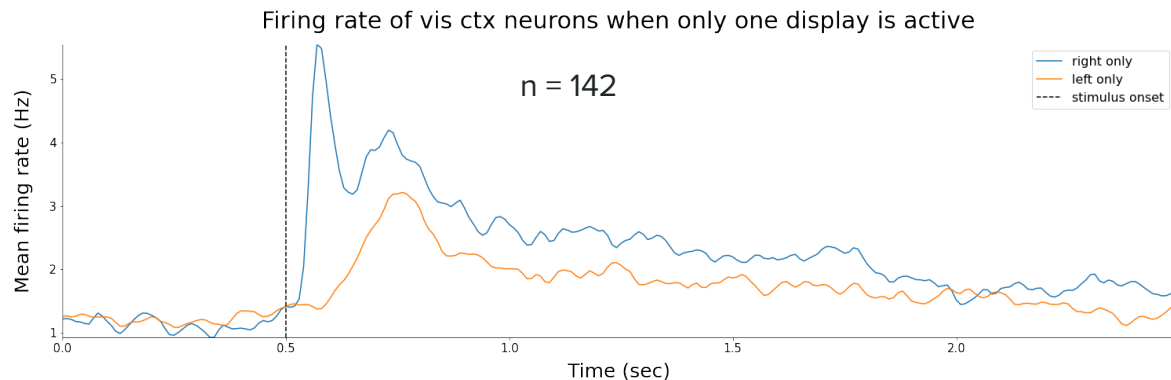
All Neuropixel recordings were from the left brain hemisphere.

Because mouse's eyes are on side of its body, we only expect to see the information from the right eye.

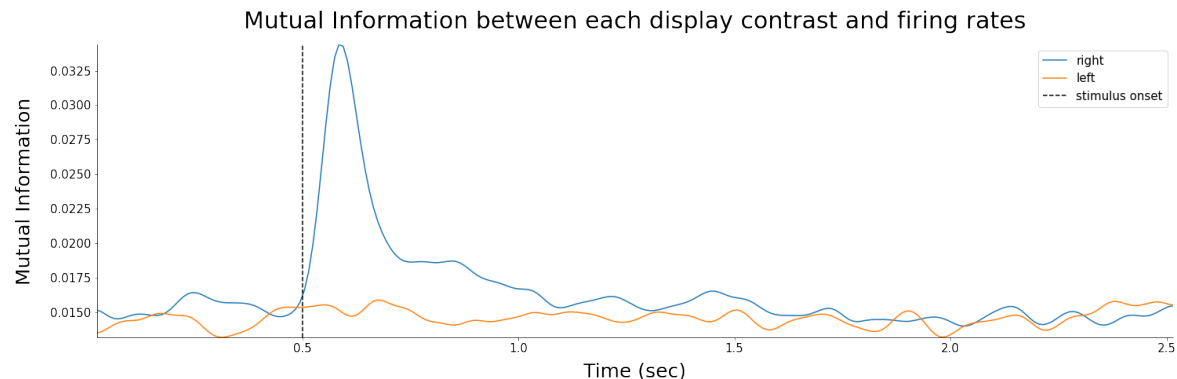
Session eight was selected.



Mean firing rate of visual cortex neurons determined different peaks in spiking activity



We can see two peaks in the firing rate of right eye-related visual cortex neurons. We know the first one is for visual information processing. However, what about the second one? It just ends before the onset of movement. Is it somehow related to decision-making?

