ANN Lab 2
Radial Basis Function, Self Organizing Map

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Batch RBF Thresholds

Threshold	Absolute Residual Error Achieved	Number of units	Variance
0.1	0.0997	5	0.695
0.01	0.0099	13	0.080
0.001	0.00099	56	0.007

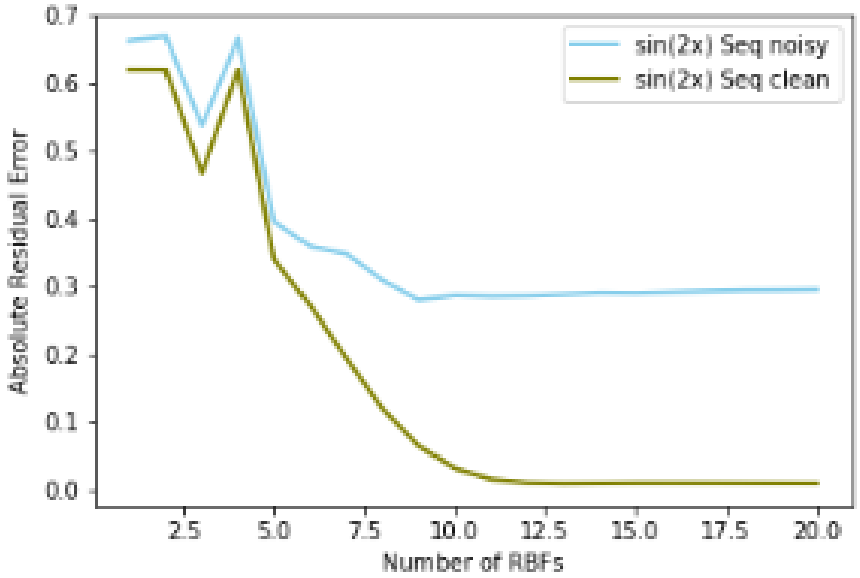
Tabell 1: Parameters needed to meet required thresholds for sin(2x)

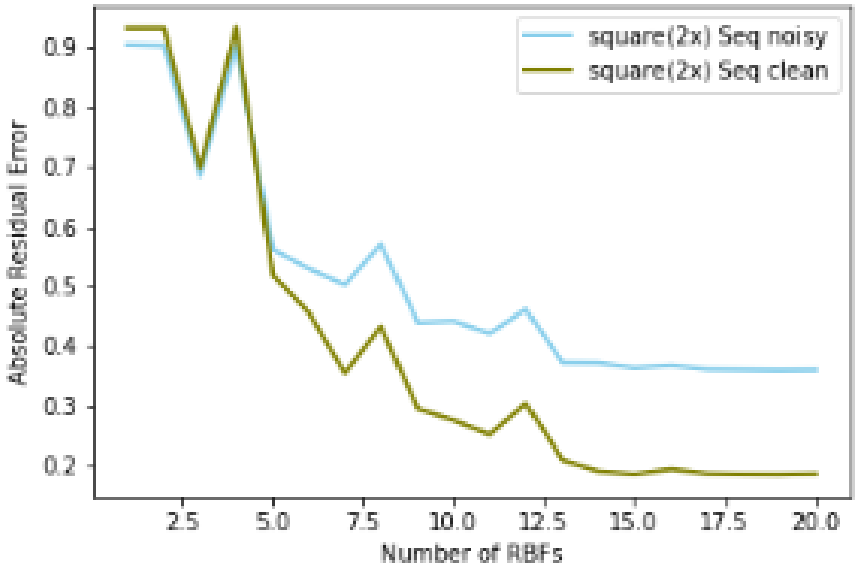
Threshold	Absolute Residual Error Achieved	Number of units	Variance
0.1	0.0958	35	0.015
0.01	-	-	-
0.001	-	-	-

Tabell 2: Parameters needed to meet required thresholds for square(2x)

- To reduce the residual error to 0 for the square(2x) function, we could use a sign activation function

