

GAME AI

Project 3

Submitted By:

Megha Jayakumar

Shramana Thakur

Rishi Tripathi

Srinivas Nandagudi Sridharamurthy

Subbulakshmi Sundaram

Deepansh Pandey

Introduction

Goals of Project 3:

1. *Using Minimax algorithm for 19x19 Connect Four gameplay.*
2. *Implementation of a fuzzy controller for Breakout.*
3. *Implementation of the Self Organizing Maps algorithm.*
4. *Implementing Bayesian Imitation Learning on human player trajectories*

Task 3.1

- Alter game board configuration to 19x19
- Gather the win/loss/draw statistics.

Depth	X wins	O wins	Avg. time taken for a game (seconds)	Avg. no. of moves for X to win	Avg. time taken by X to move (seconds)
1	100	0	0.04	7	0.01
2	100	0	1.39	9	0.26
3	100	0	39.87	7	9.18
4	100	0	530.14	9	115.24

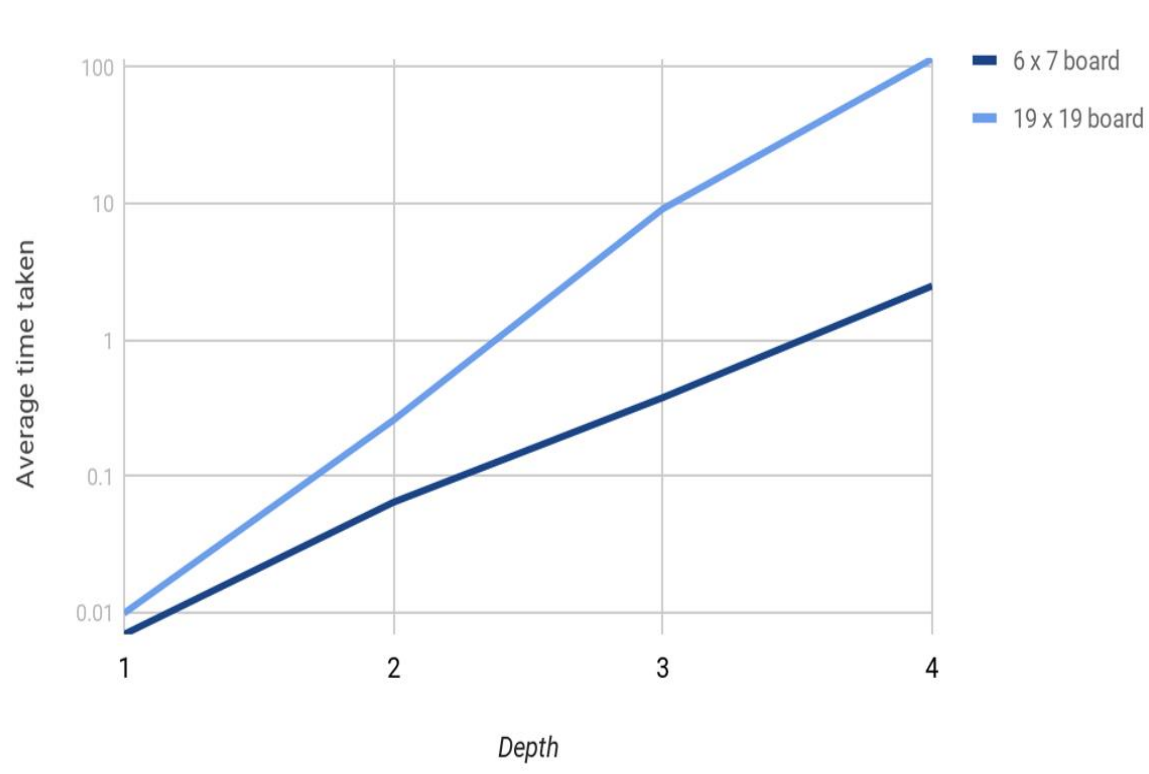
Player X uses minimax, Player O moves randomly (100 games)

Depth	X wins	O wins	Avg. time taken for a game (seconds)	Avg. no. of moves for O to win	Avg. time taken by O to move (seconds)
1	1	99	0.076	10	0.013
2	0	100	2.26	13	0.34
3	0	100	40.87	12	6.46
4	0	100	892.45	12	139.45

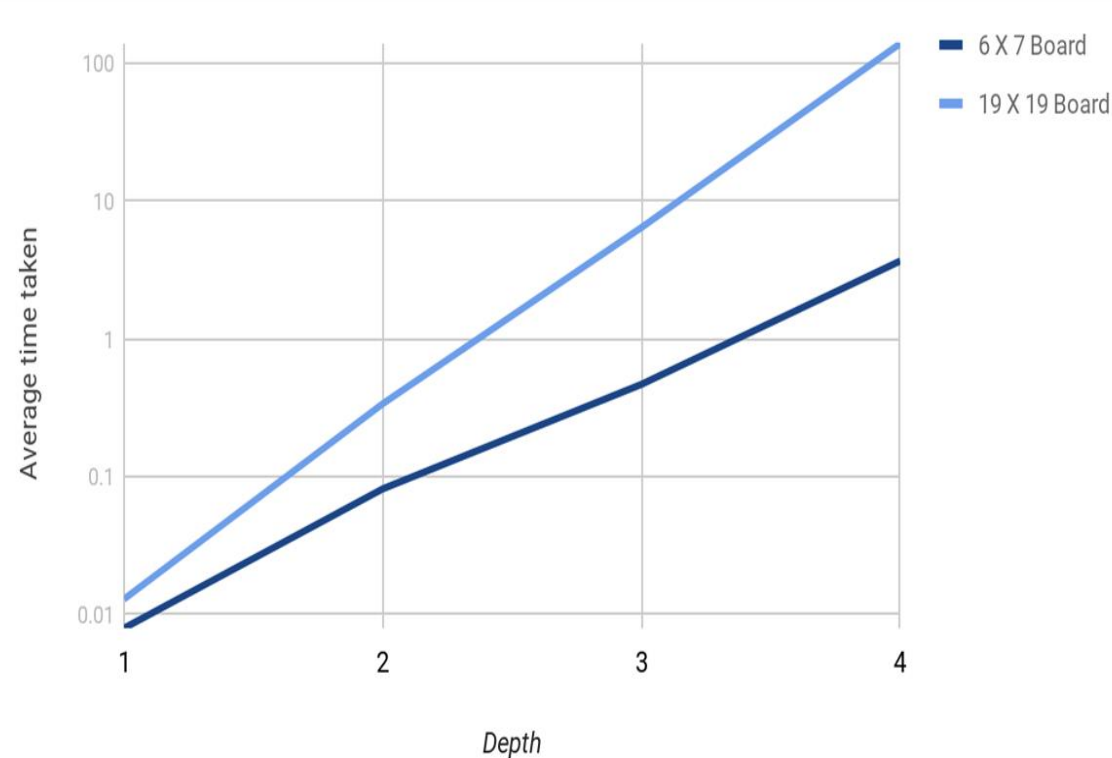
Player O uses minimax, Player X moves randomly (100 games)

Task 3.1

- Gather the win/loss/draw statistics.



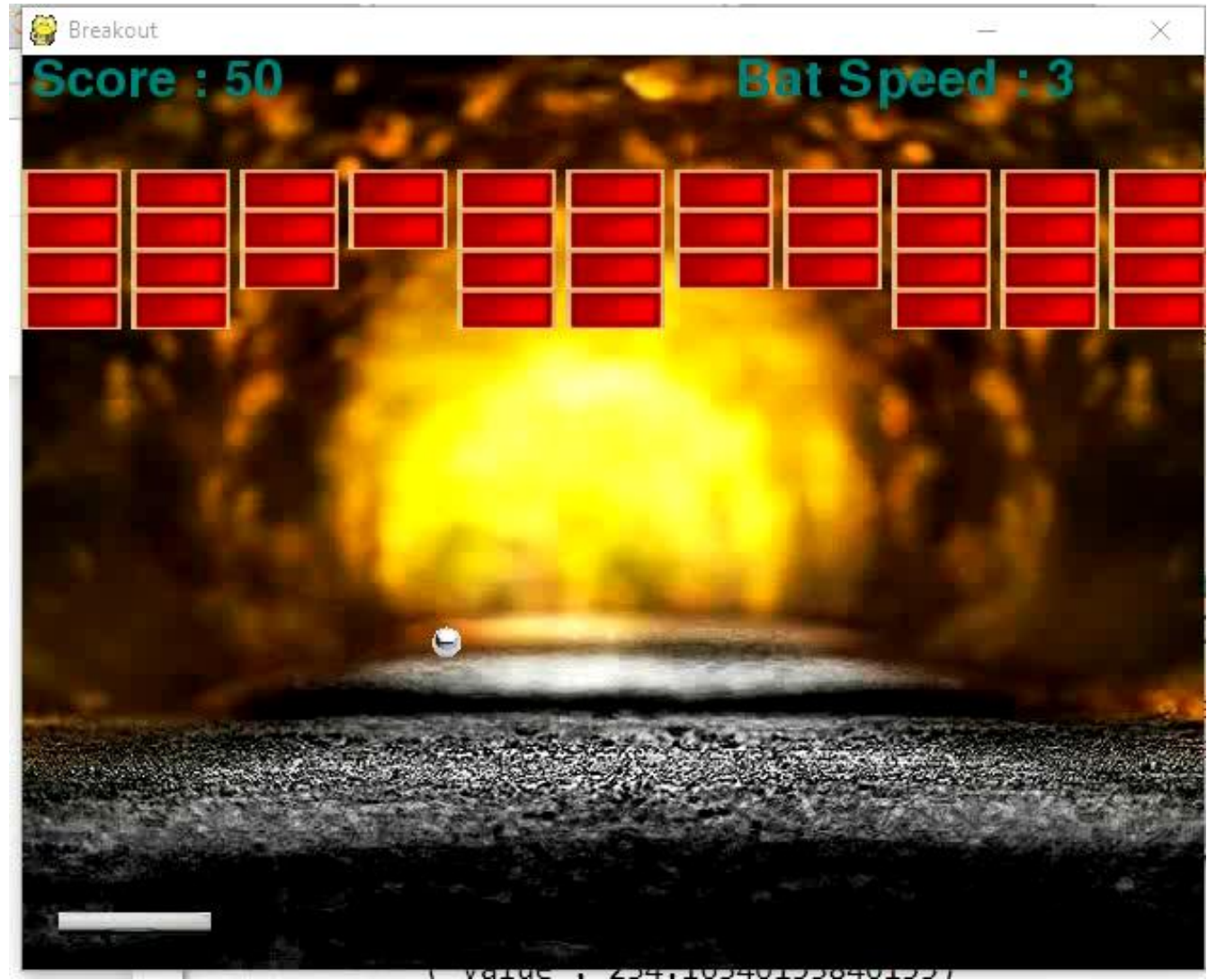
Player X uses minimax, Player O moves randomly (100 games)



Player O uses minimax, Player X moves randomly (100 games)

