Artificial Neural Networks - Assignment 3
Group 21

Fernando Garcia, Lucas Q. Gongora and Maria Bjelikj

February, 2020

Convergence and Attractors

Given the following initial patterns:

x1d =	-1	-1	1	-1	1	-1	-1	1
x2d =	-1	-1	-1	-1	-1	1	-1	-1
x3d =	-1	1	1	-1	-1	1	-1	1

- The network converged after two iterations
- All 3 patterns are attractors - total of 14
- 1 bit or 2 bit distortion: patterns converge to the attractors
- More than half distorted: network can't recall

Sequential Update

The first three patterns are stable

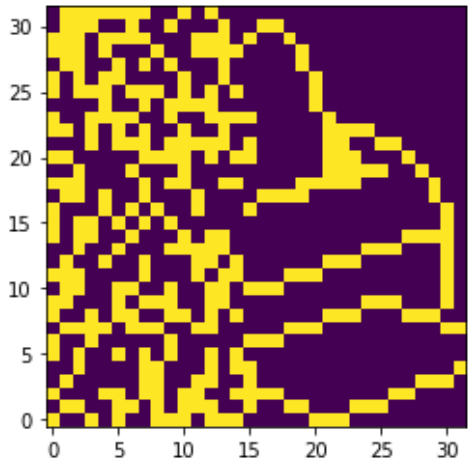


Figure: Degraded pattern **p10** of the original pattern **p1** – noise/degradation in half the image.

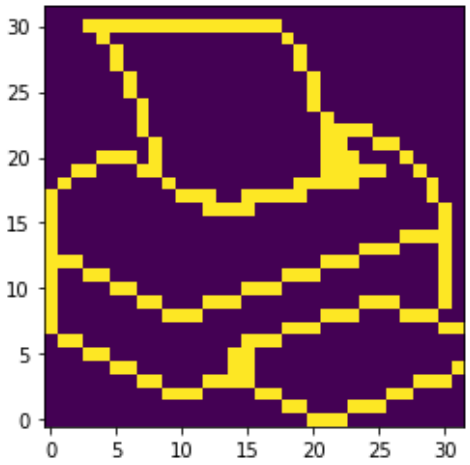


Figure: Degraded pattern **p10** after sequential update, converged to stable pattern **p1**.

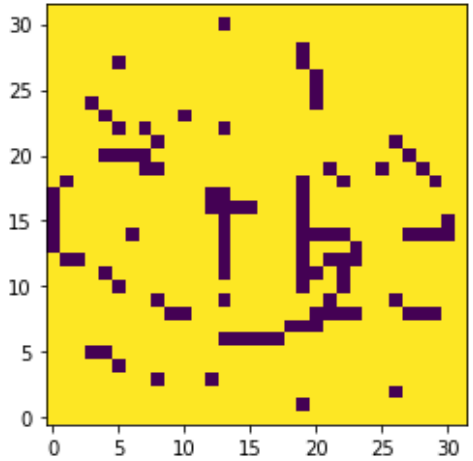


Figure: Recalled pattern **p11** – didn't converge to any stable pattern, and is instead spurious.