On-line Number of RBFs

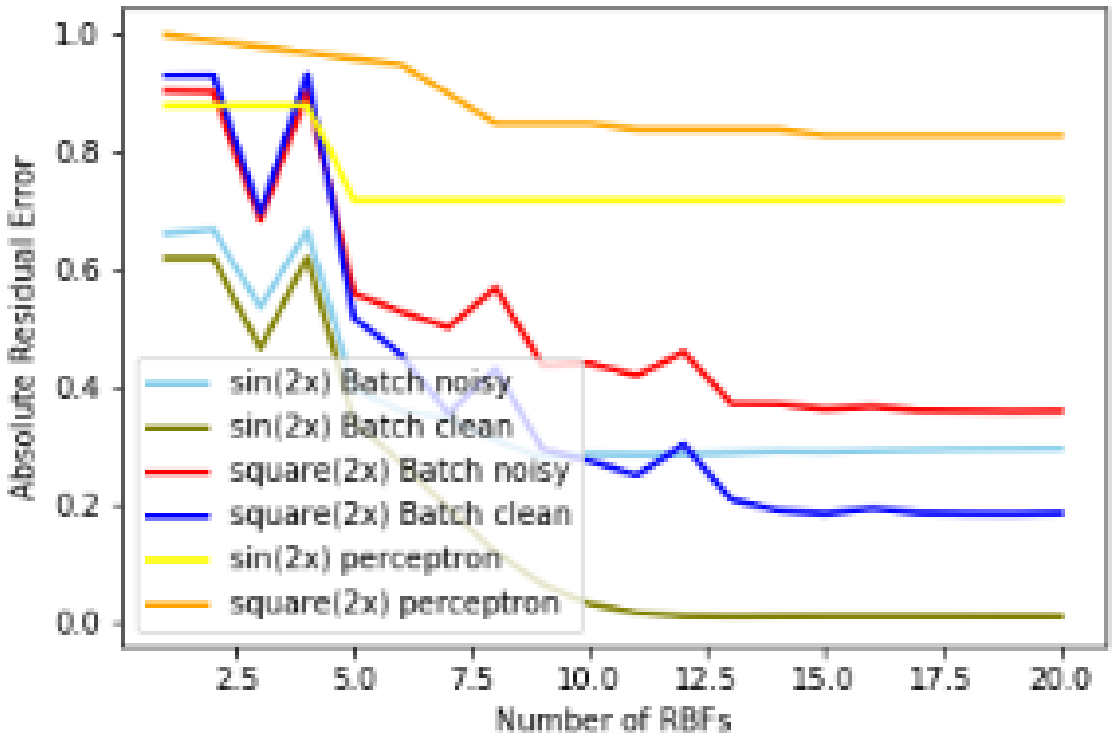


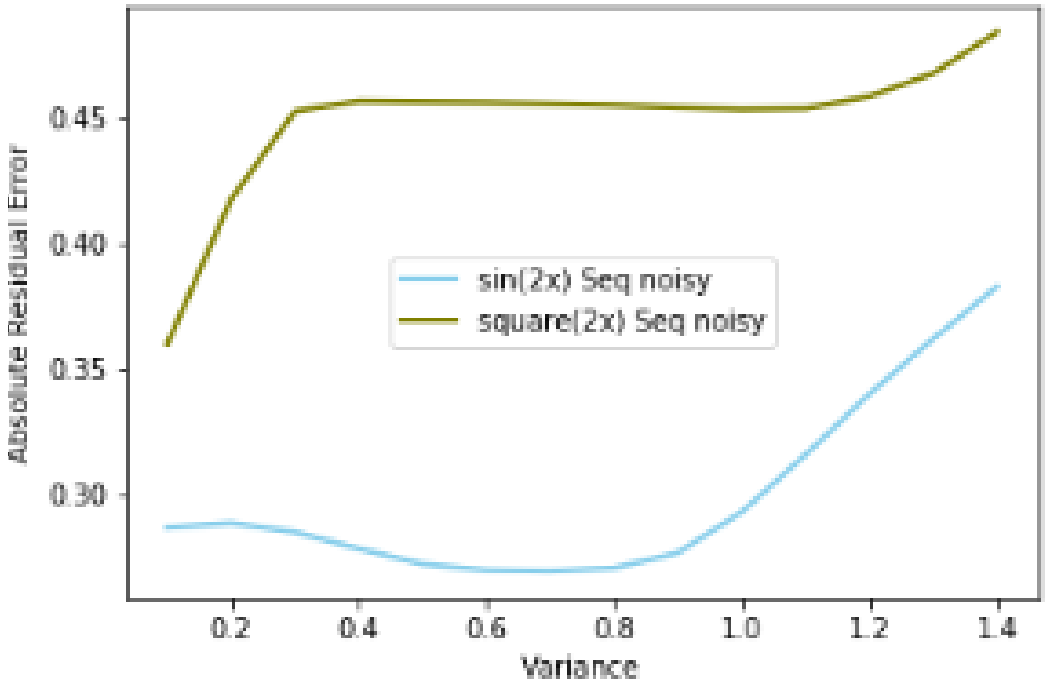


Figur 1: sin(2x) Number of RBFs vs Er-ror

Figur 2: square(2x) Number of RBFs vs Error

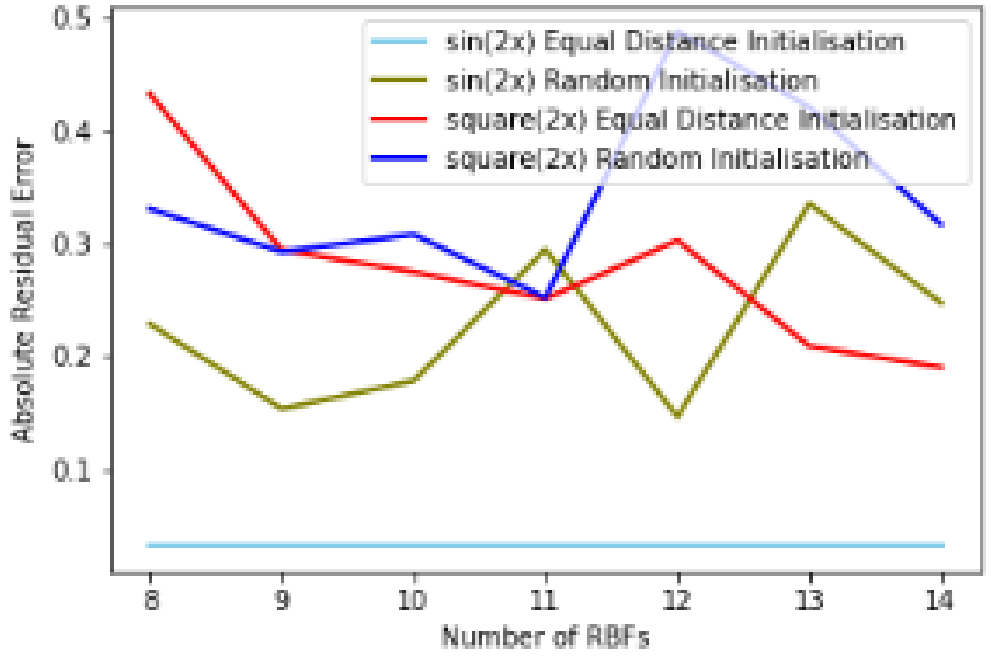
Batch RBFs and Variance





Figur 4: Variance vs Error

RBF initialisations



Figur 5: Investigating RBF Initialisations

competitive learning

	pure sin(2x)	noisy sin(2x)
evenly distributed RBF	0.0555	0.2925
evenly distributed RBF + CL	0.0547	0.2919