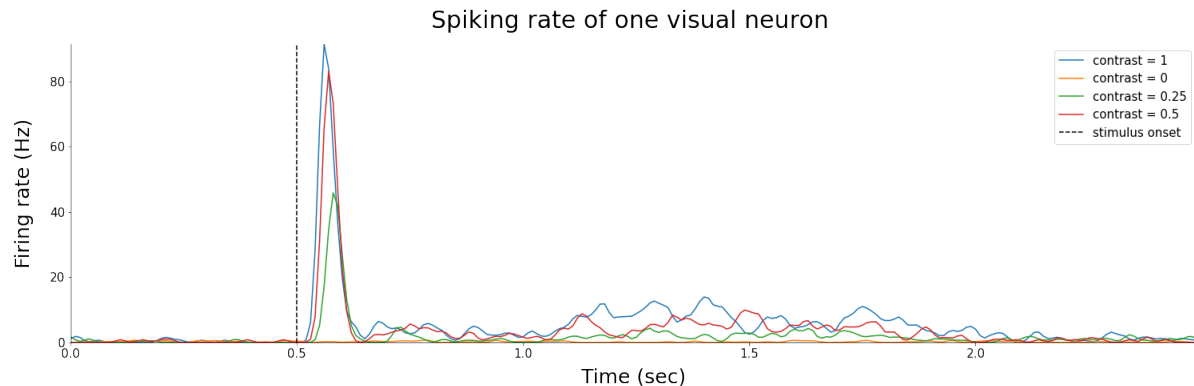
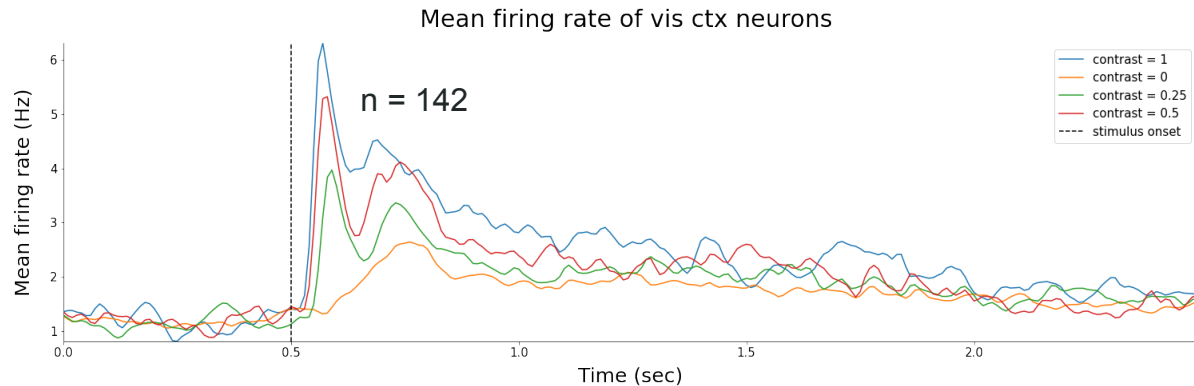


As we expected, there was no information about the left display's contrast firing rates.

The second peak is present regardless of visual processing.

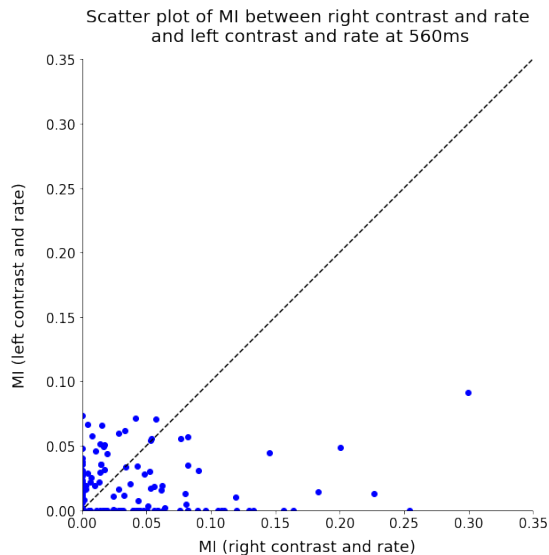
How different contrasts are coded within the visual cortex?

- Four different contrasts were presented.
- Different contrasts showed distinctive firing rates.
- Some neurons like this one are related to the first peak. However, which neurons cause the second one?

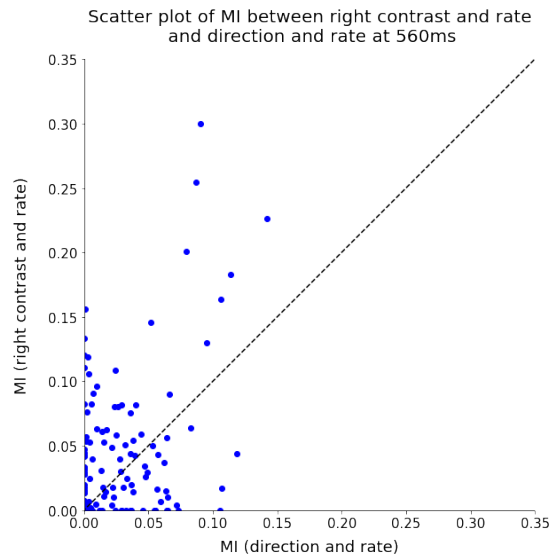


Mutual information of firing rates with different contrasts and directions of the wheel

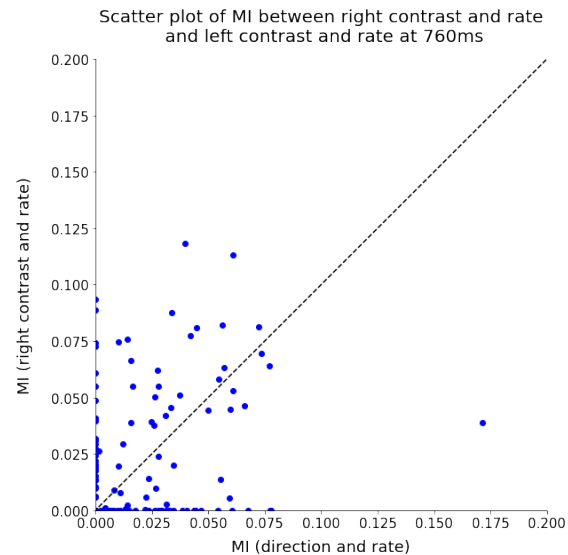
- Each dot represents a single neuron.



