



Introduction to Computational Neuroscience Project:

Predict a rat's location based on its neuronal activity

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Introduction

- Ability to navigate well in the environment
- Main region of the brain responsible for our navigation and memory abilities is the hippocampus
- Place cells



Scientific Goal

- Explore the high-dimensional patterns of neuronal activity in the hippocampus and understand how this relates to the rat navigation
- Decode a rat's position just based on its neuronal activity
- Use machine learning techniques and compare the power of different classifiers



Where the data comes from

- Data recorded from Buzsaki lab
- We analyzed data sets contain recordings from experiments where 11 rats performed multiple behavioral tasks.
- To record the data, electrodes (shanks) were implanted in the hippocampus
- Two LEDs were also attached on the animal's head in order to identify the coordinates of the animal while doing a task



Used Algorithms

- Random Forest
- Support Vector Machine
- K -nearest Neighbor

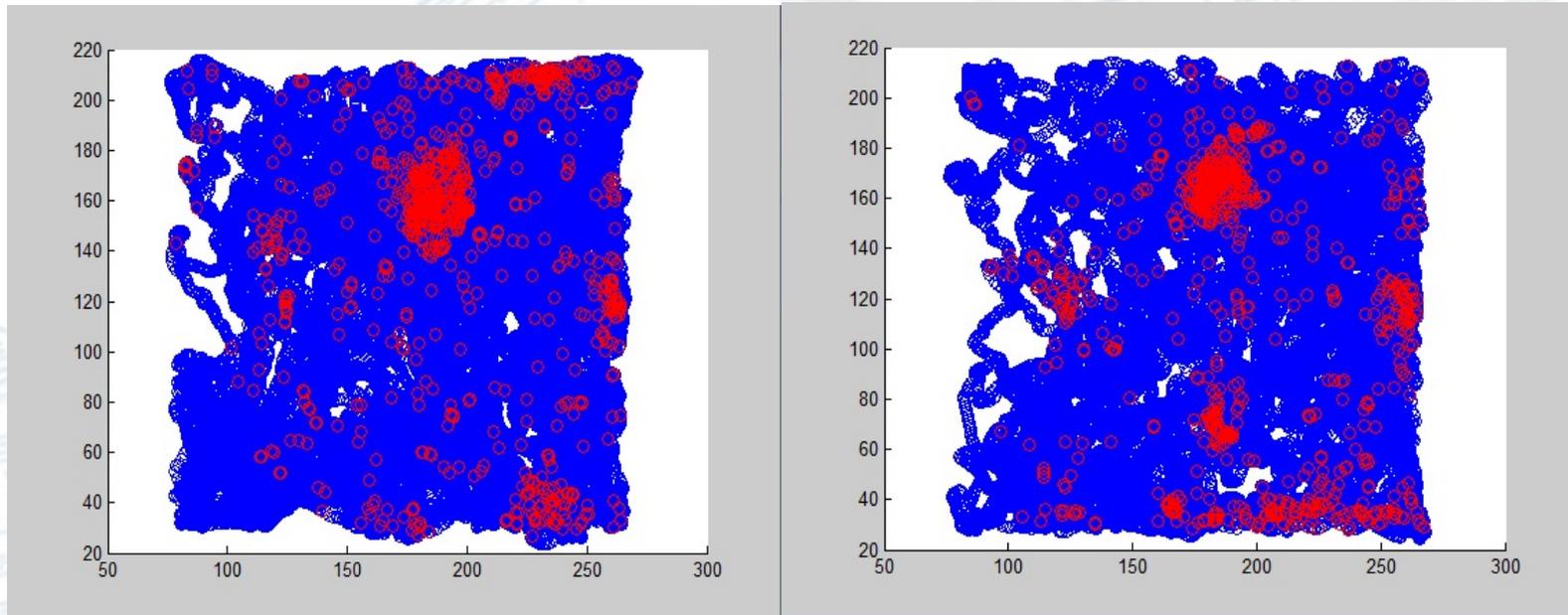


Test to identify Place cells

- Compare neurons from two different recording sessions that had been conducted in the same day with the same animal.
- Specific neurons fire at one particular place during the both experiments