Random Sequential Update

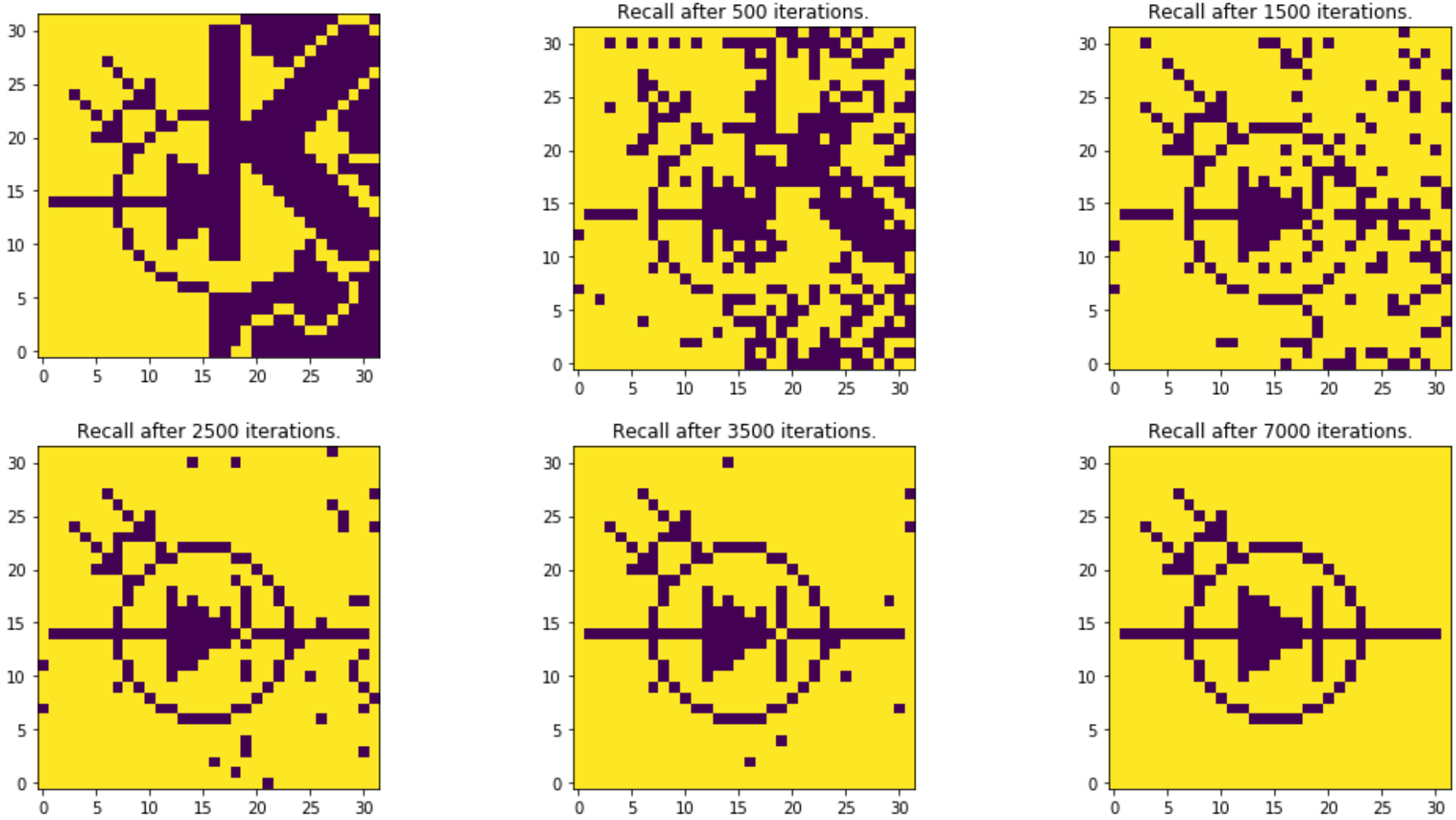
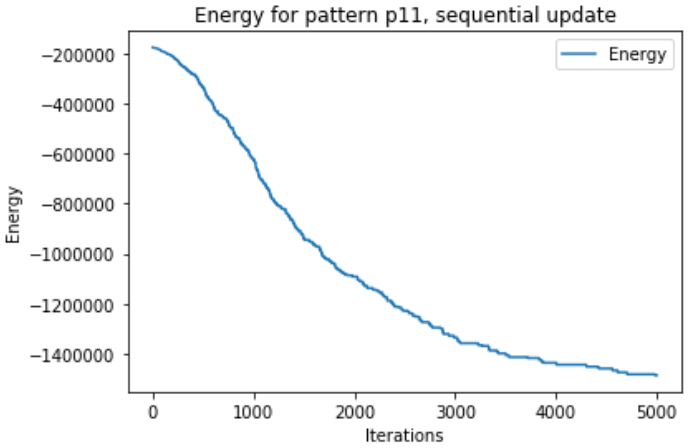
