Data Analytics In Neuroscience

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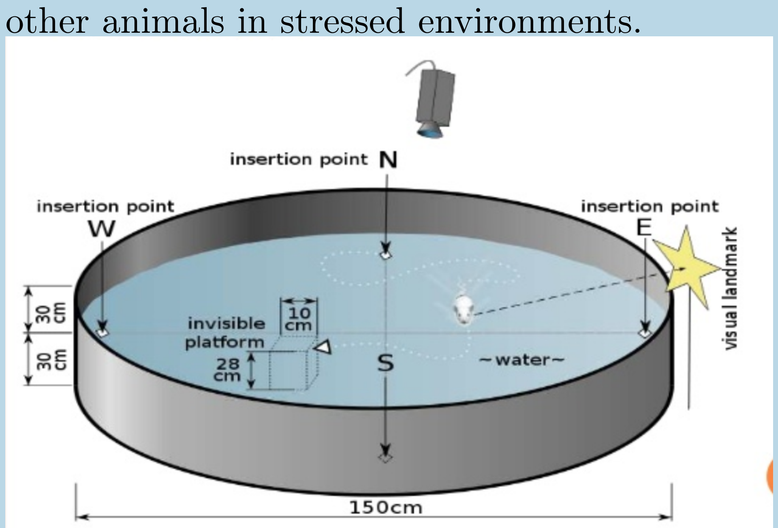
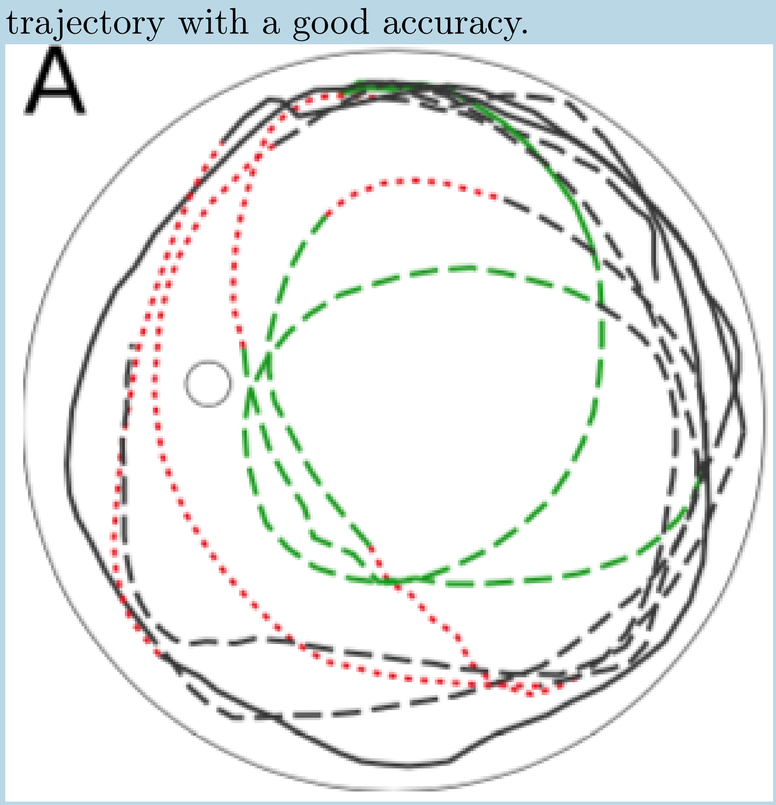
Morris Water Maze

Morris water maze is one of the most commonly used technique in behavioral neuroscince. Using the results of this experiment there have been a significant development in the models to estimate the behavioral patterns of rodents and other animals in stressed environments.



Model

Taking a rodent's trajectory in account a classification and validation model was developed which segments the trajectory based on the behavioral traits. The result sets were made based on the segments than can be joined to give a trajectory with a good accuracy.