First peak



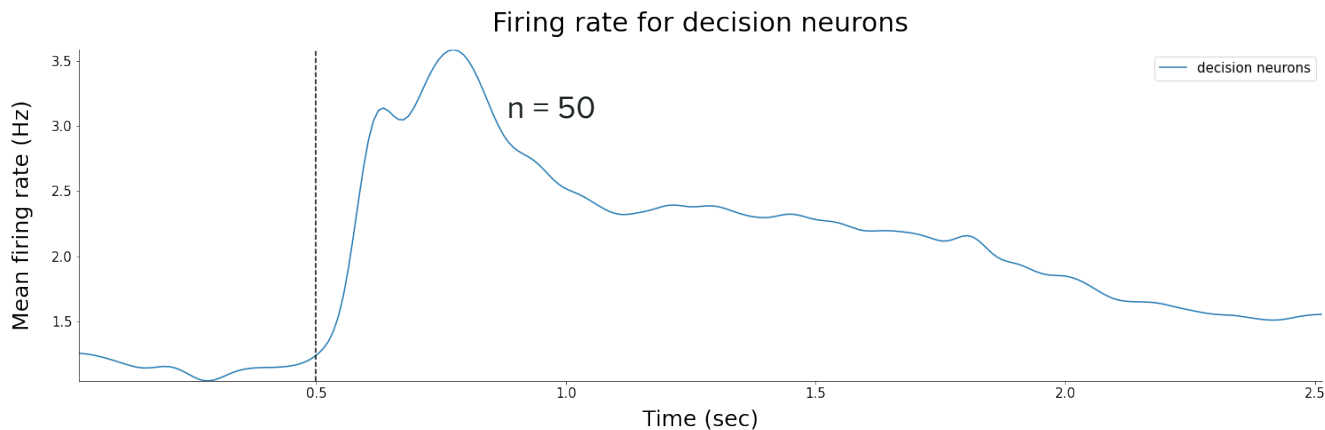
First peak



Second peak

A subset of visual cortex neurons showed remarkable decision-making activity

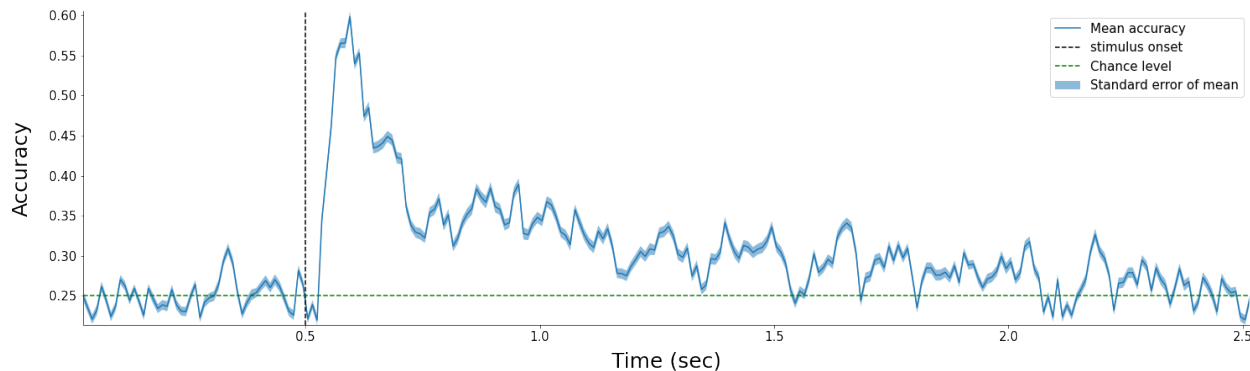
- Out of 142 visual cortex neurons, neurons with higher decision information were selected. We called them decision neurons.