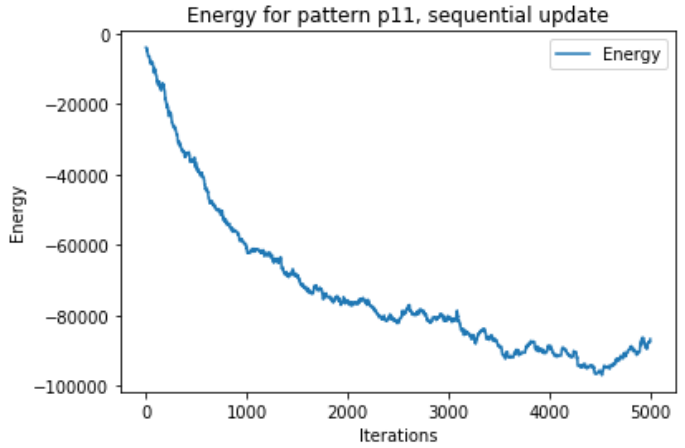
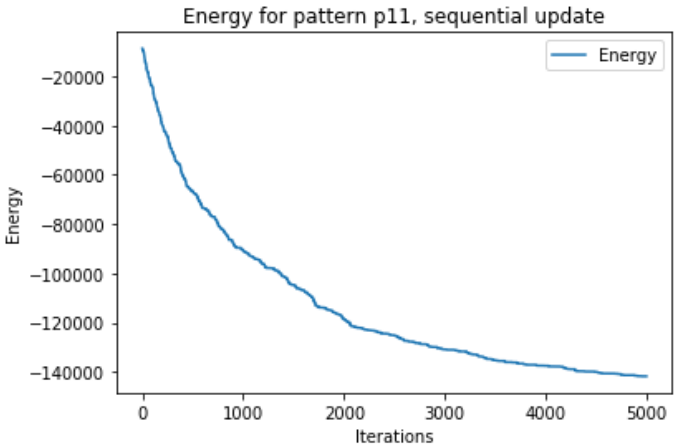