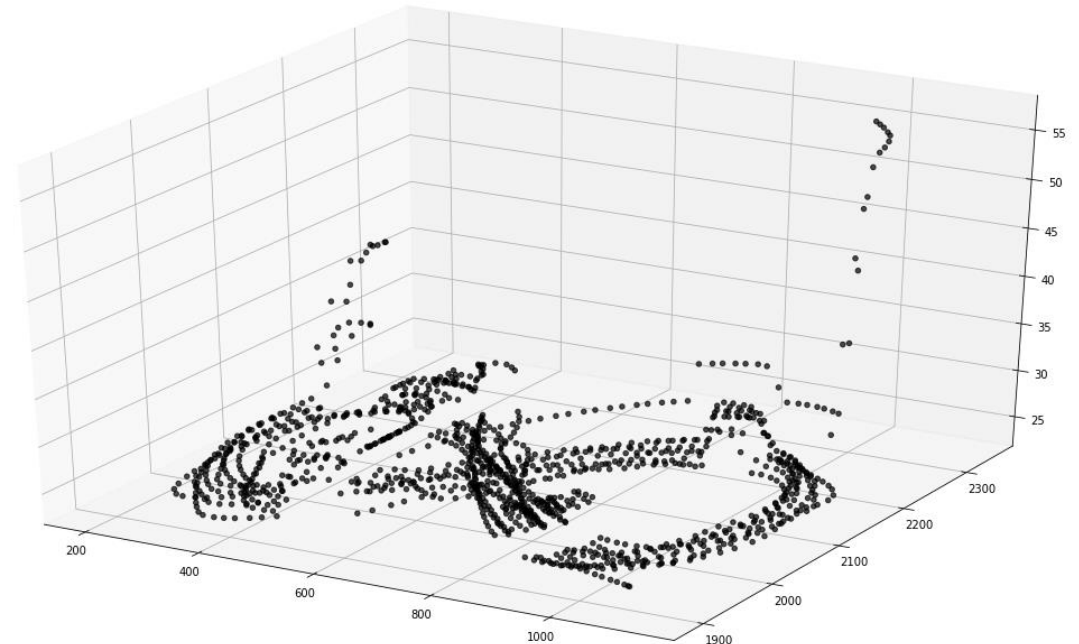
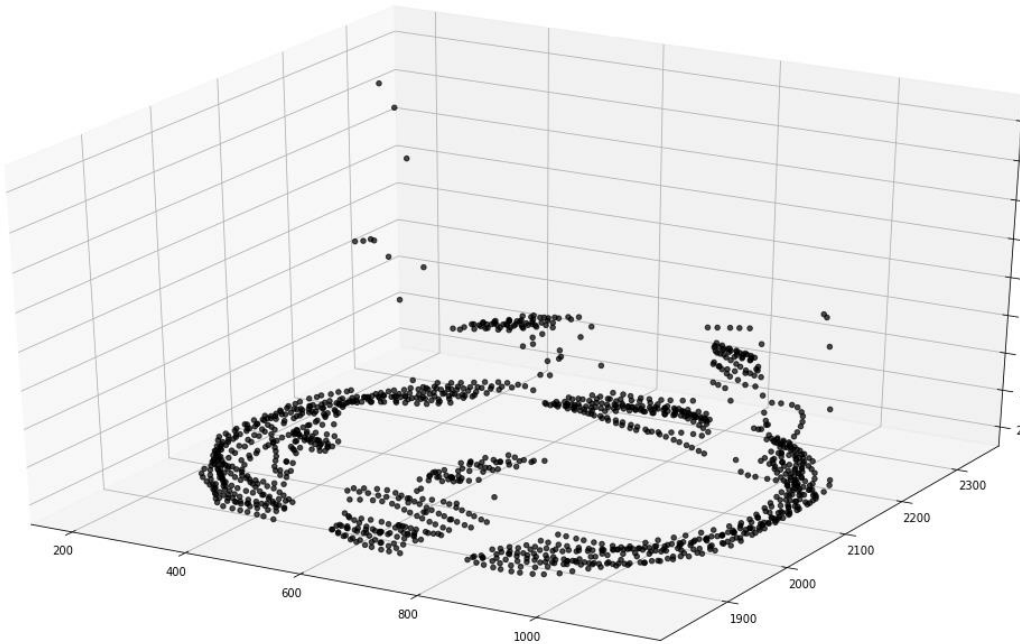
Task 3.2

- Implement a fuzzy controller for the breakout game

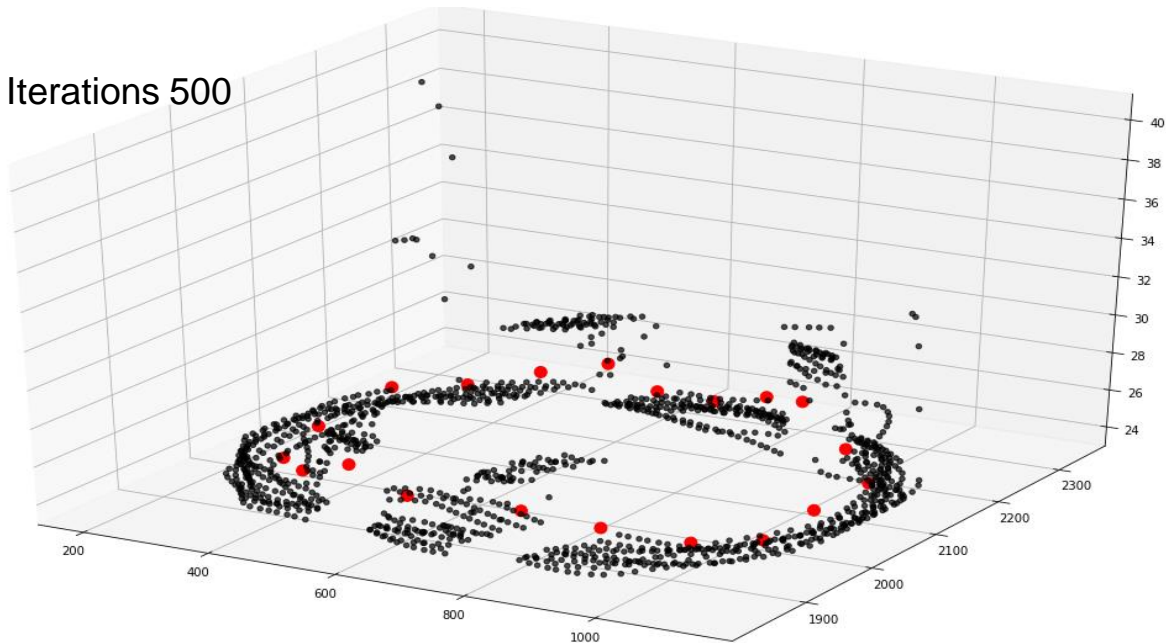


Task 3.3

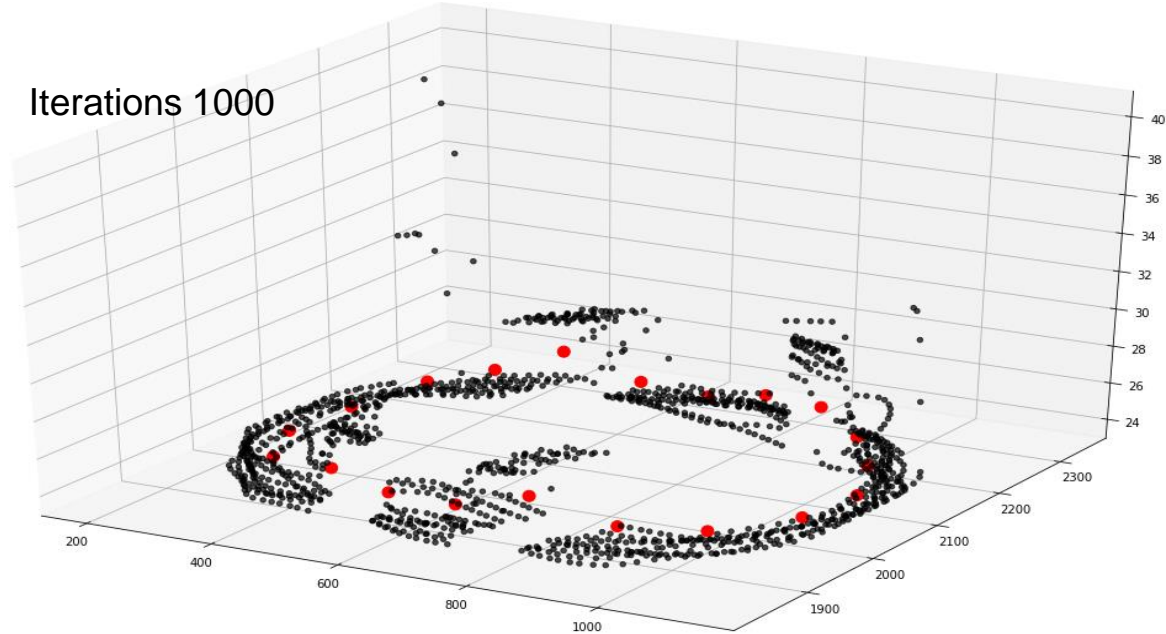
- Implement the SOM algorithm for given maps:



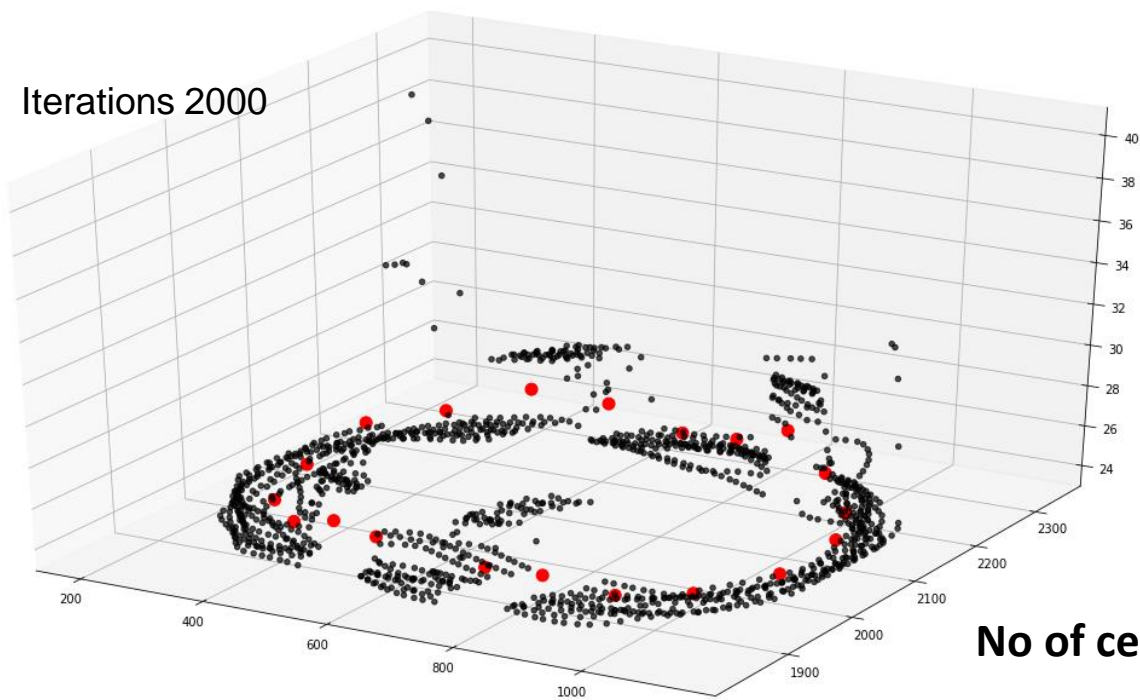
Iterations 500



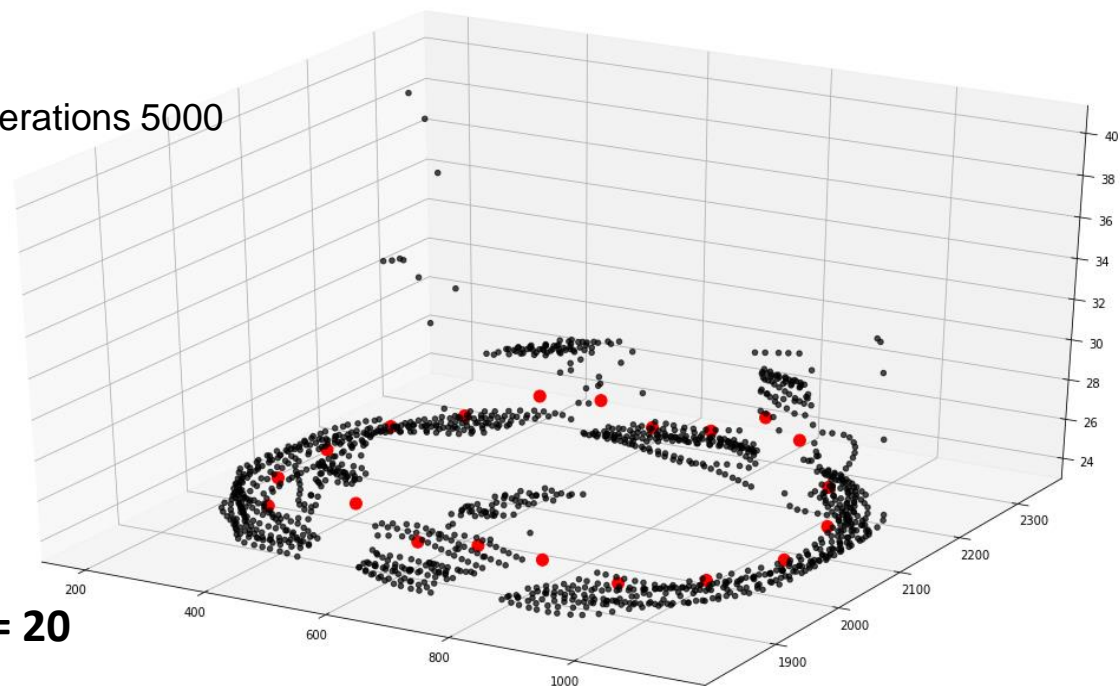
Iterations 1000



Iterations 2000

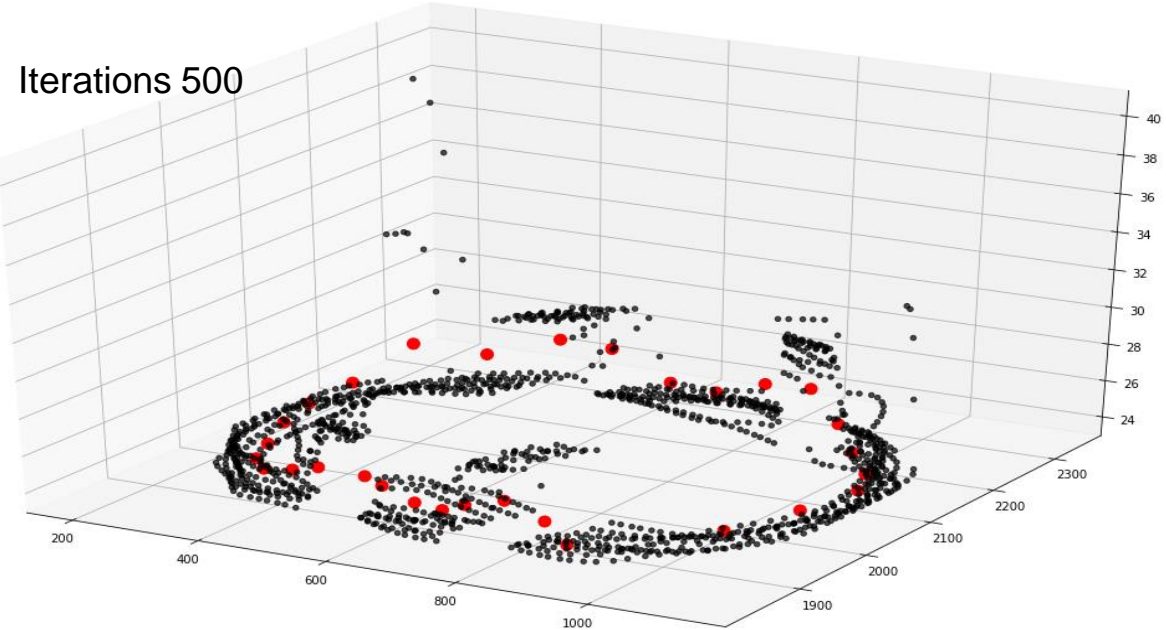


Iterations 5000

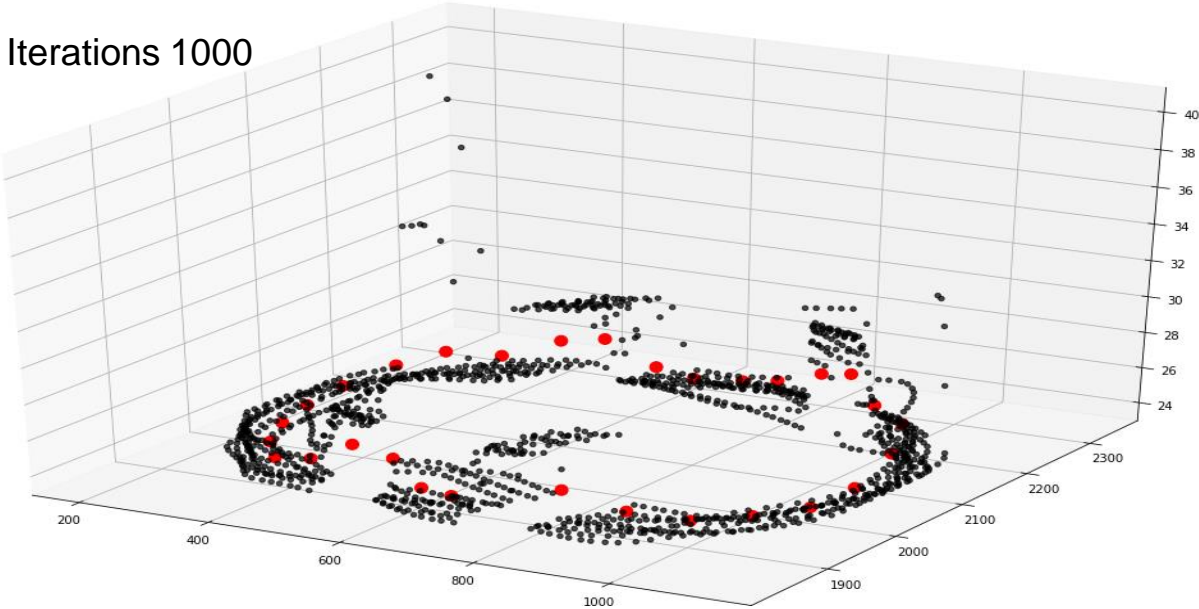


No of centroids = 20

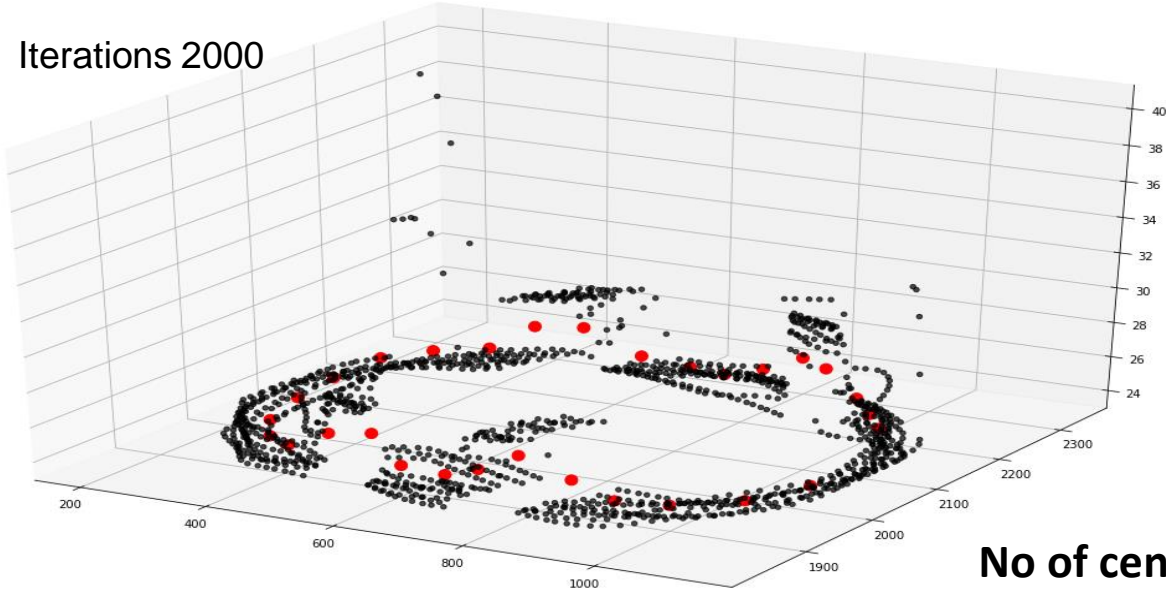
Iterations 500



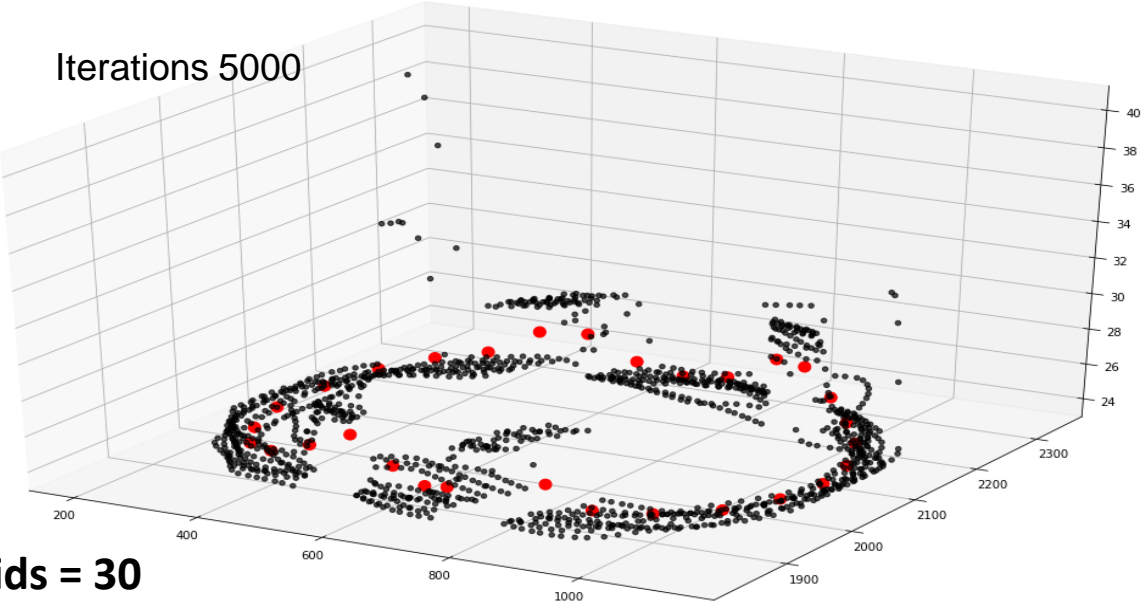
Iterations 1000



Iterations 2000