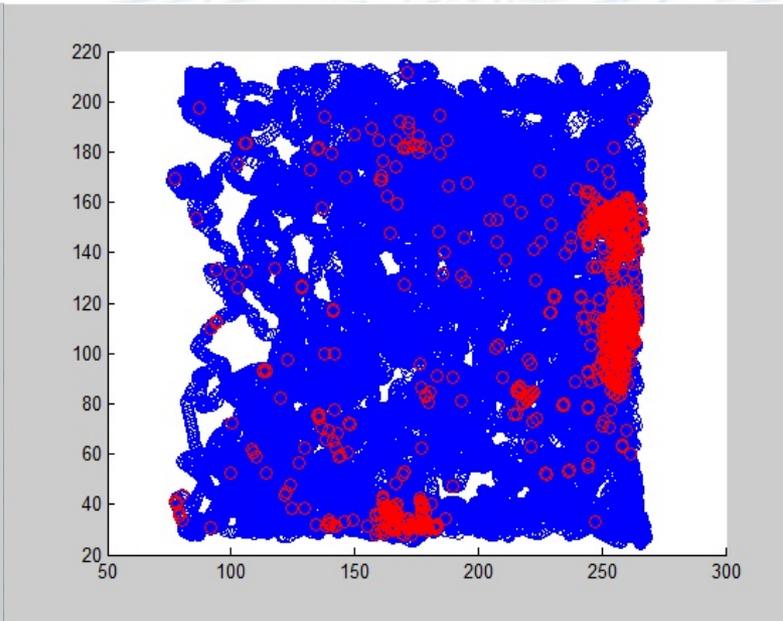
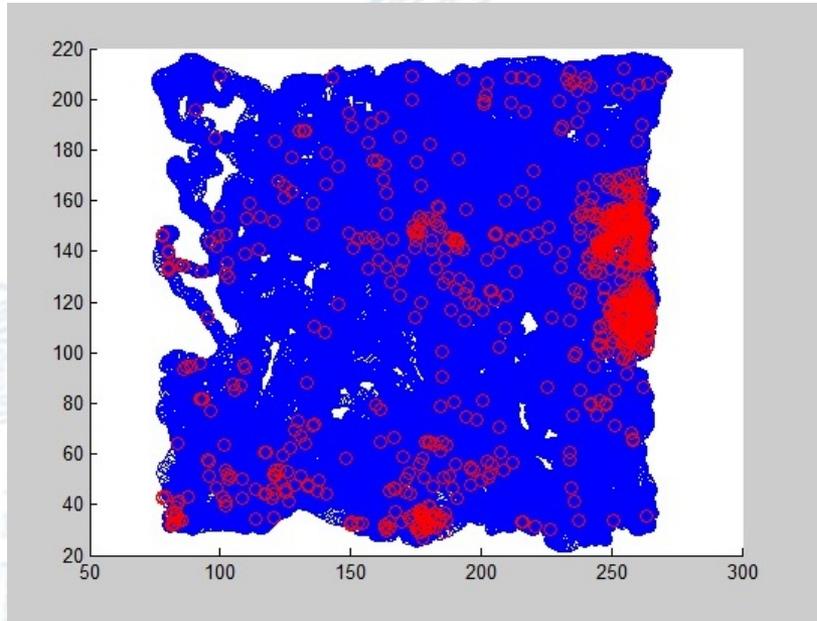
Identified Place cells