Figure: Pattern **p11** converging to learned pattern **p3** with sequential update

Energy







Pattern	Energy
p1	-1470864.0
p2	-1395344.0
p3	-1494272.0
p10	-1631244.0
p11	-1395344.0

Distortion Resistance

Images data

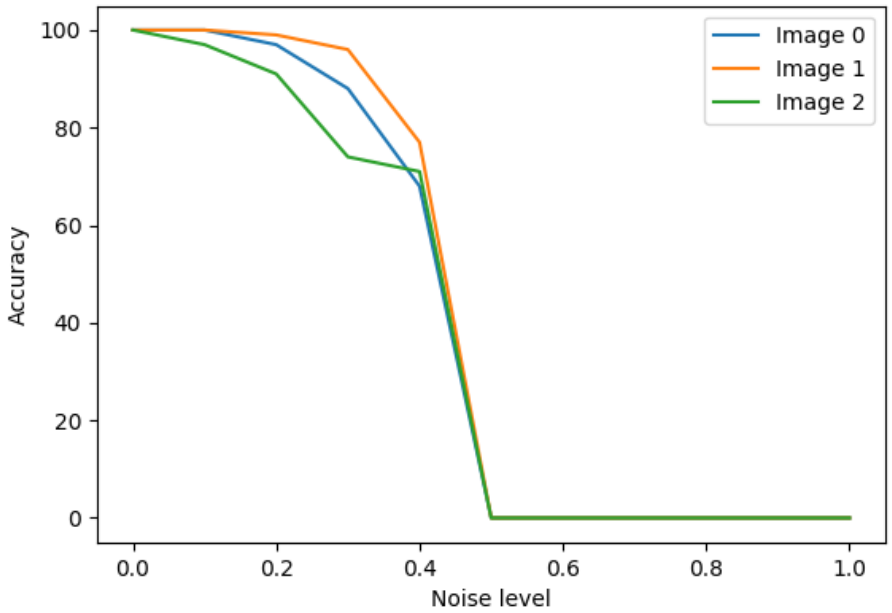


Figure: Plot of image 0 recovered for different noise percentage

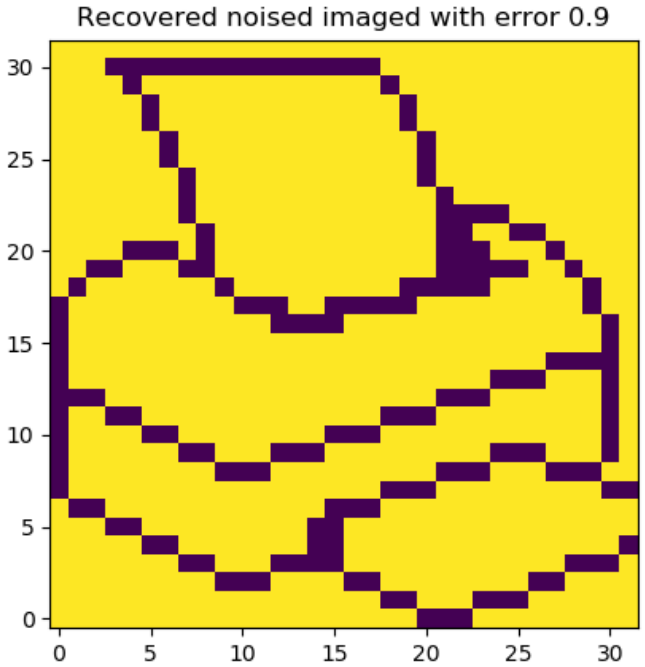


Figure: Image 0 recovered with 90% noise

Capacity

Random Patterns

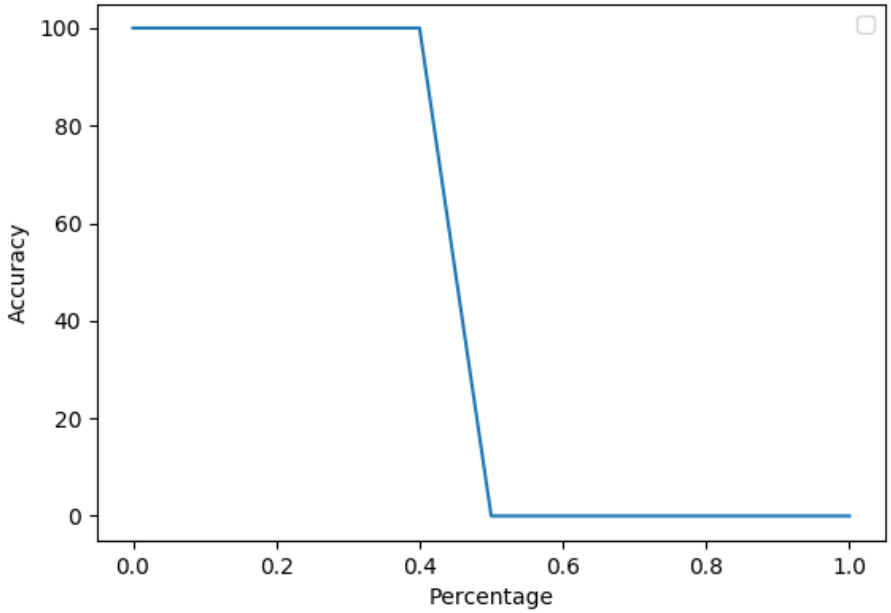


Figure: Plot of random patterns recovered for different noise percentage with 4 patterns train