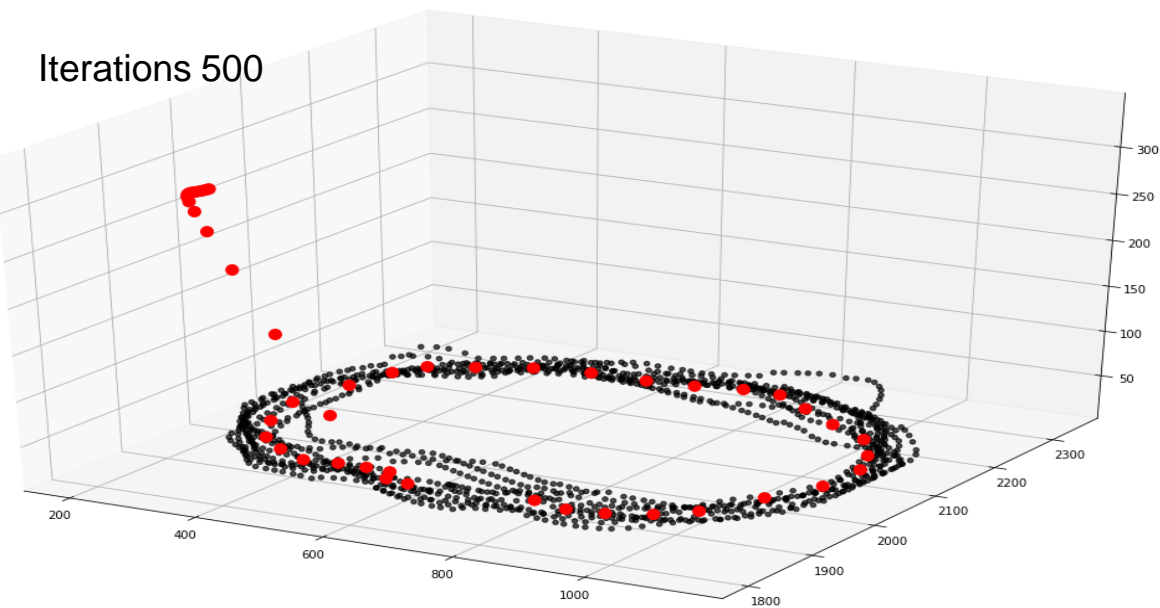


Iterations 5000

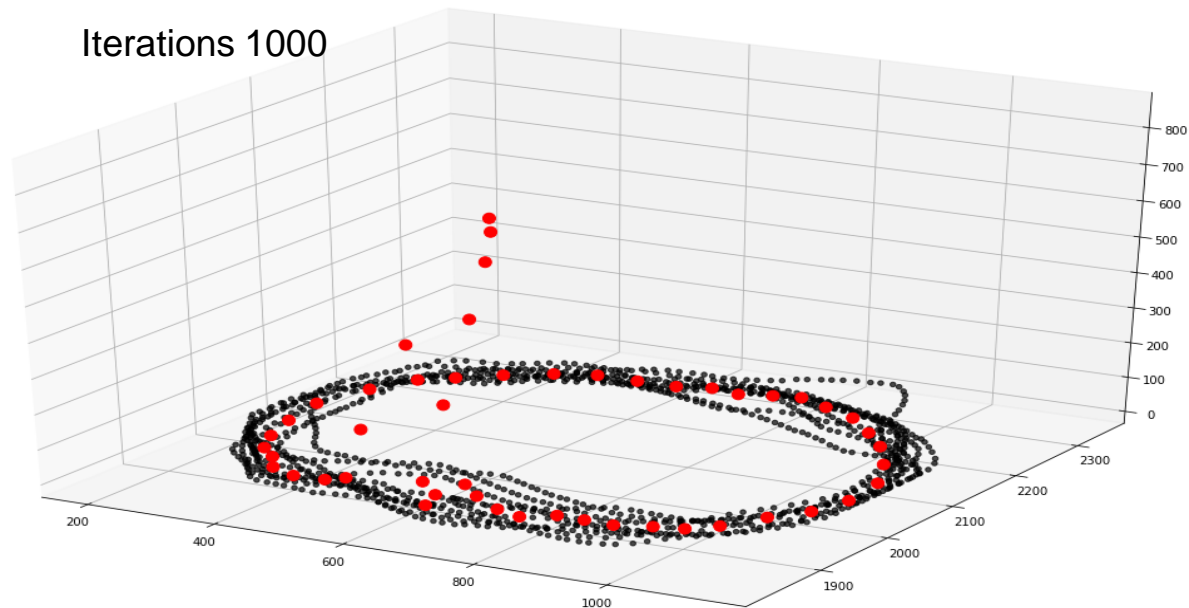


No of centroids = 30

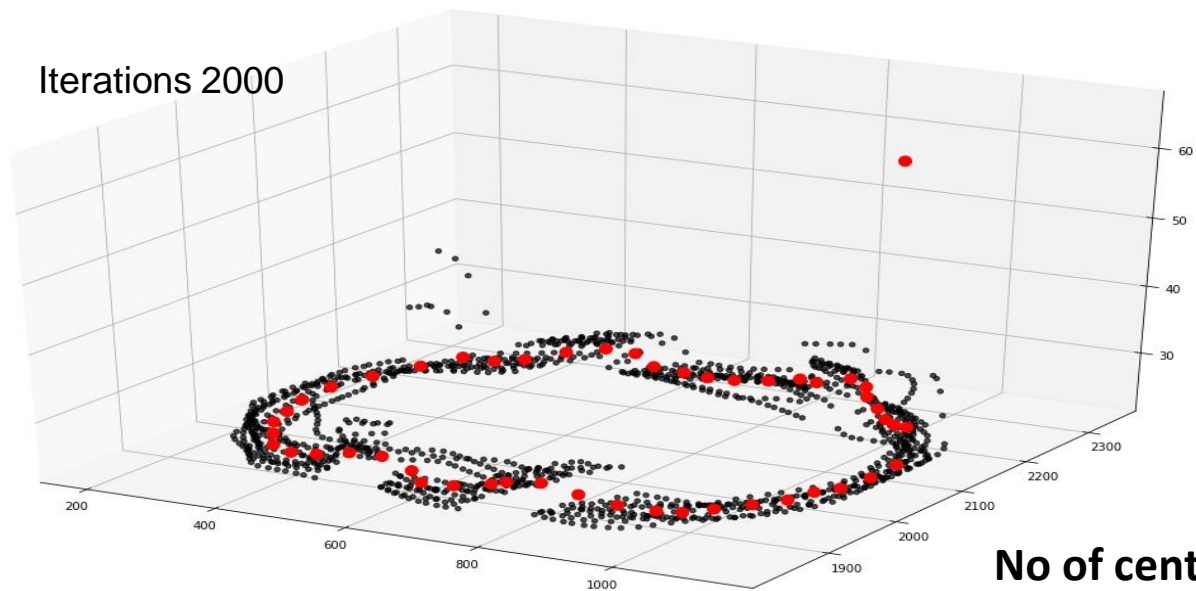
Iterations 500



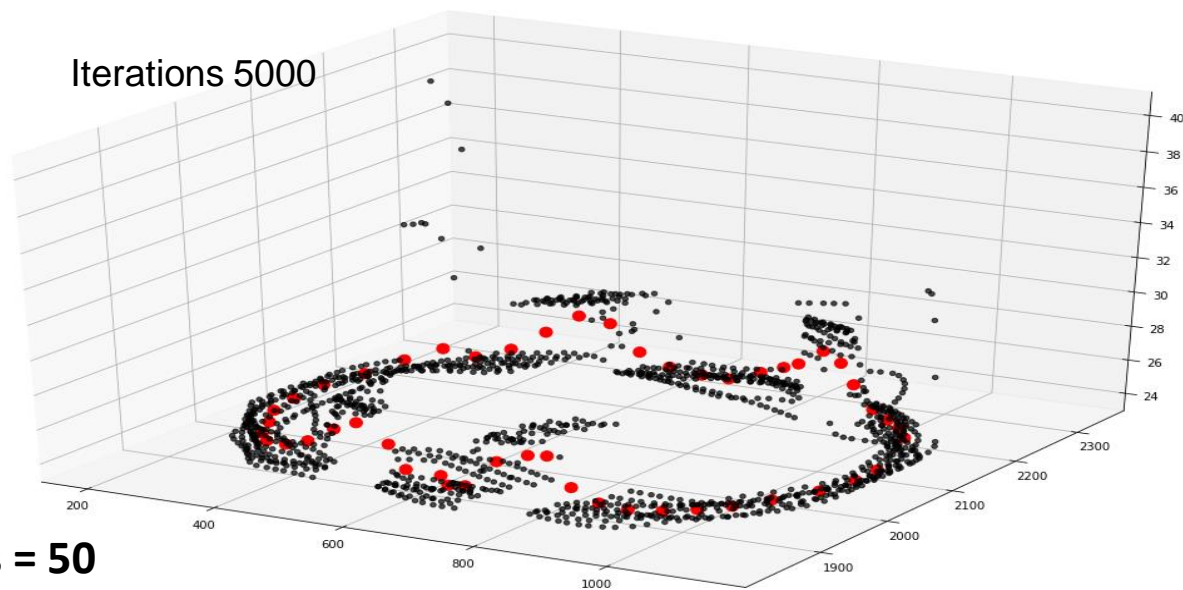
Iterations 1000



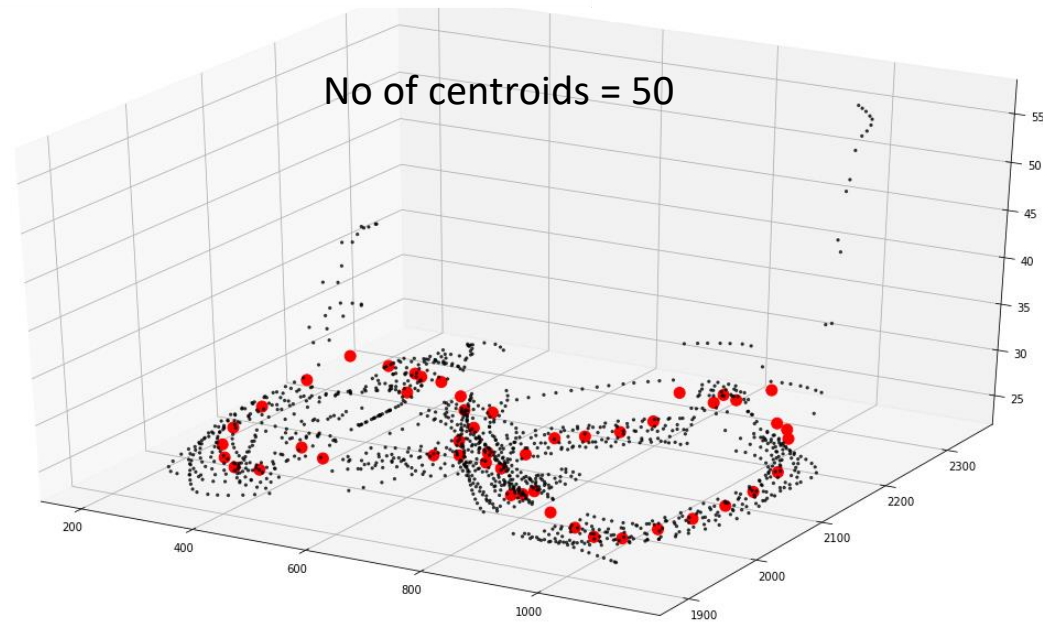
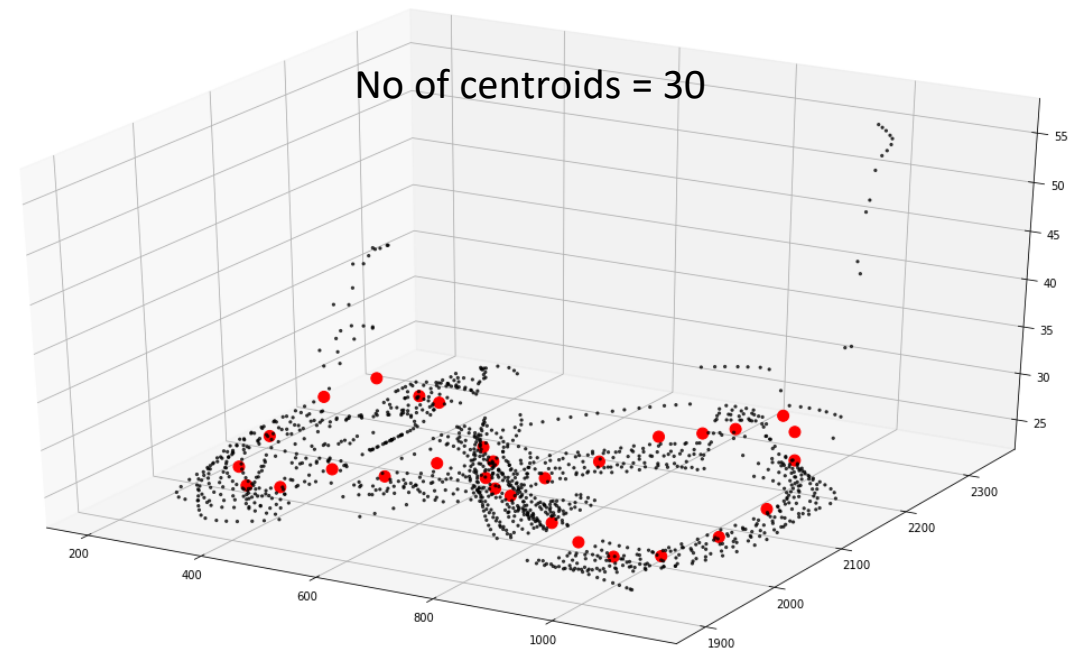
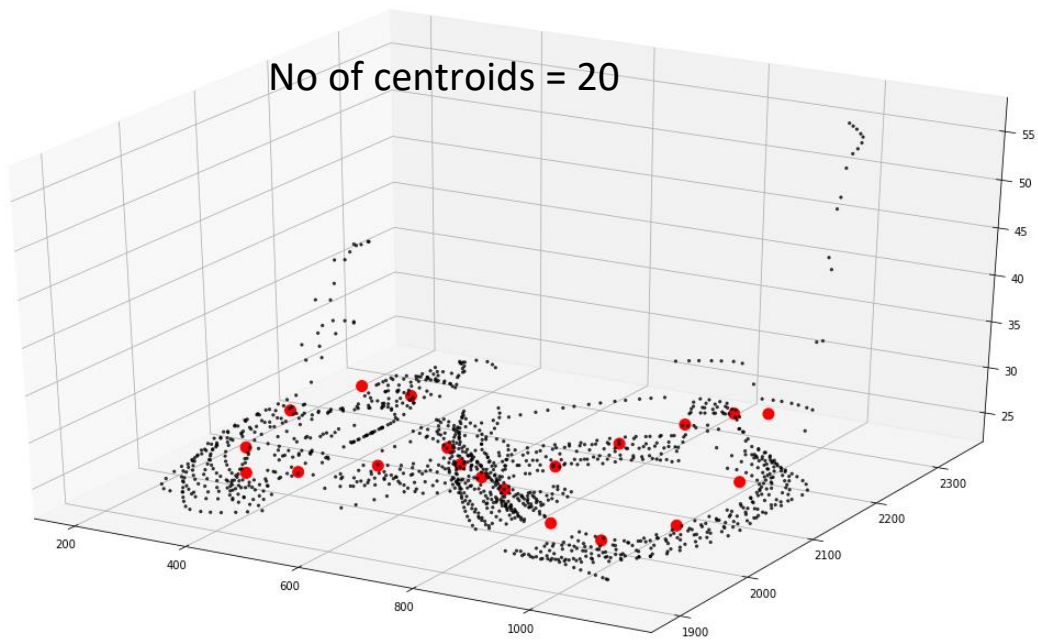
Iterations 2000