Neuron #510

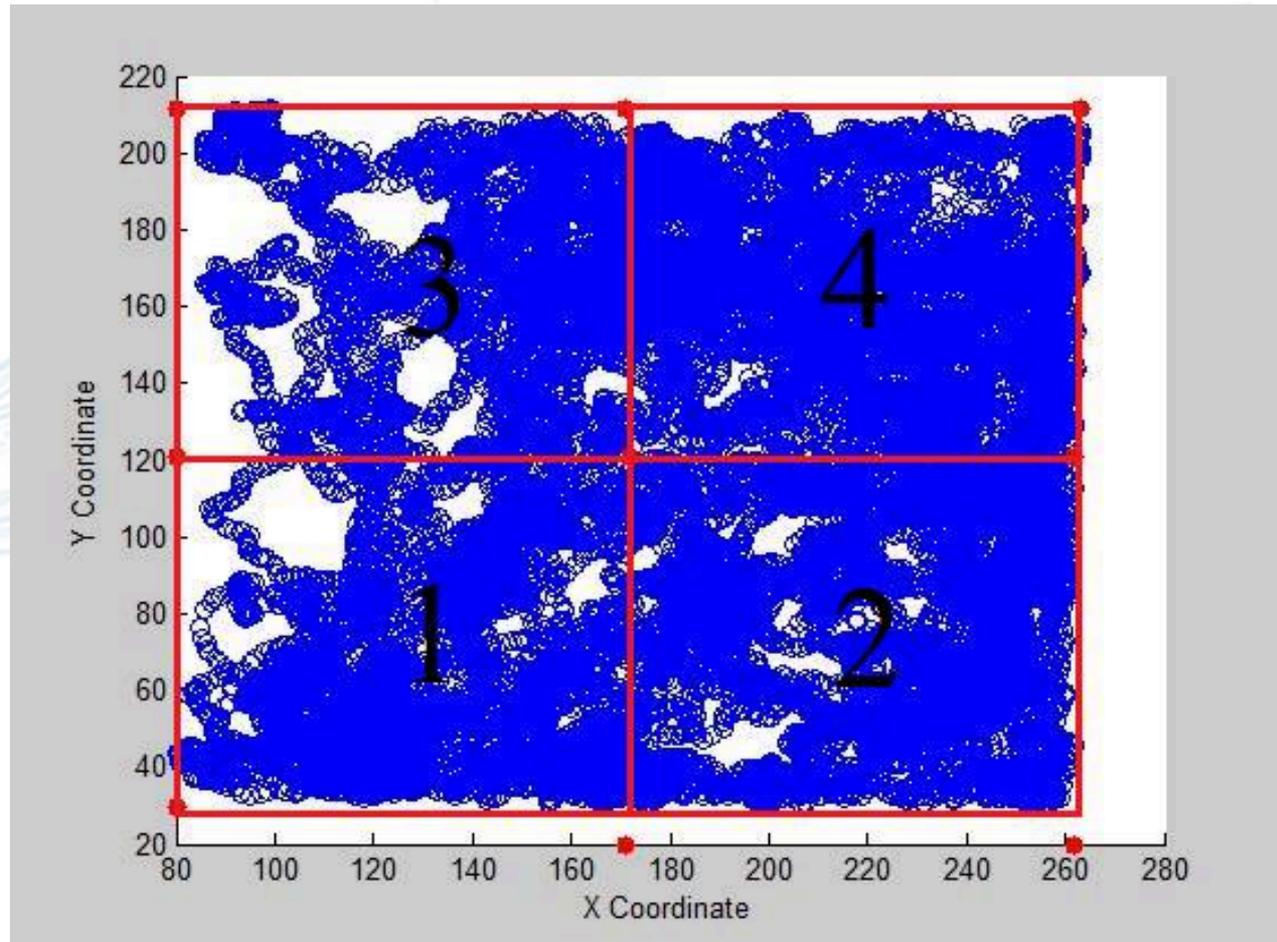


Identified Place Cells

Neuron #605

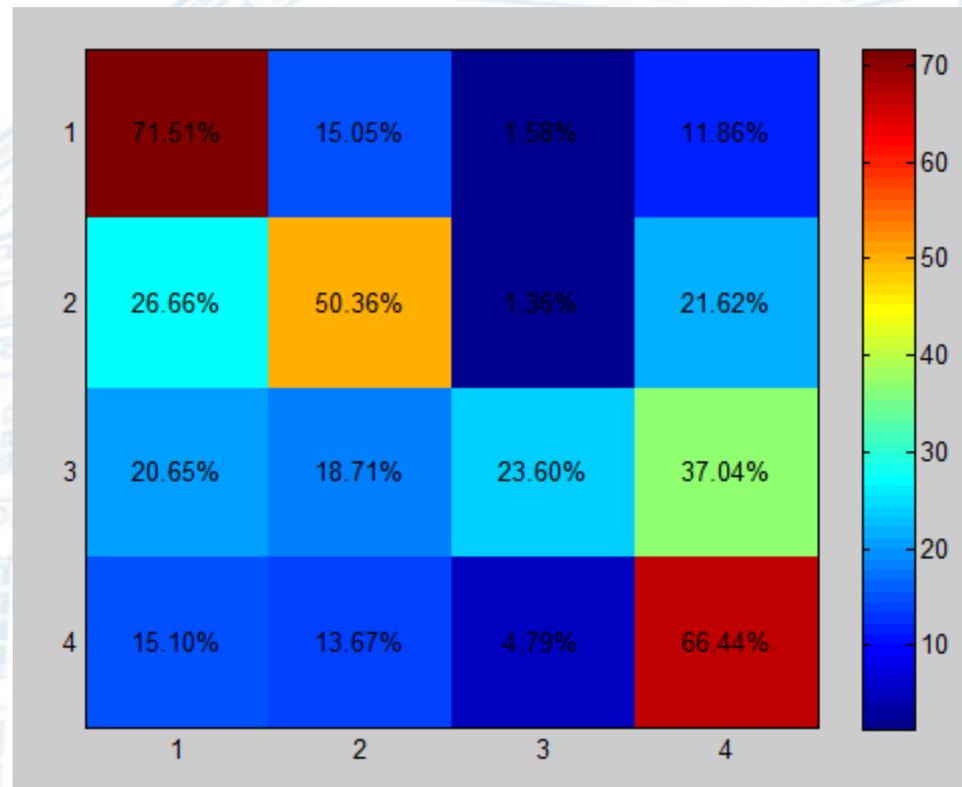


Divide the arena into 4 Blocks



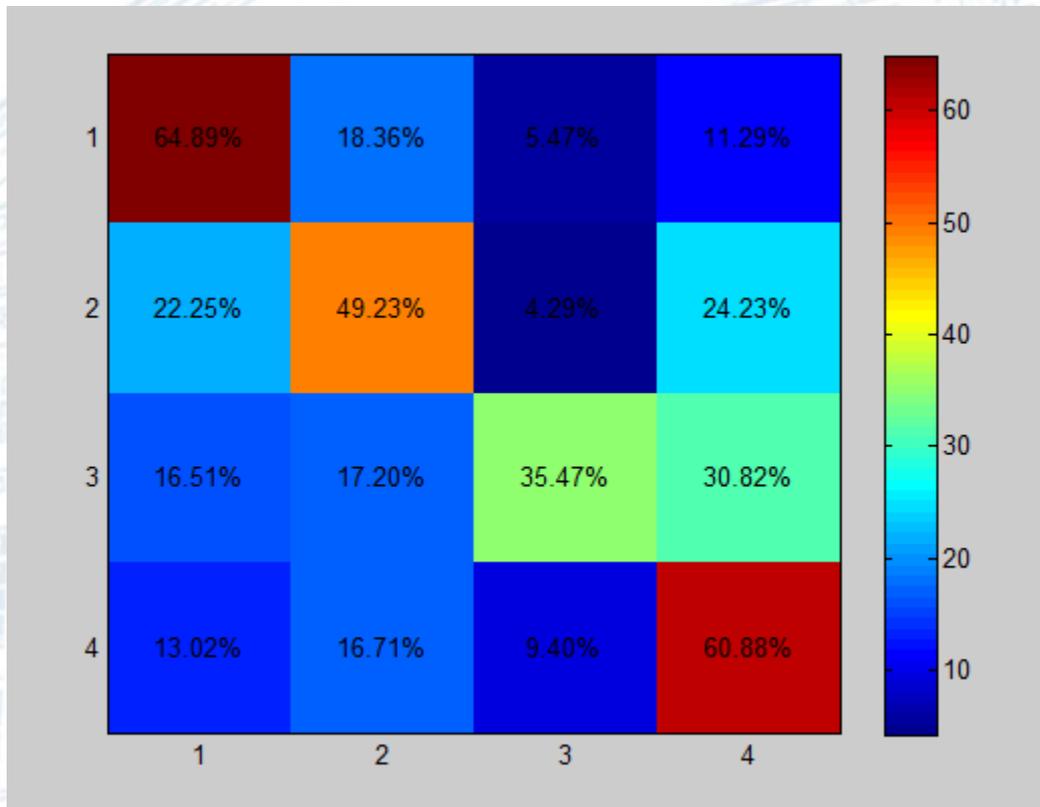
Results

- Confusion matrix by Random Forest



Results

- Confusion matrix given by SVM





Results

- **Accuracy** - calculated by dividing number of correctly classes by total number of classes
- **Random Classifier** - classifier which predicts only one class that is the most common in a data set
- Comparing Accuracy of the Algorithms

	Random Classifier	Random Forest	SVM	KNN
Accuracy	31%	57.8%	55.5%	49.6%



Conclusion

- Random Forest Provided with the best performance
- SVM provided almost the same results
- Analyzing more data and with a better neuron quality, presumably it would provide classifiers with better accuracy



Thanks for your attention!

Q/A?