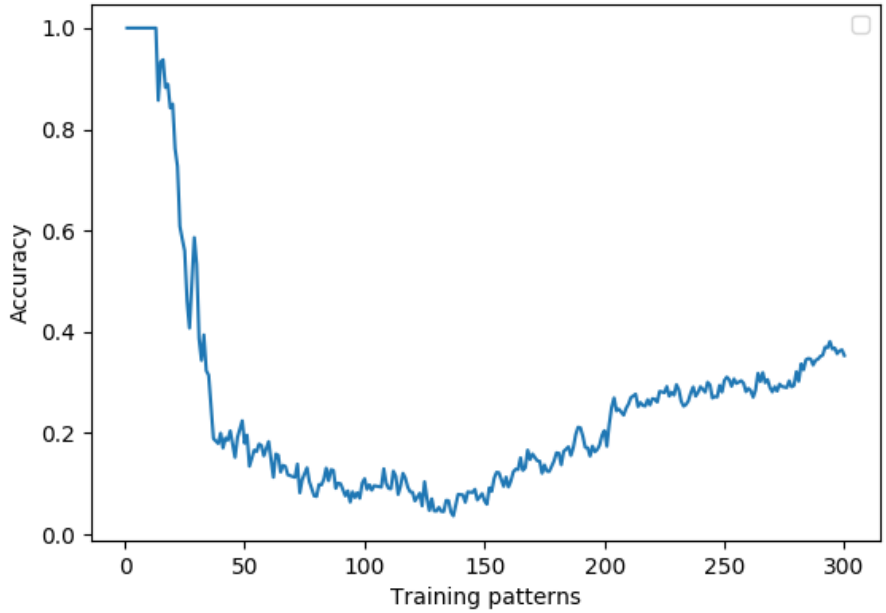


Figure: Plot of random patterns recovered for different number of patterns

Capacity

Random Patterns with noise

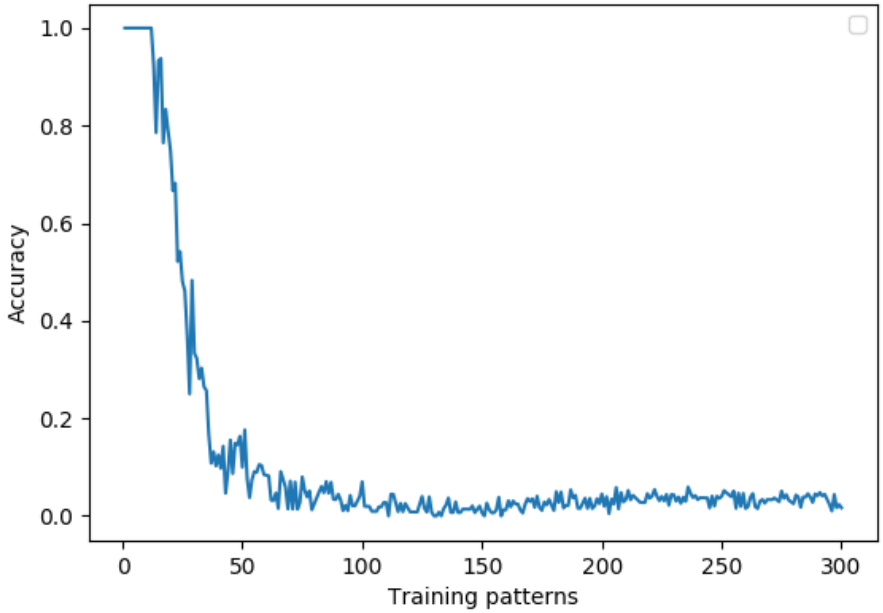


Figure: Plot of random patterns recovered for different number of patterns with 1% noise