Iterations 5000



No of centroids = 50



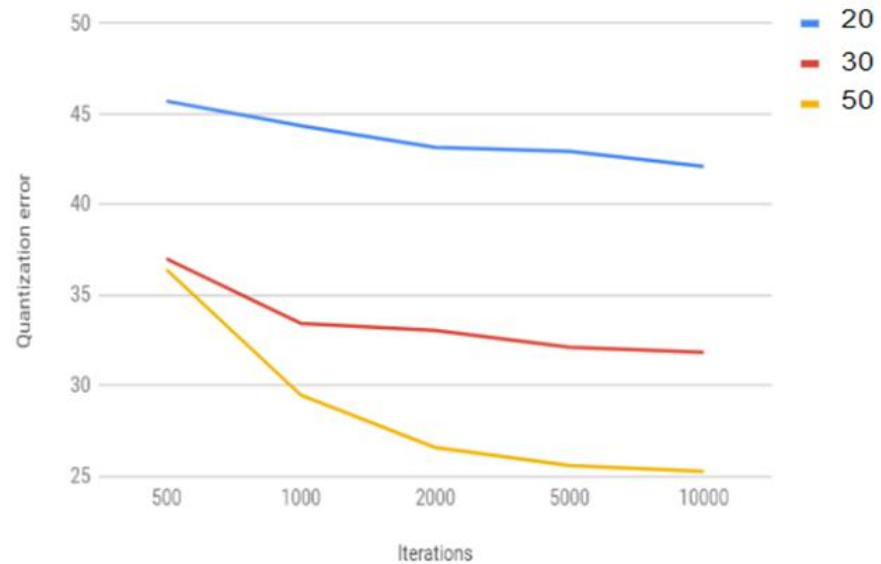
MAP 2

Task 3.3

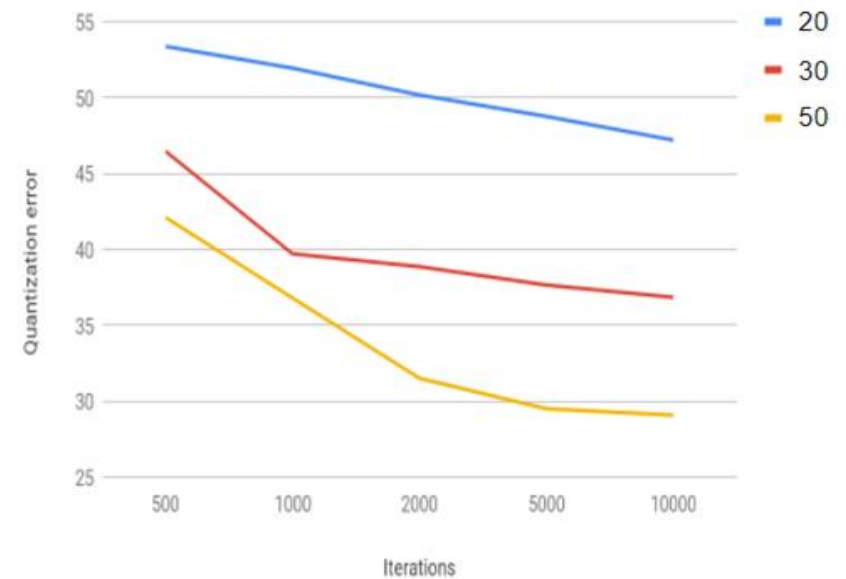
$$\text{Quantization error} = \frac{\sum_1^n ||x_i - c_i||}{n}$$

(Mean Euclidean distance of each data point from its corresponding centroid)

Map 1



Map 2

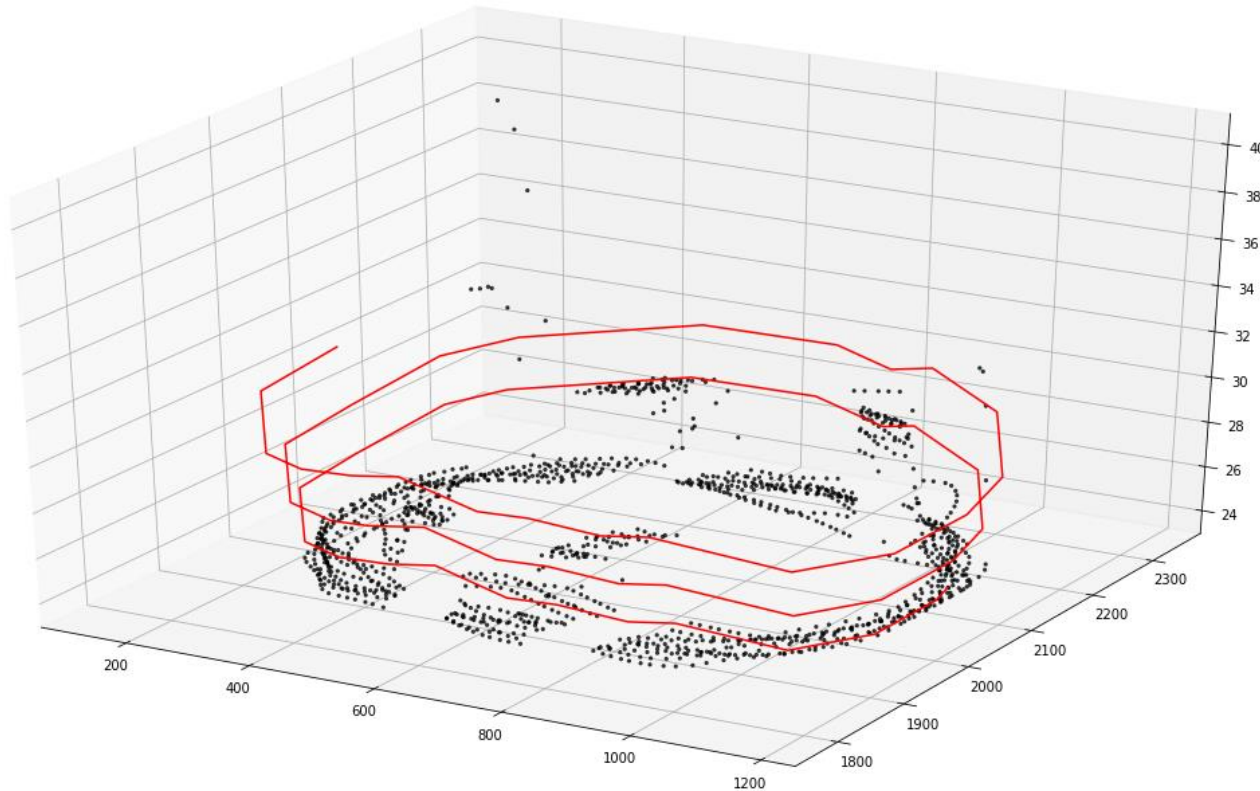


Task 3.3

- Output depends heavily on the choice of initial points.
However, for random initialization, this dependency can be reduced by increasing the number of iterations (T_{\max})
- For larger number of centroids, T_{\max} needs to be large enough for the graph to be able to represent the data points.
- Increasing T_{\max} beyond a certain value, does not result in drastic changes of the representation.

Task 3.4

- **Implementation of Bayesian Imitation Learning for the maps given in Task 3.3**

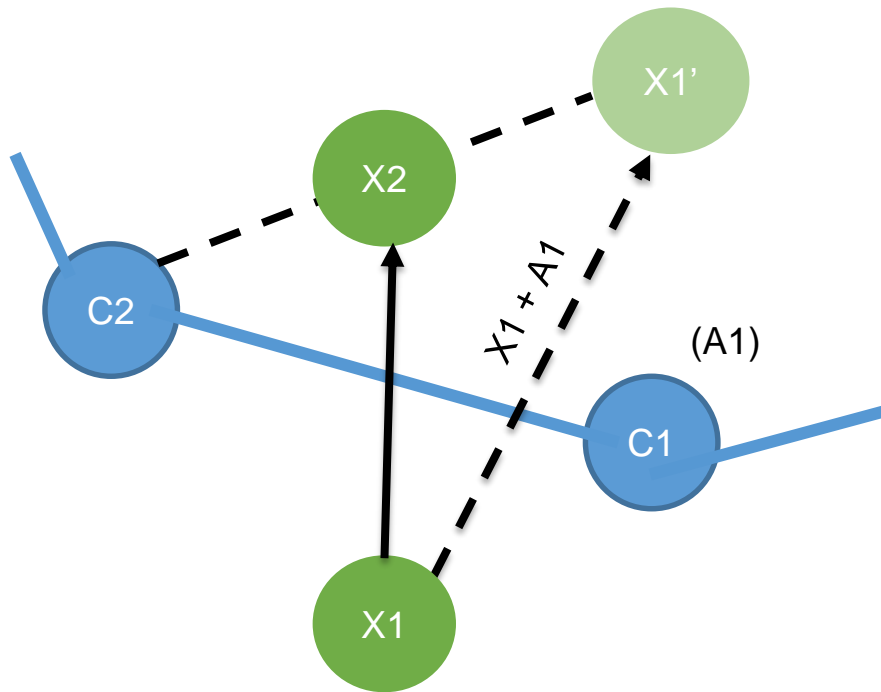


Using the probabilistic approach, the algorithm performs the same action A_i , for each point belonging to the corresponding cluster C_i

Results in a repetitive pattern

Task 3.4

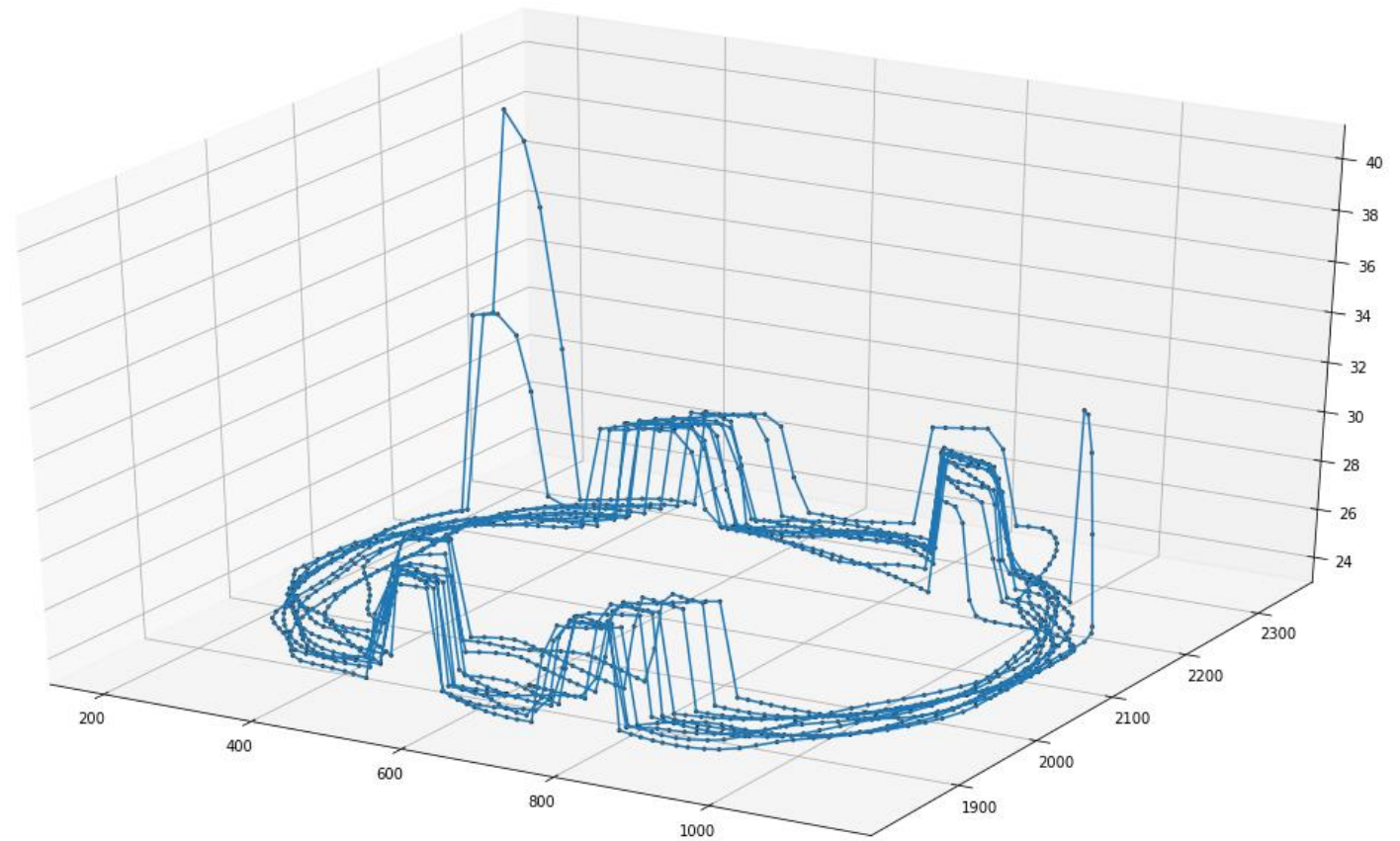
- Implementation of Bayesian Imitation Learning for the maps given in Task 3.3