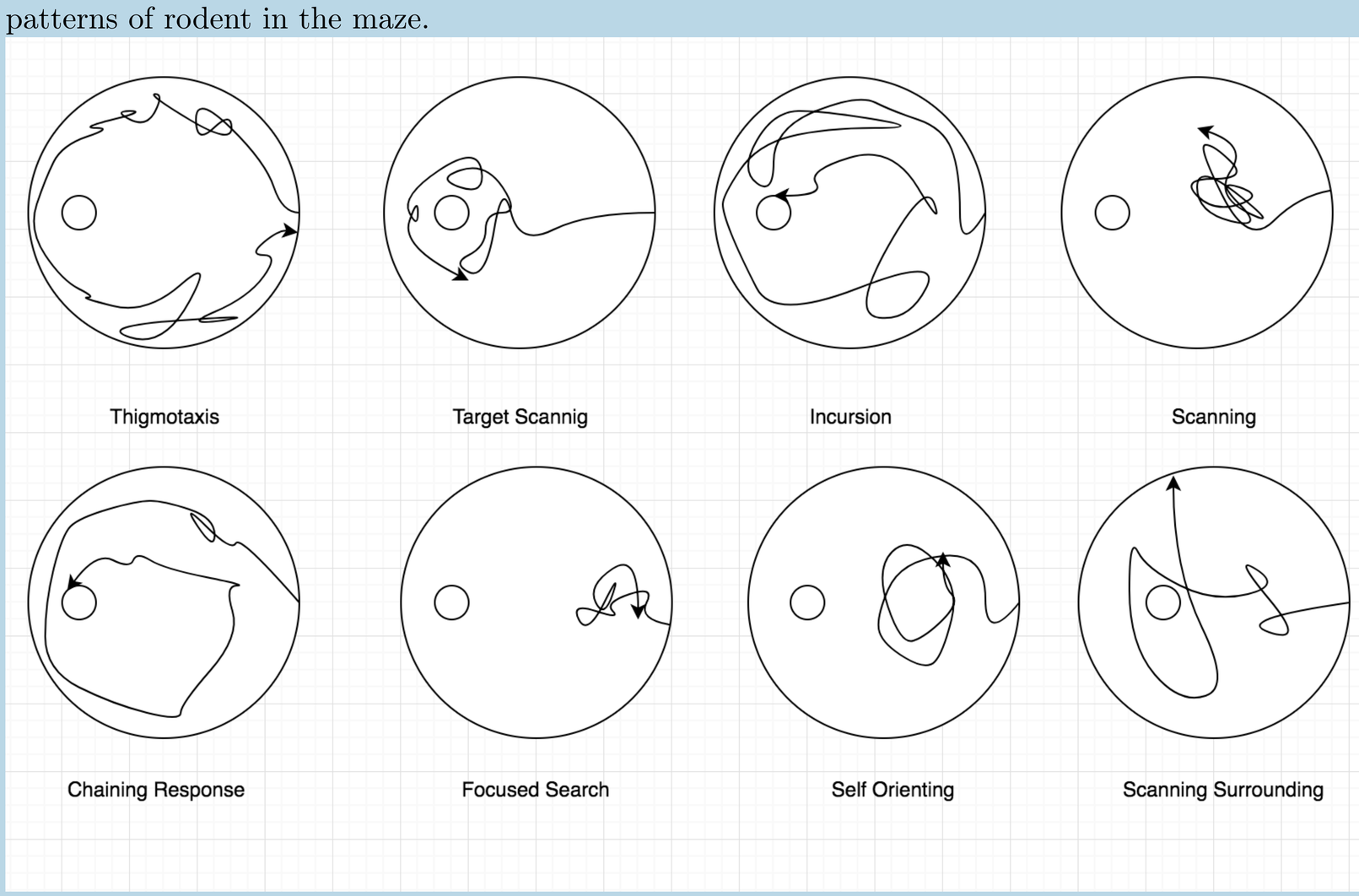
Using this dataset a model is developed for this project that will determine the most probable path than can or will be taken rodent to reach platform. This model also analyses the efficiency of learning between two rodent groups one subjected to stress in peripubertal age and other for the first time during experiment.

Algorithm

The algorithm used in this project is based on **Hidden Markov Model** with **Viterbi Style Algorithm**.
HMM with Viterbi algorithm uses three parameters to determine the most probable path taken by rodent. These are **Transition Probability, Emission Probability and Average Time** rodent stays in one particular state.
The Emission probability also serves as the condition for using the Average Time as a factor to determine the state in this model.
For Validation of model and analysis of results **K-Fold Cross Validation** technique is used.