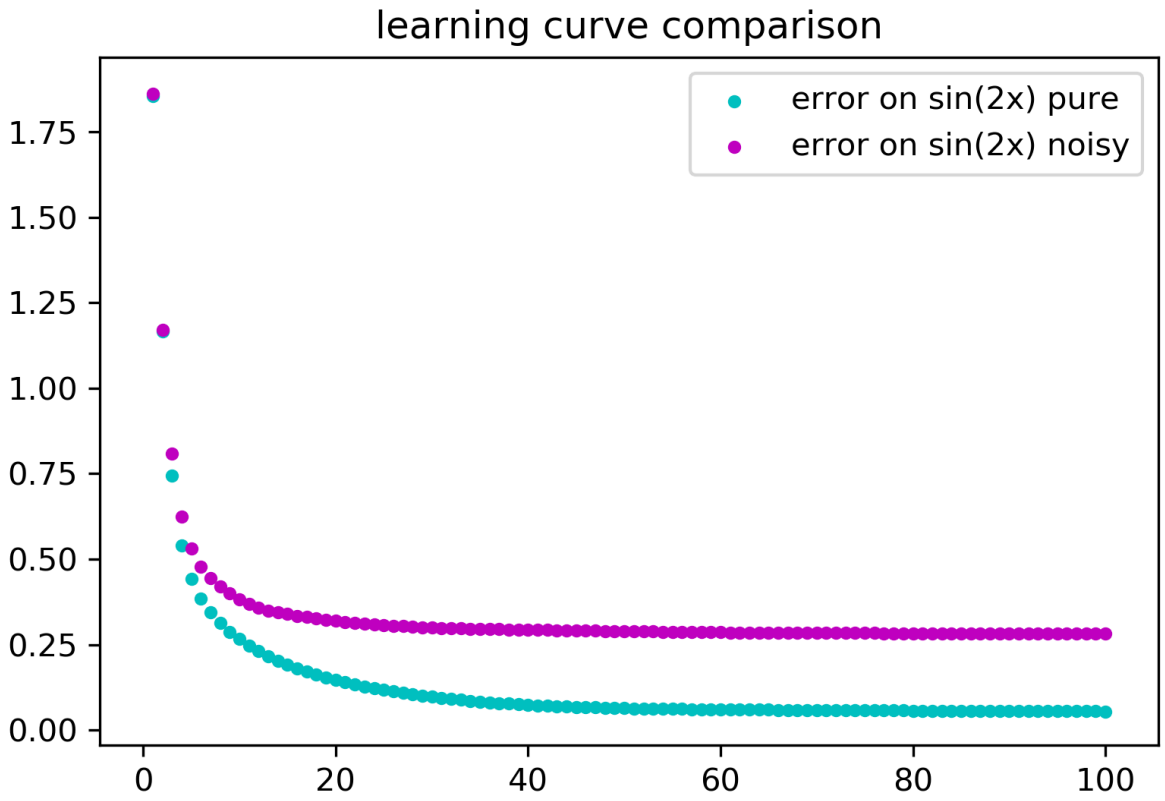
Tabell 3: a comparison between using and not using competitive learning on pure function sin(2x) and noisy function sin(2x). (CL means competitive learning. learning rate = 0.01 number of RBF = 13 var of RBF =0.4)

avoiding dead units

	without CL	CL with one winner	CL with all winners
absolute residual error	0.0555	0.0547	0.0536

Tabell 4: error on pure function sin(2x), in 3 different cases. (CL means competitive learning. learning rate = 0.01. number of RBF=13 var of RBF =0.4)