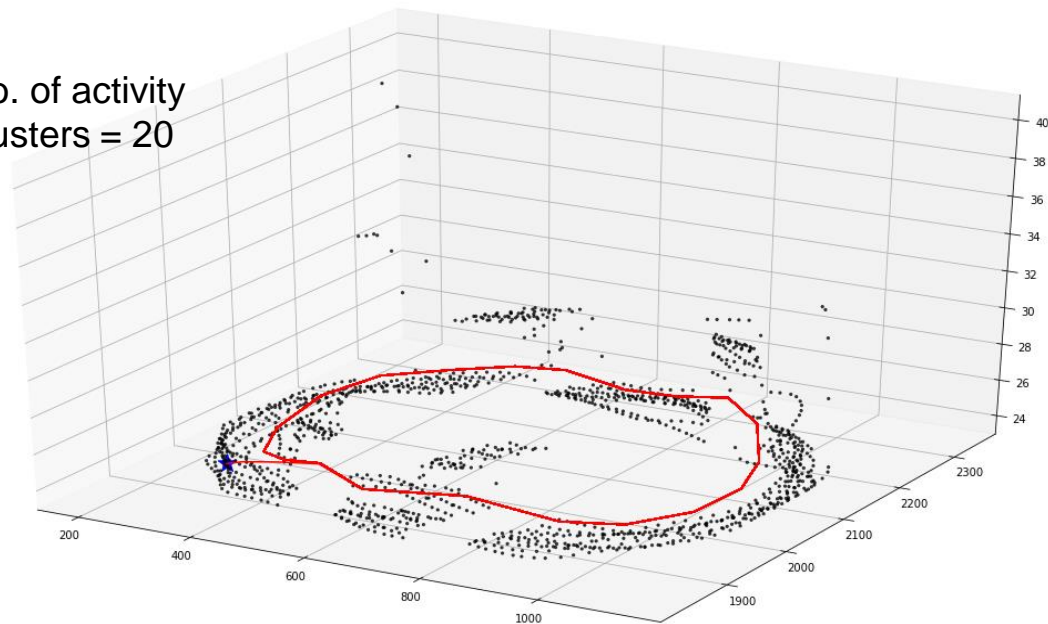
Given current trajectory point X_t
New trajectory point = midpoint (next
cluster centroid, $A_t + X_t$)

Task 3.4

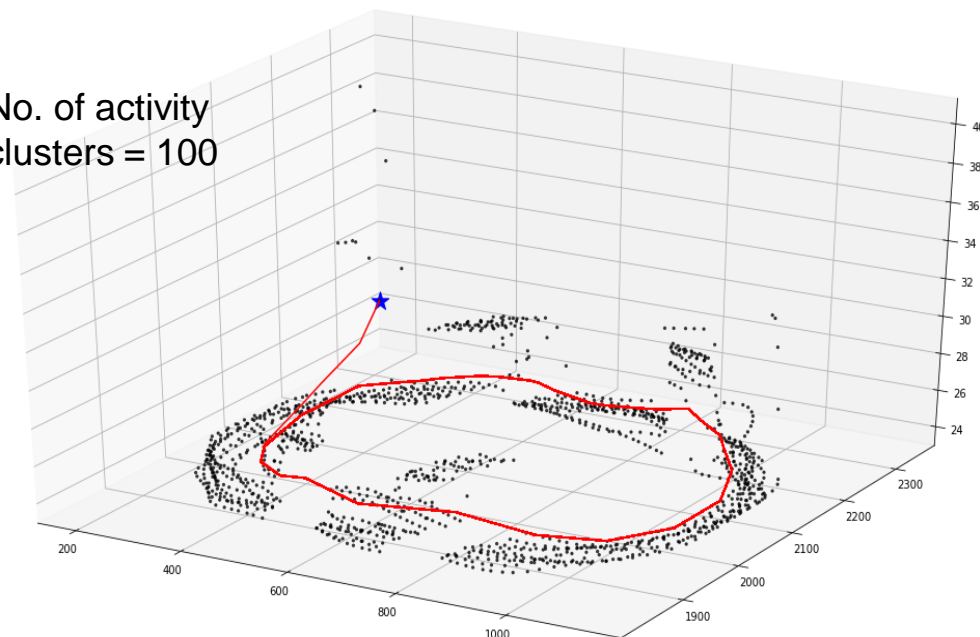
Actual human player trajectory (Map 1)