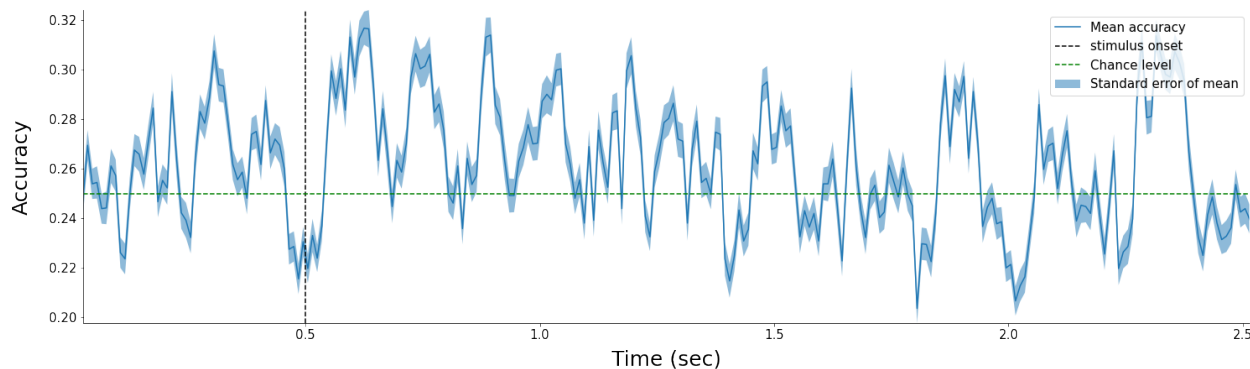
- These 50 neurons which have more decision-making information, also have a larger second peak. Therefore, it's plausible that the second peak is related to decision-making.

SVM classifier predicting different presented contrasts

Classifier predicting right contrasts

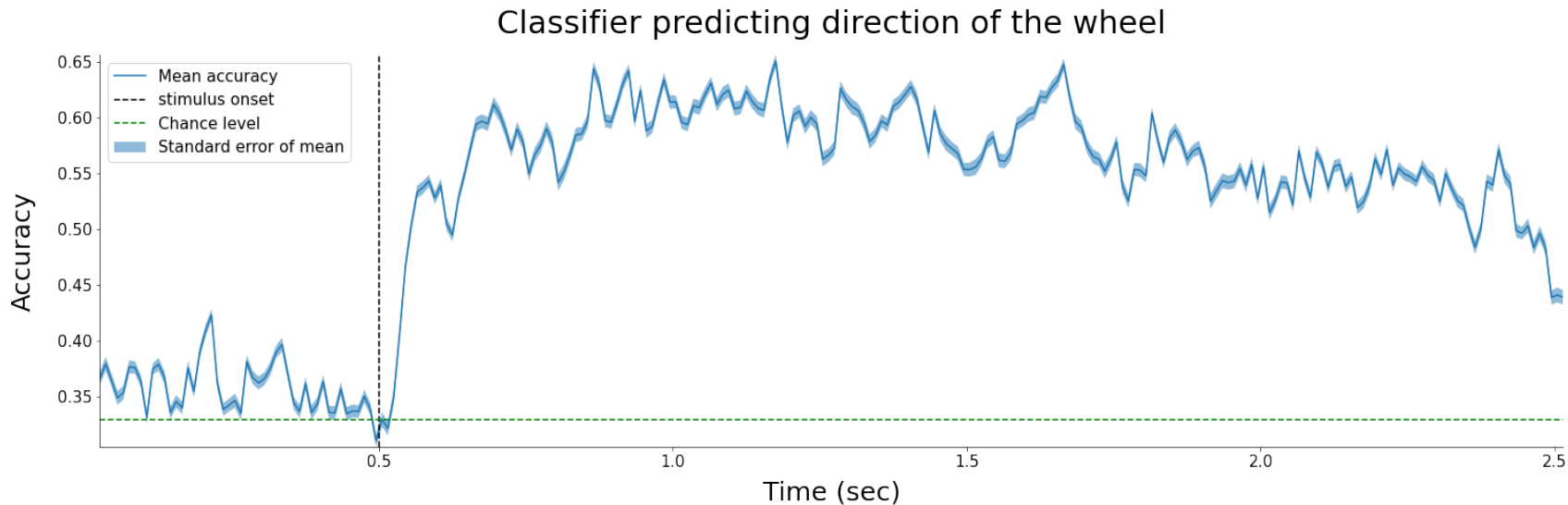


Classifier predicting left contrasts



- SVM classifier, trained with visual cortex firing rates, predicting the right contrast has relatively good accuracy.
- As expected, since there is no information about the left contrast in these recordings, the accuracy of SVM classifier for predicting the left contrast was random.

SVM classifier predicting different directions of the wheel



- Accuracy of the classifier, trained with visual cortex firing rates, was remarkably above the chance level; therefore, there is decision information in the visual cortex.

Conclusion

- Decision-making information is detected in the visual cortex.
- The origin of this information could be from visual cortex neurons or other brain areas.