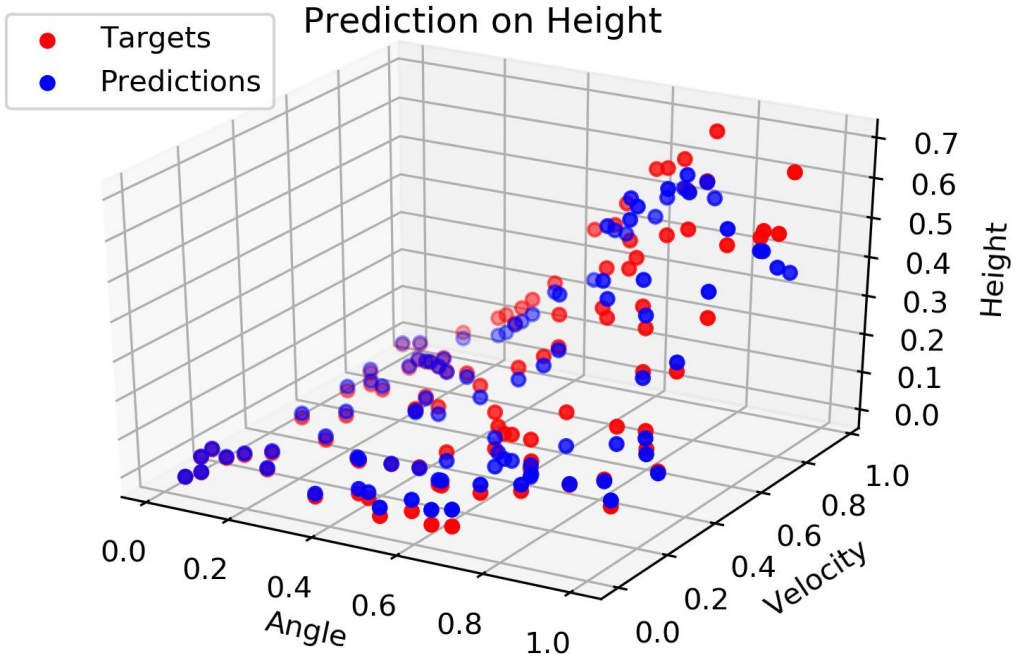
convergence of learning rate



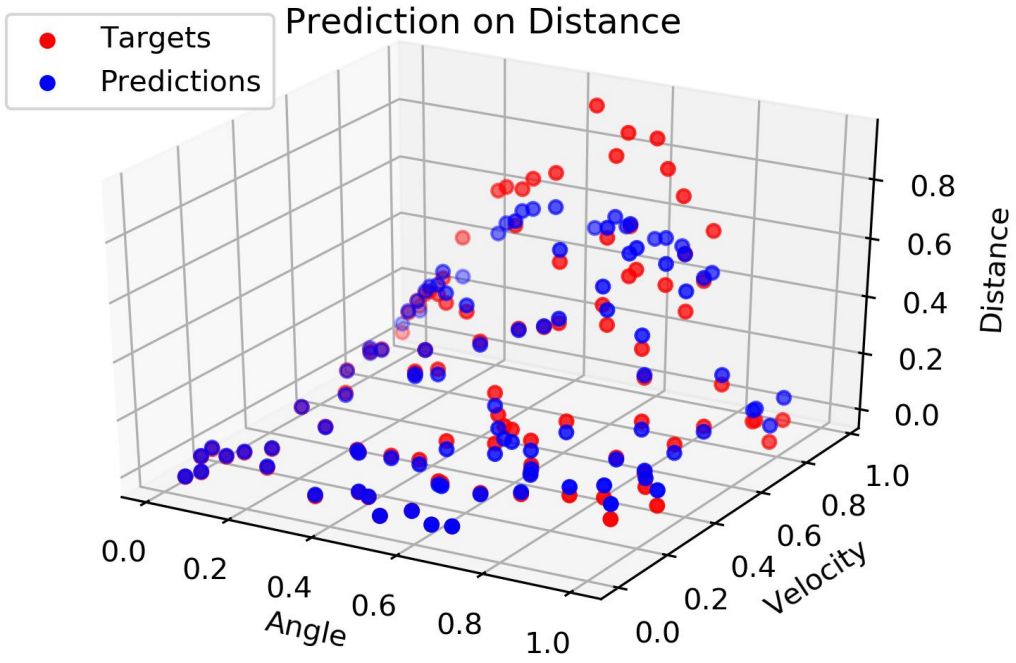
learning curve of pure and noisy sin(2x), when using competitive learning with only one winner