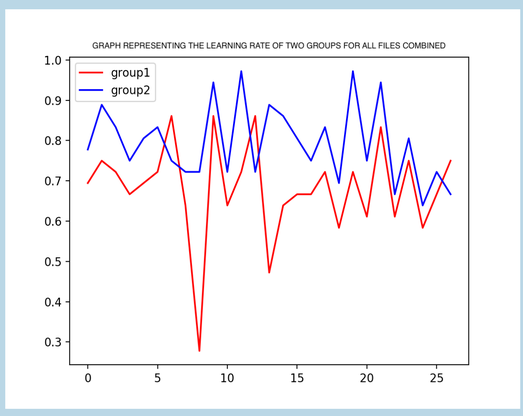
Behavioral Traits

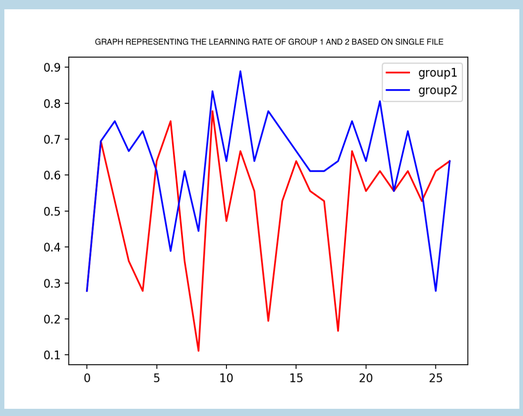
For the model developed in this project 8 major behavior traits were used to analyze the movement patterns of rodent in the maze.

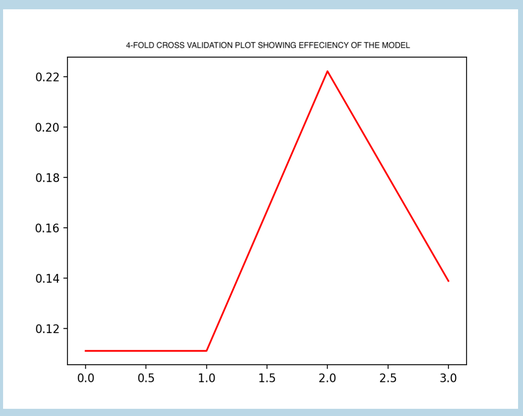


Results and Analysis

Results are obtained in two different formats, either graphical or tabular.
Graphical results represents two aspects of model. **First** is the learning rate of the target group and control group based on separate files and all the files combined. **Second** is the efficiency of model using cross validation.







Tabular results gives the most probable paths for different instances.
First table shows small sample of the most probable paths taken by different rodents in Group1 based on one of the dataset file.
Second table shows small sample of the most probable paths taken by different rodents in Group2 based on the all the datasets files combined.
Third table shows the sample output of one animalID rodent for all the trials based on all for dataset files.

AnimalID	TargetID	PATH
87	1	[1 6 8 8 8 8 8 8 8 8 8 4 2 3 2 2 1 1 1 1 1 1 1 2 2 2 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
103	1	[1 2 8 8 7 7 6 6 1 1 1 1 1 1 1 1 1 2 1 1 1 1 2 2 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
91	1	[1 7 7 7 7 1 3 2 1 1 1 1 1 1 1 1 1 1 1 3 2 2 2 3 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
93	1	[1 8 8 8 8 4 3 3 1 1 1 2 2 2 3 3 2 2 5 5 5 5 5 5 5 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]

88	2	[1 2 7 1 1 2 2 2 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
104	2	[1 3 3 3 3 3 4 4 4 3 3 2 2 3 4 1 1 1 1 1 1 1 1 1 1 1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
90	2	[1 2 2 7 7 7 3 2 4 2 1 1 1 4 3 3 4 1 1 2 2 2 1 1 1 1 2 2 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
106	2	[1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 4 3 3 5 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]

AnimalID	TrialNo.	TargetID	PATH
87	1	1	[1 2 1 7 7 7 1 4 4 1 1 1 1 4 4 4 7 6 4 4 1 1 1 1 2 2 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
87	2	1	[1 8 8 8 3 3 1 8 8 8 8 8 1 1 1 1 4 4 2 2 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
87	3	1	[1 3 2 2 7 8 8 8 8 8 5 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]
87	4	1	[1 6 6 8 8 8 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 -1]