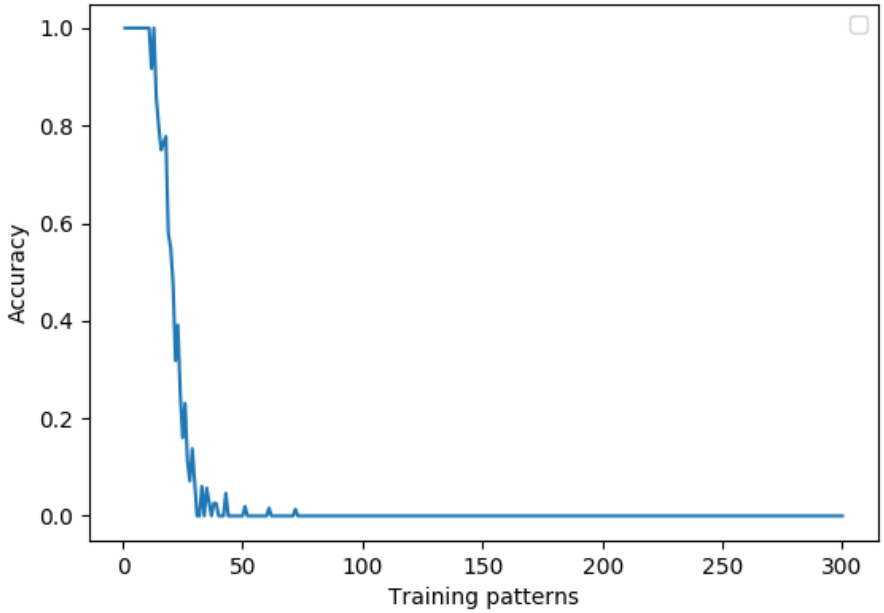


Figure: Plot of random patterns recovered for different number of patterns with 10% noise

Capacity

Random Patterns Diagonal 0

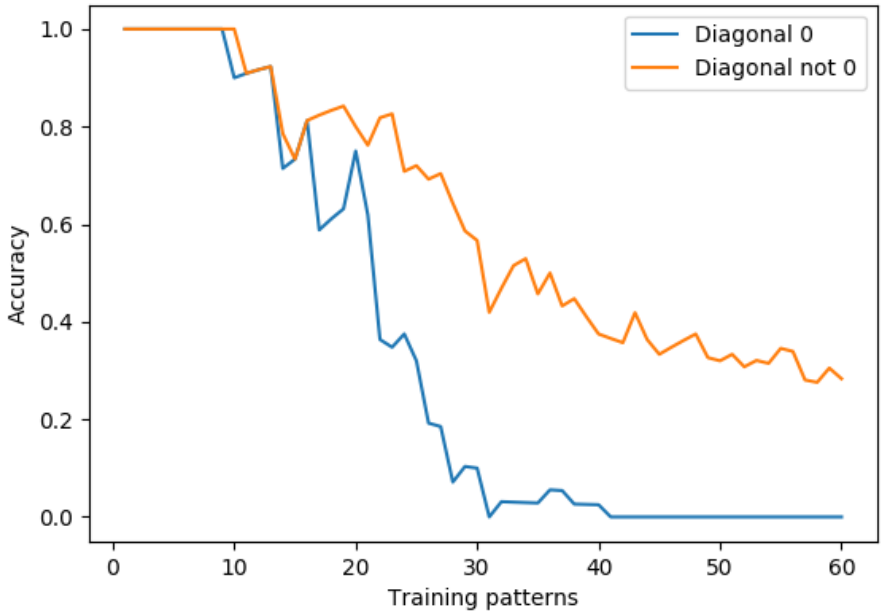


Figure: Plot of random patterns recovered for different number of patterns with main diagonal equal and different from 0.