RBF learning on two-dimentional dataset

error of prediction: 0.0304



output: height



output: distance

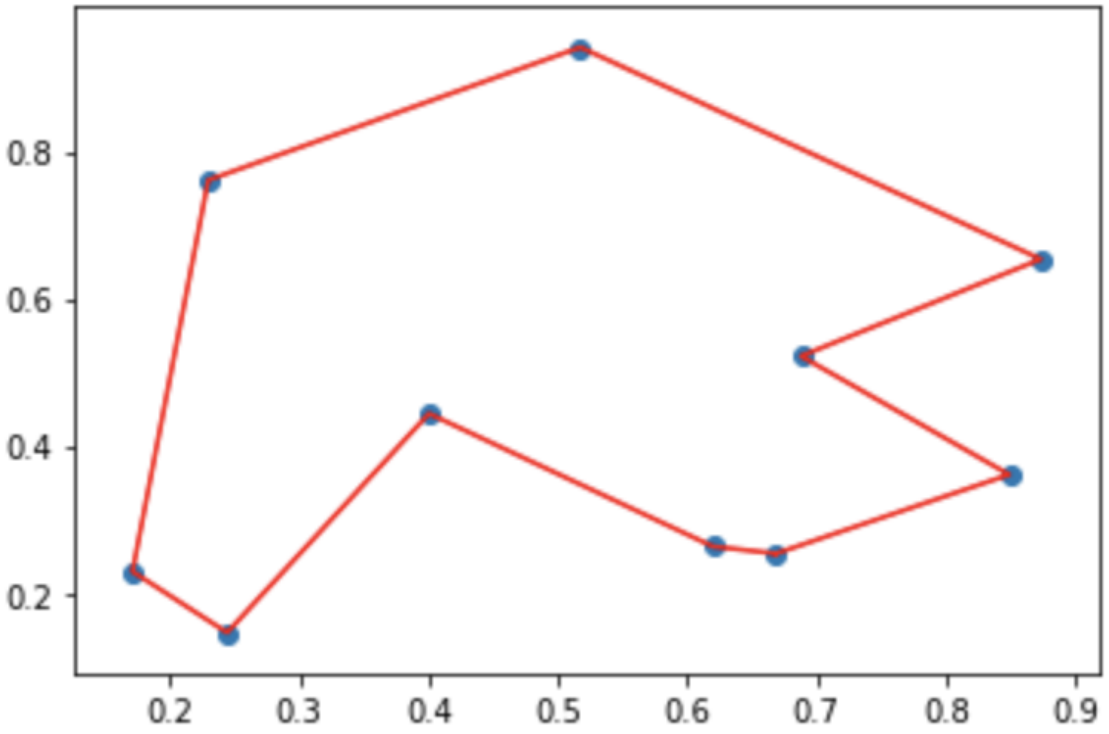
SOMS

Animal Ordering -

```
[[3 "'crocodile'"
 [3 "'seaturtle'
 [3 "'lion'"]
 [12 "'bat'"]
 [12 "'kangaroo'
 [12 "'elephant'
 [12 "'dog'"]
 [17 "'horse'"]
 [17 "'bear'"]
 [21 "'housefly'
 [21 "'dragonfly
 [21 "'moskito'"
 [21 "'butterfly
 [21 "'beetle'"]
 [21 "'grasshopp
 [61 "'rat'"]
 [68 "'pig'"]
 [68 "'antelop'"
 [68 "'ape'"]
 [69 "'pelican'"]
 [69 "'penguin'"]
 [71 "'cat'"]
 [71 "'skunk'"]
 [74 "'hyena'"]
 [83 "'giraffe'"]
 [83 "'rabbit'"]
 [83 "'camel'"]
 [84 "'ostrich'"]
 [89 "'walrus'"]
 [90 "'frog'"]
 [90 "'duck'"]
 [99 "'spider'"]]
```

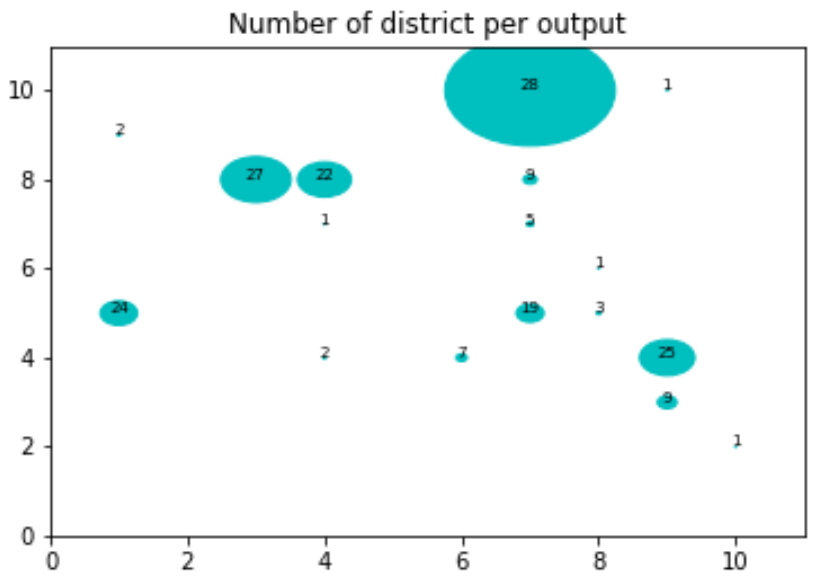
We can see that insects are grouped together. Sea turtle and crocodile are often together as well as frog and duck as they are water type. 4-legged species are often together.