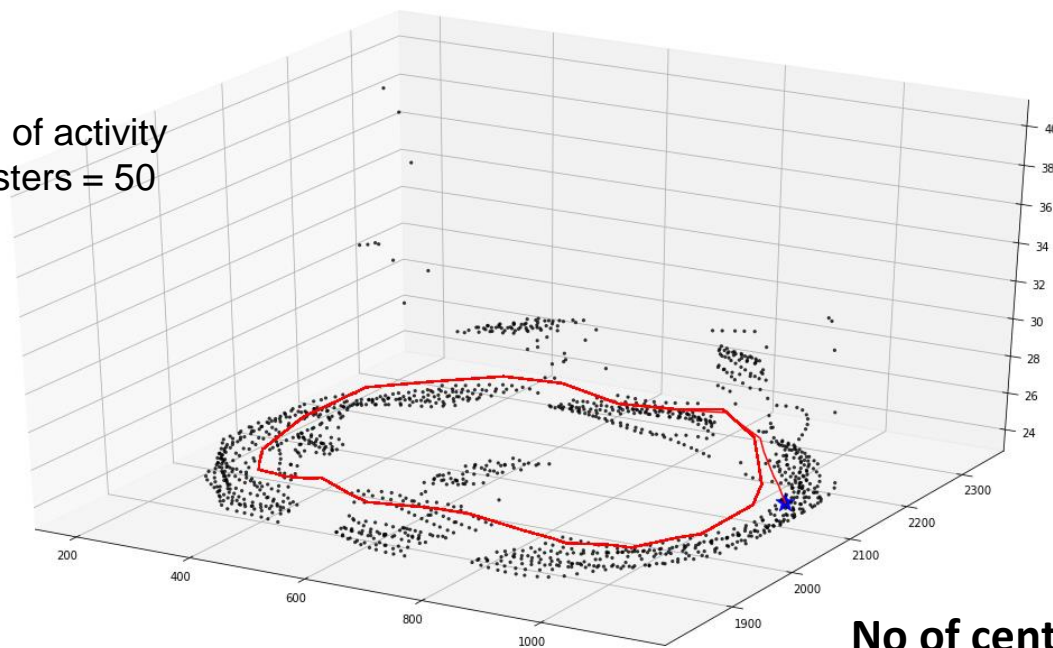
No. of activity
clusters = 20



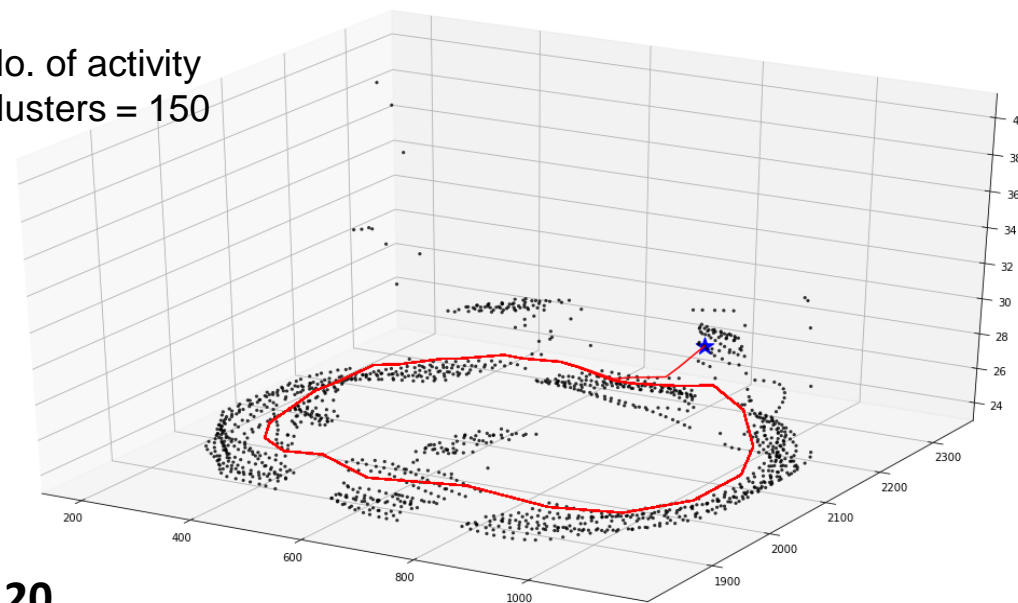
No. of activity
clusters = 100



No. of activity
clusters = 50

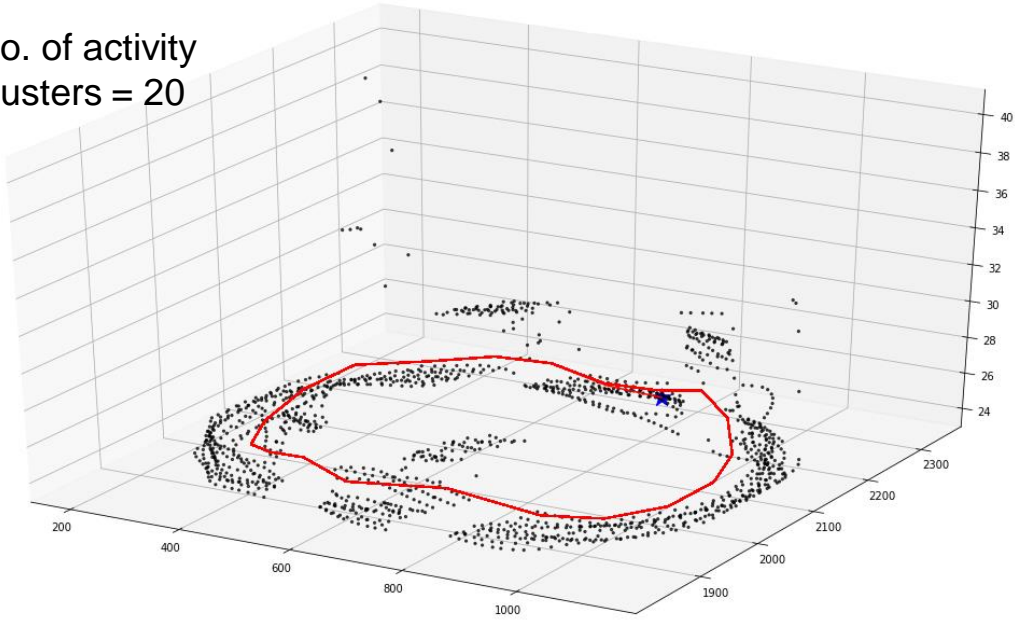


No. of activity
clusters = 150

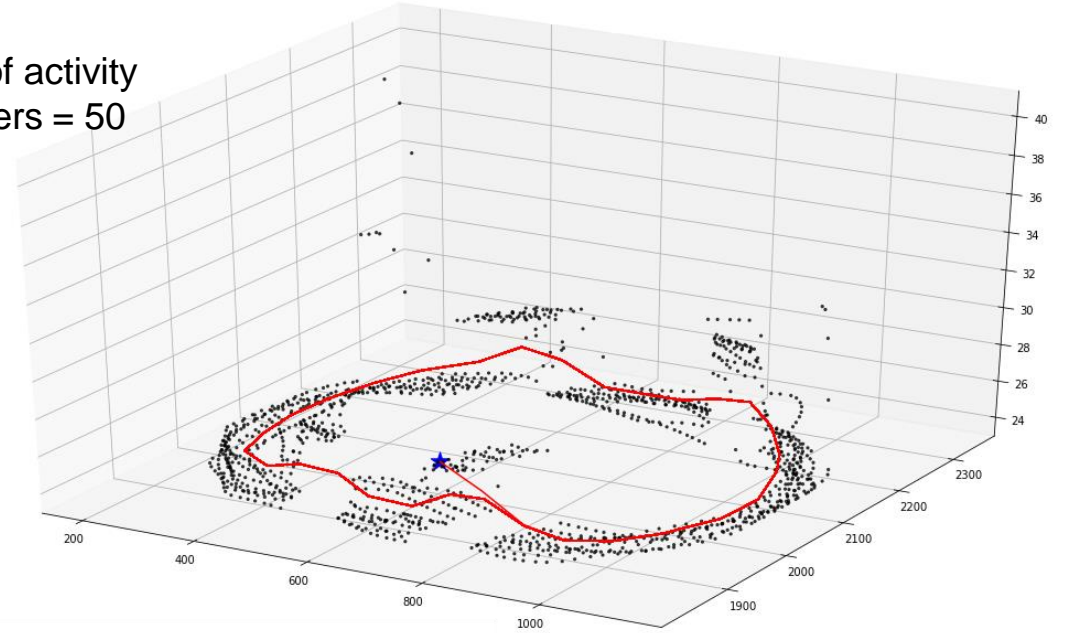


No of centroids = 20

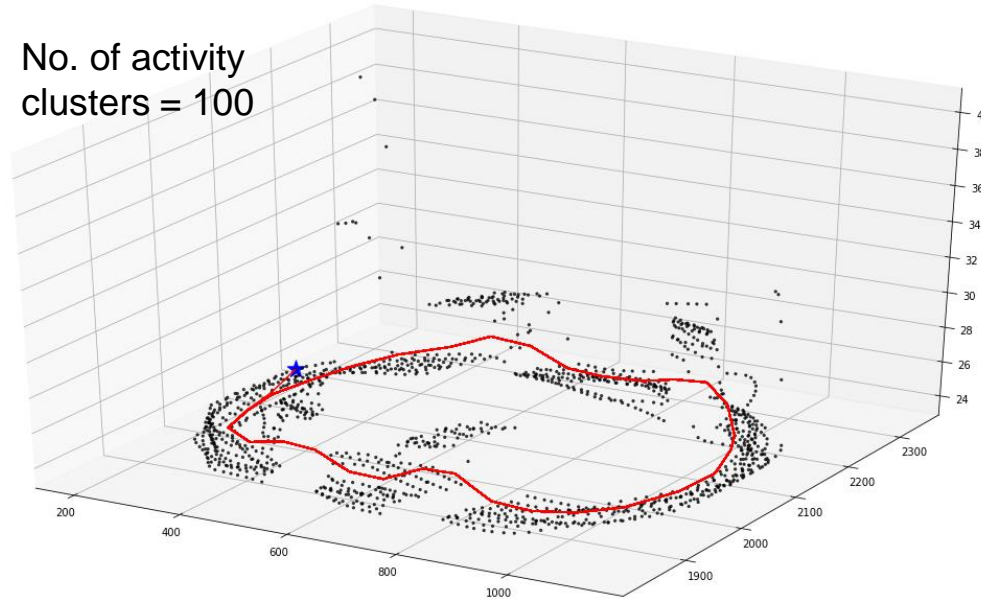
No. of activity
clusters = 20



No. of activity
clusters = 50

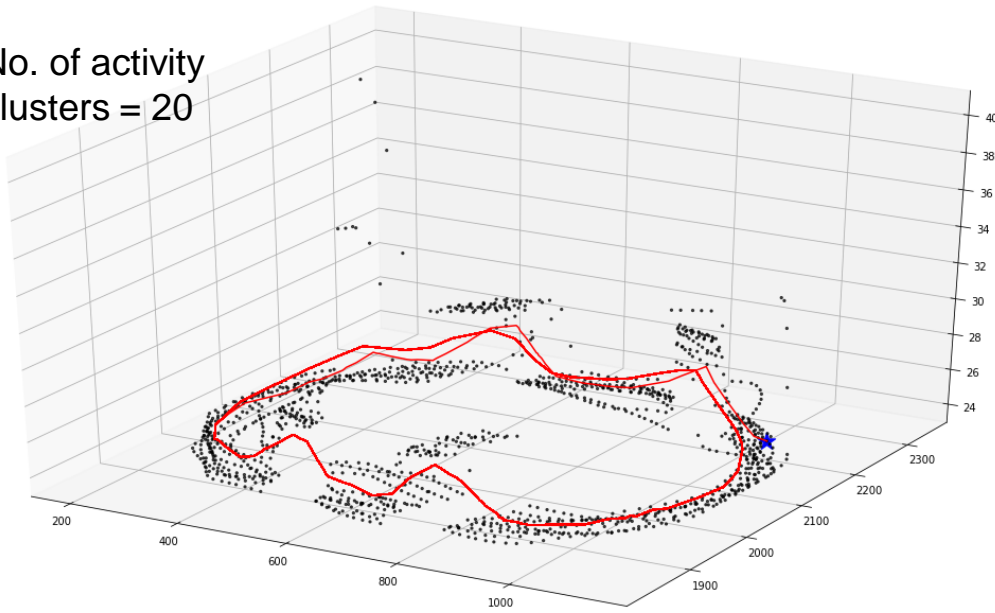


No. of activity
clusters = 100

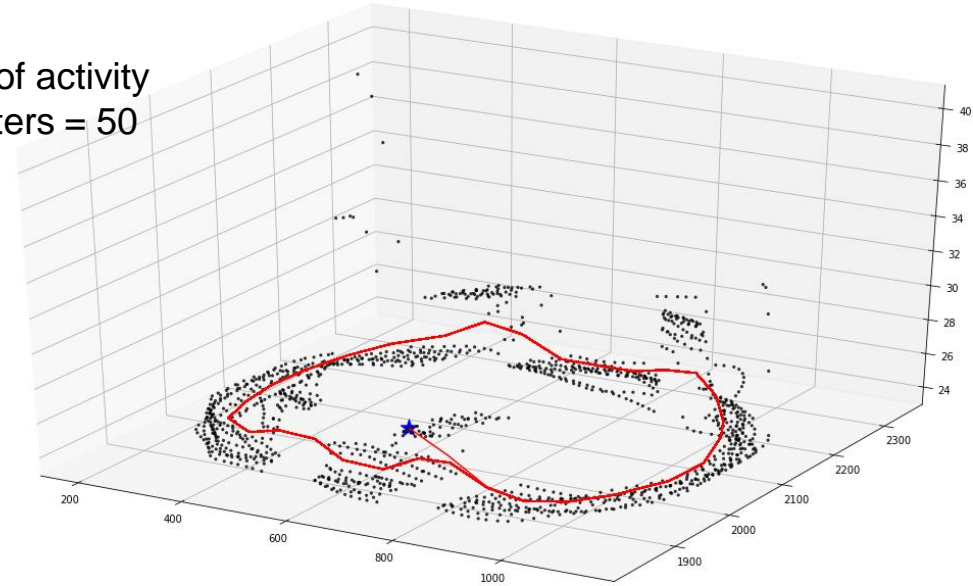


No of centroids = 30

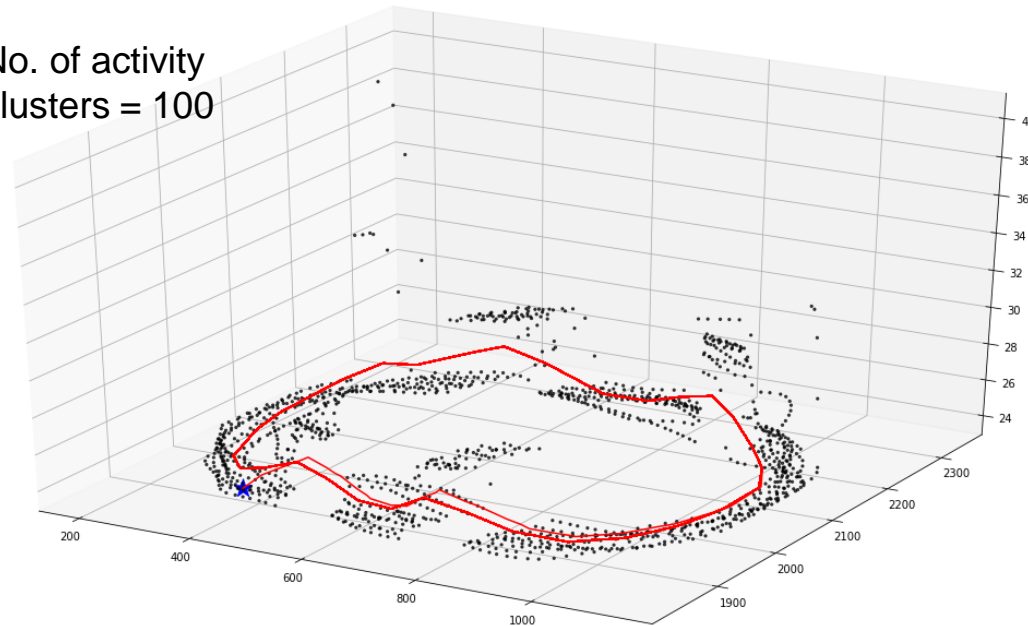
No. of activity