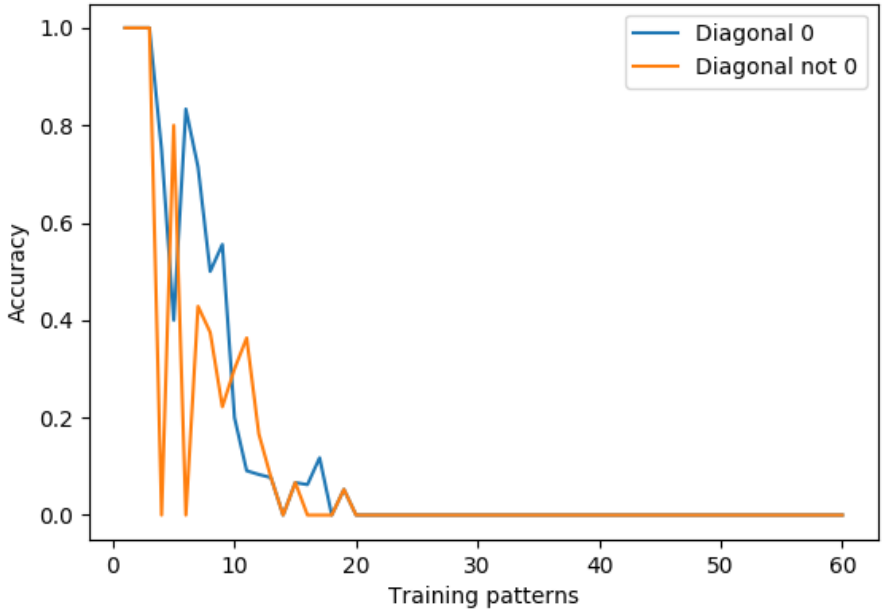
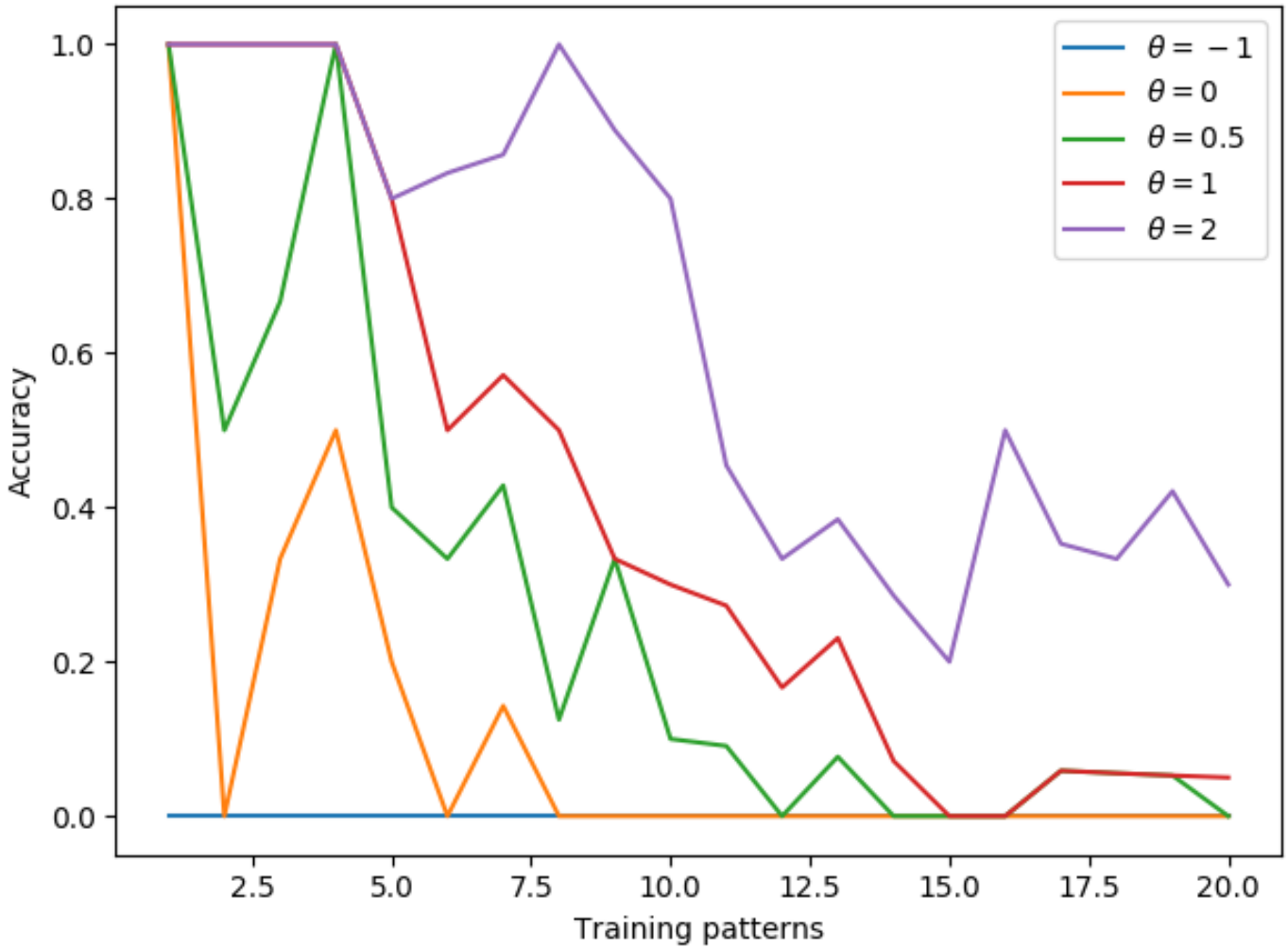