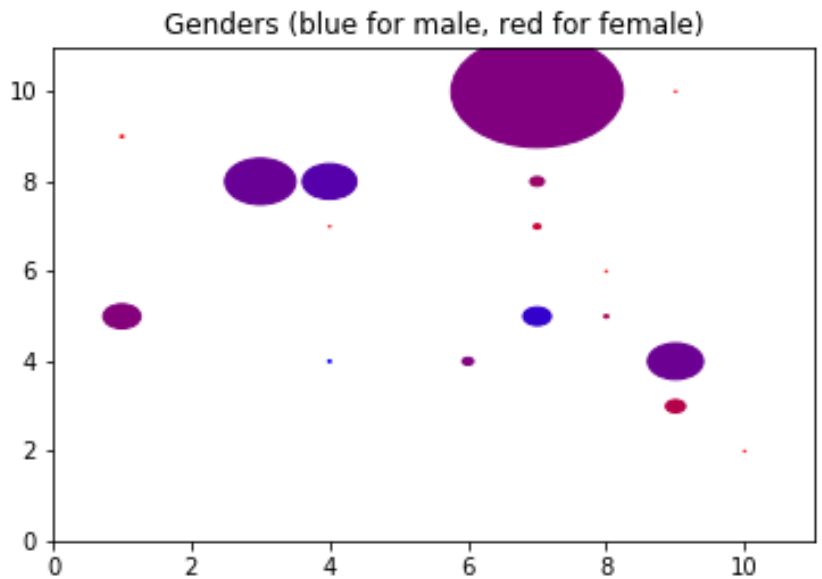
Cyclic Tour

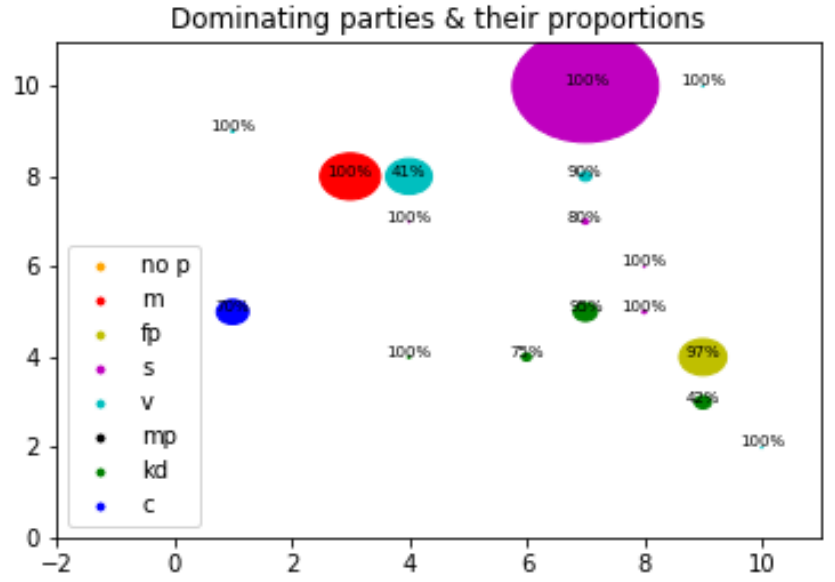


We keep on decreasing the neighbourhood after each epoch. We are able to find a good tour as shown in the figure above but sometimes, the algorithm takes a detour between the two points in the bottom left edge. This might be due to very small neighbourhood or less training.

Clustering with SOMS







Sex and district doesn’t decide the voting patterns. Party on the other side affects voting majorly.