clusters = 20



No. of activity
clusters = 50

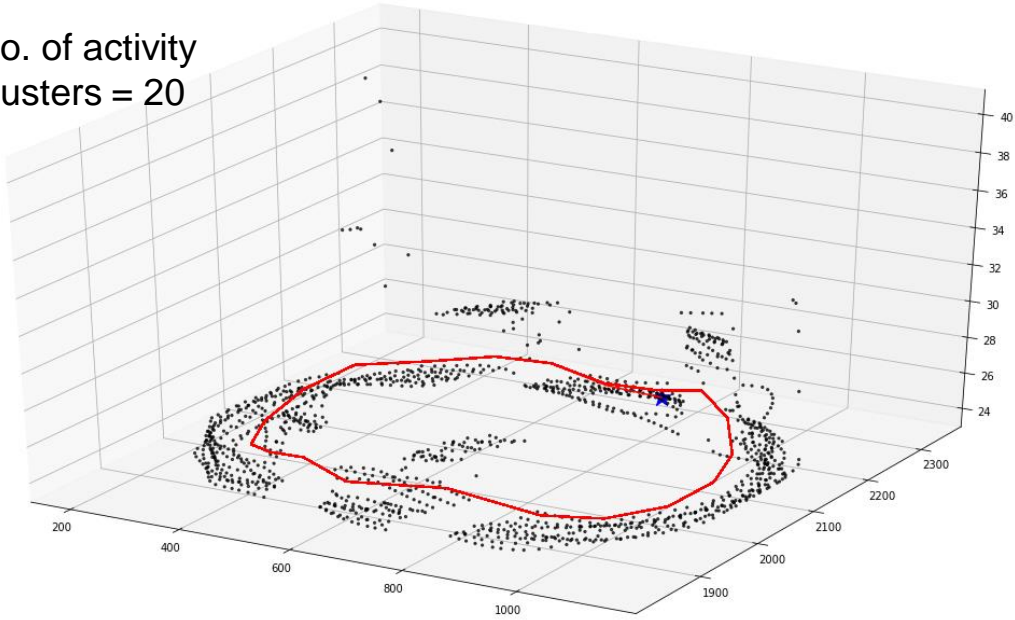


No. of activity
clusters = 100

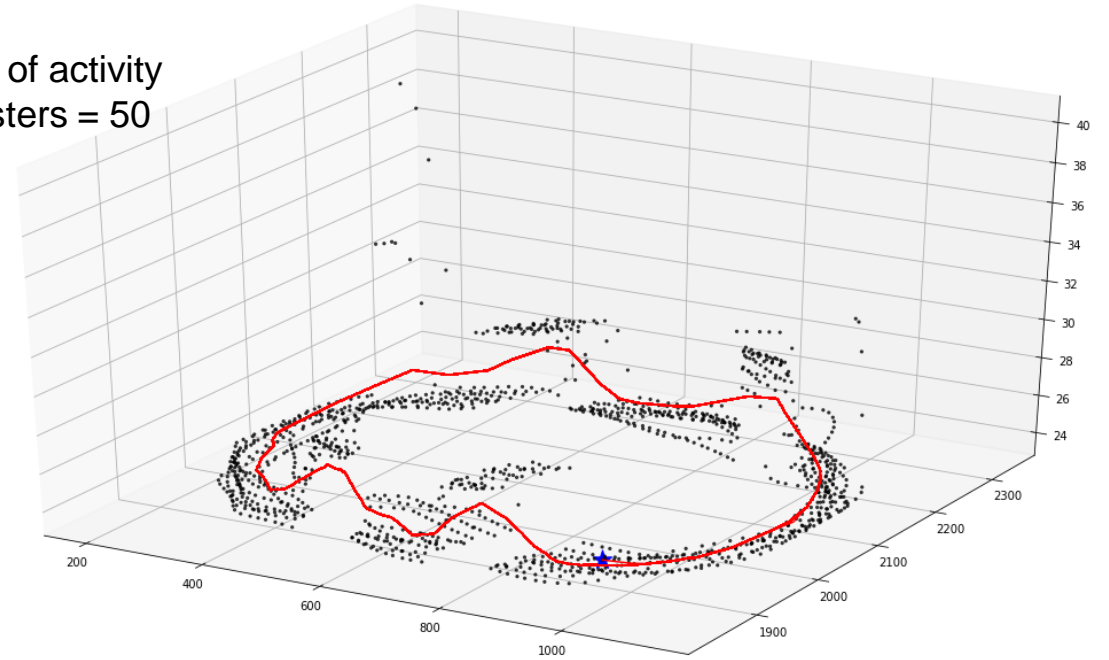


No of centroids = 30

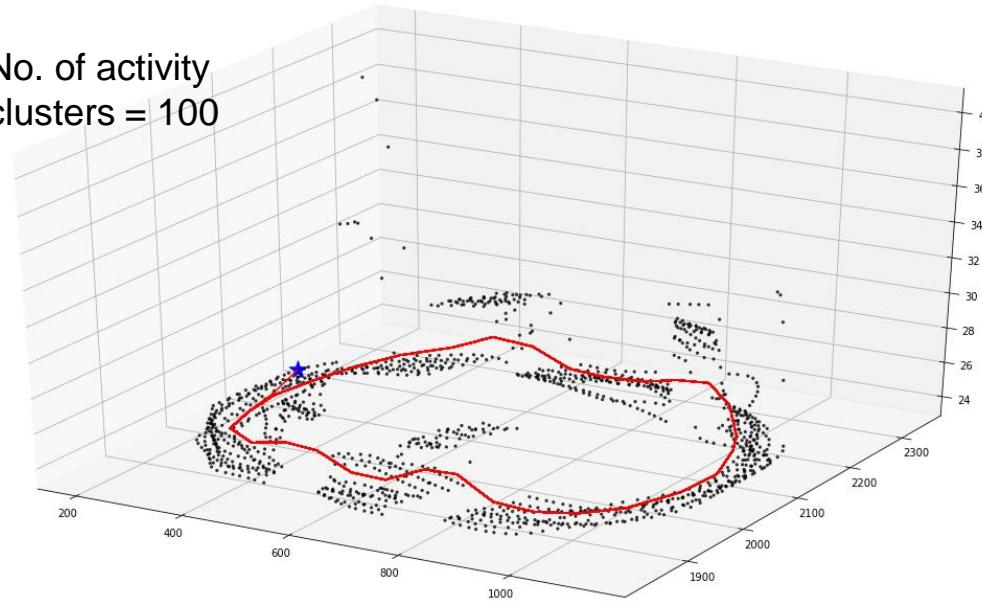
No. of activity
clusters = 20



No. of activity
clusters = 50



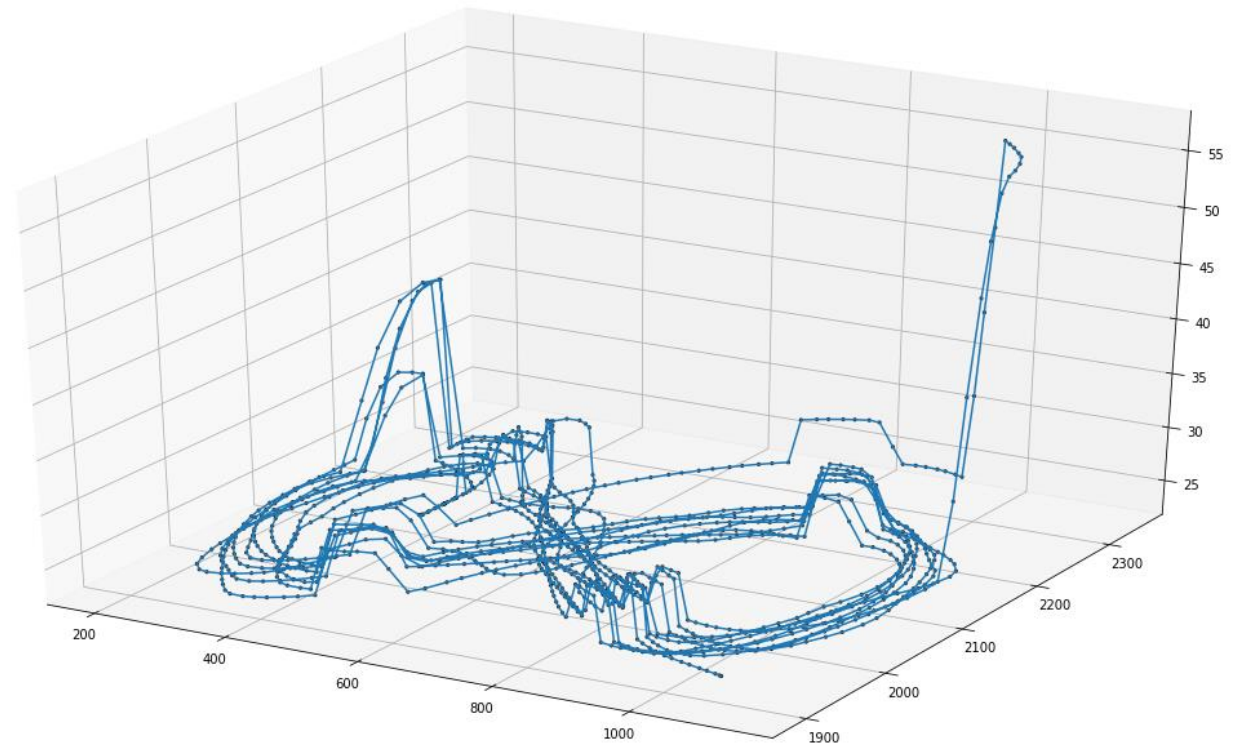
No. of activity
clusters = 100



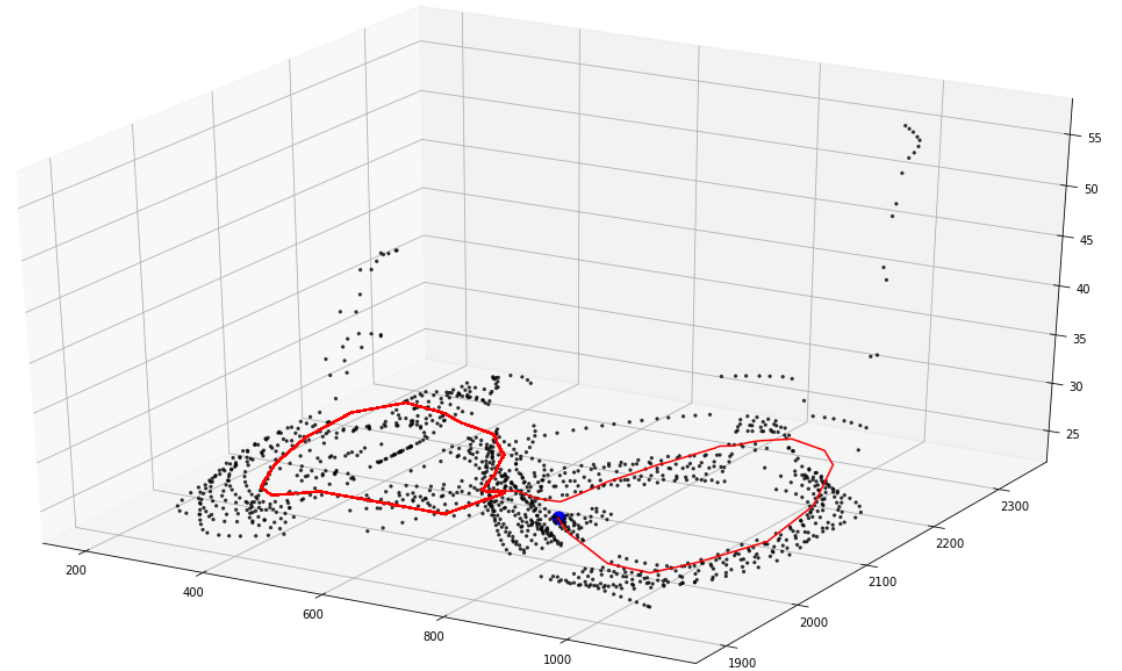
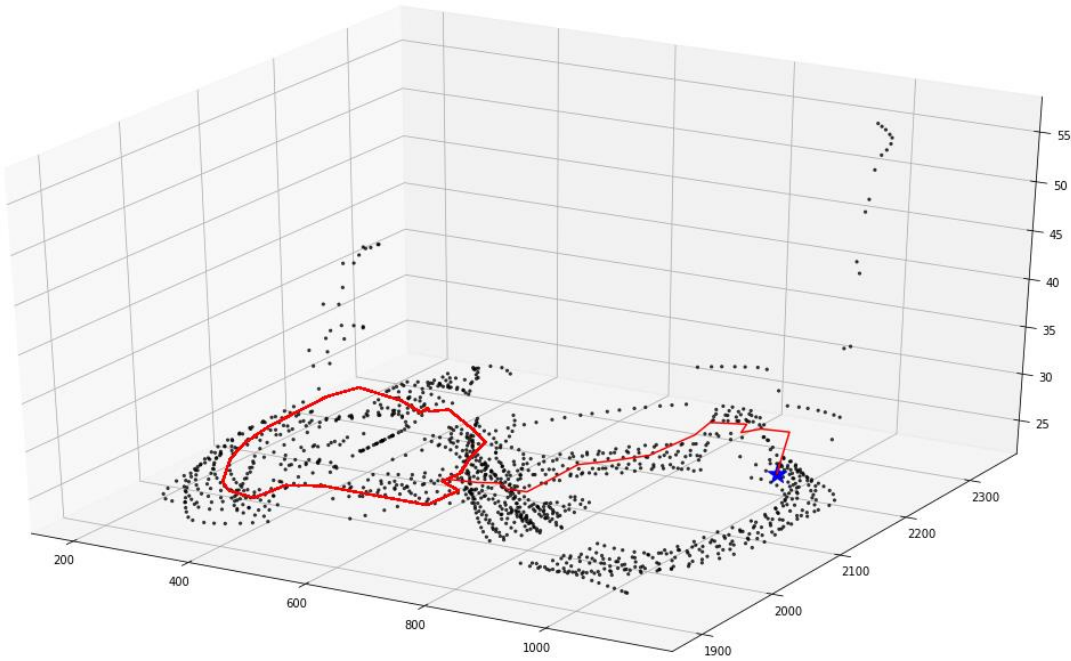
No of centroids = 50

Task 3.4

Actual human player trajectory (Map 2)



Task 3.4



Number of activity clusters = 100

Number of location centroids = 30

Thank You.