Figure: Plot of random patterns recovered for different number of patterns with main diagonal equal and different from 0 and 40% noise.

Sparse Patterns



Sparse Patterns

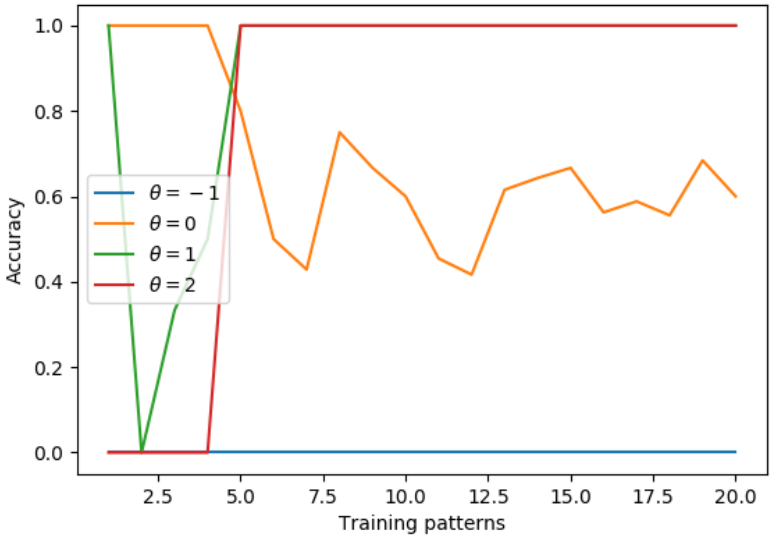


Figure: Plot of random patterns recovered for $\theta = 1$ and $\rho = 0.01$

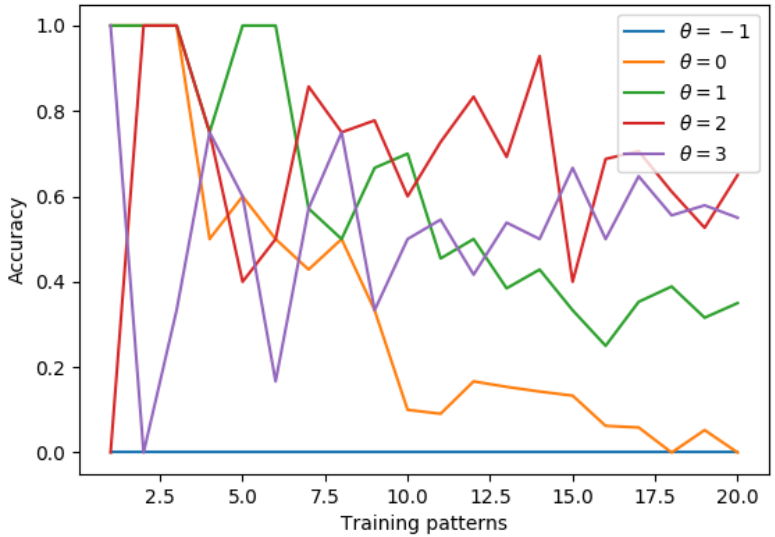


Figure: Plot of random patterns recovered for $\theta = 1$ and $\rho = 0.05$