ANN Lab 3
Hopfield Network

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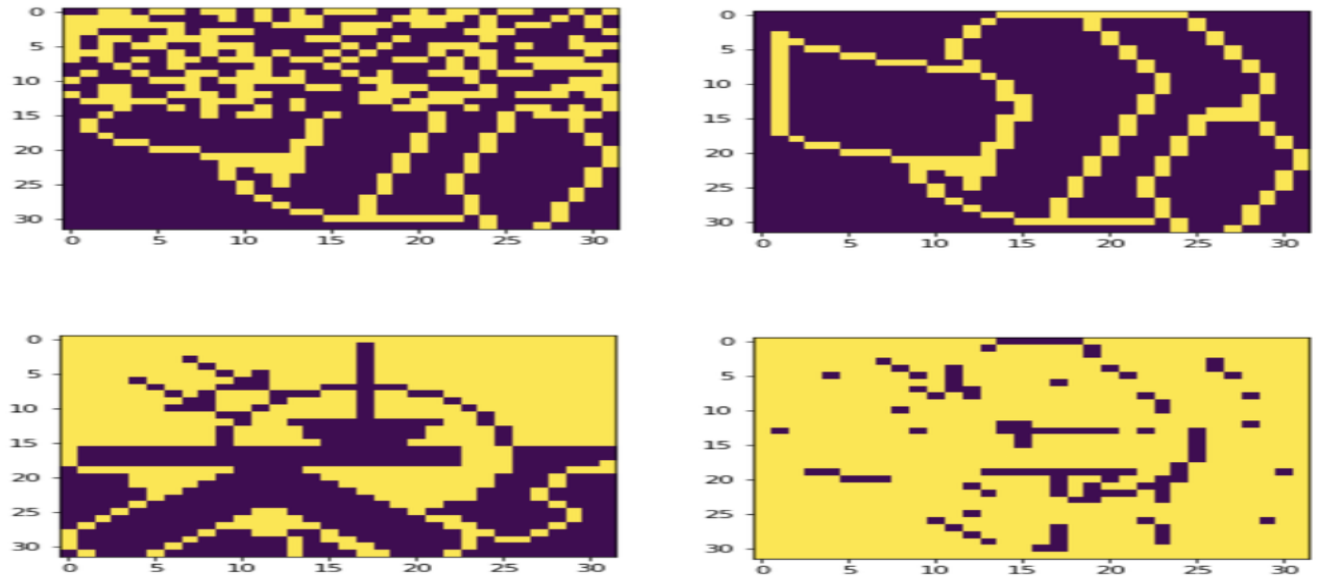
Convergence and Attractors

- The network was able to store all the patterns successfully.
- No, with Little model update, x2d didn’t converge to the stored pattern. Only x1d and x3d were able to converge to their stored patterns x1 and x3.
- By trying out every possible combination of input patterns, we found that they converged to a total of 14 attractors.
- When we make the distorted patterns dissimilar to the stored ones by more than 50 percent, the patterns don’t converge to the given attractors anymore, they converge to different patterns.

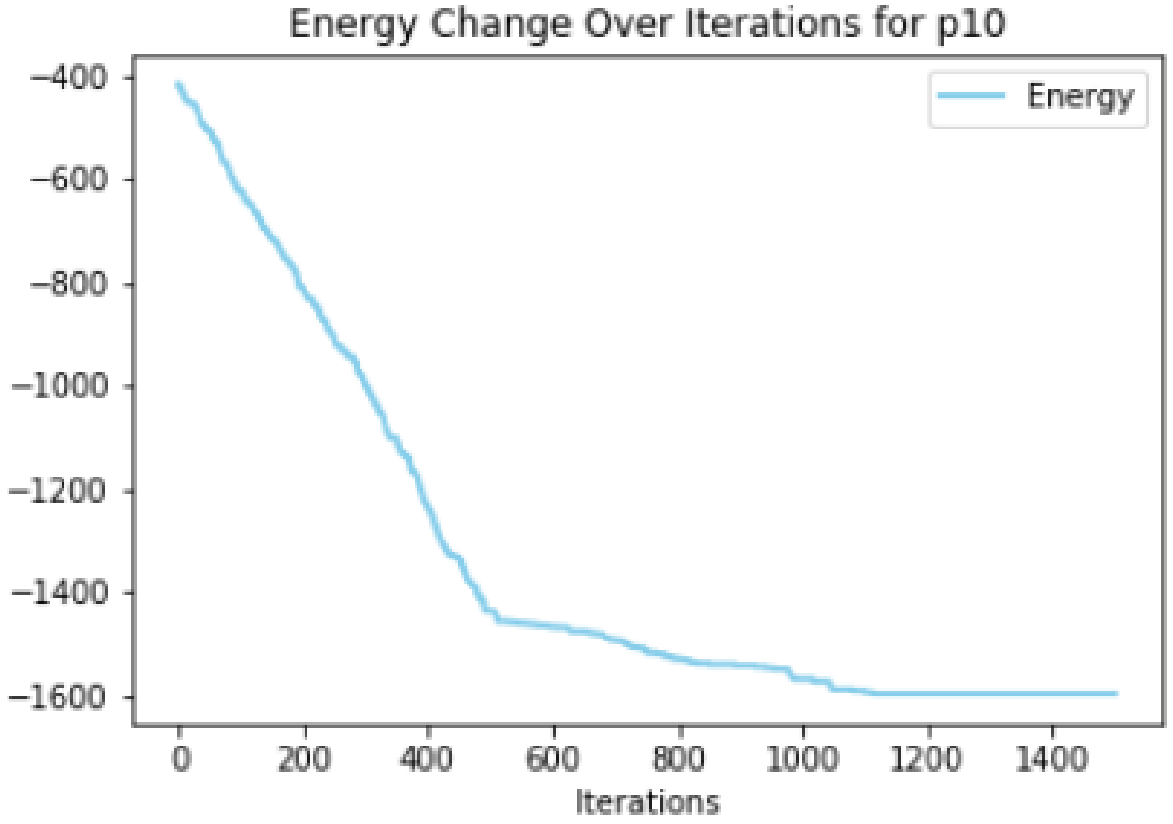
Sequential Update

- In batch mode, the network was able to retrieve the complete p1 pattern from p10 but nothing from p11.
- In sequential mode, the network was able to retrieve p1 from p10 and was able to retrieve p3 from p11, but not p2 from p11

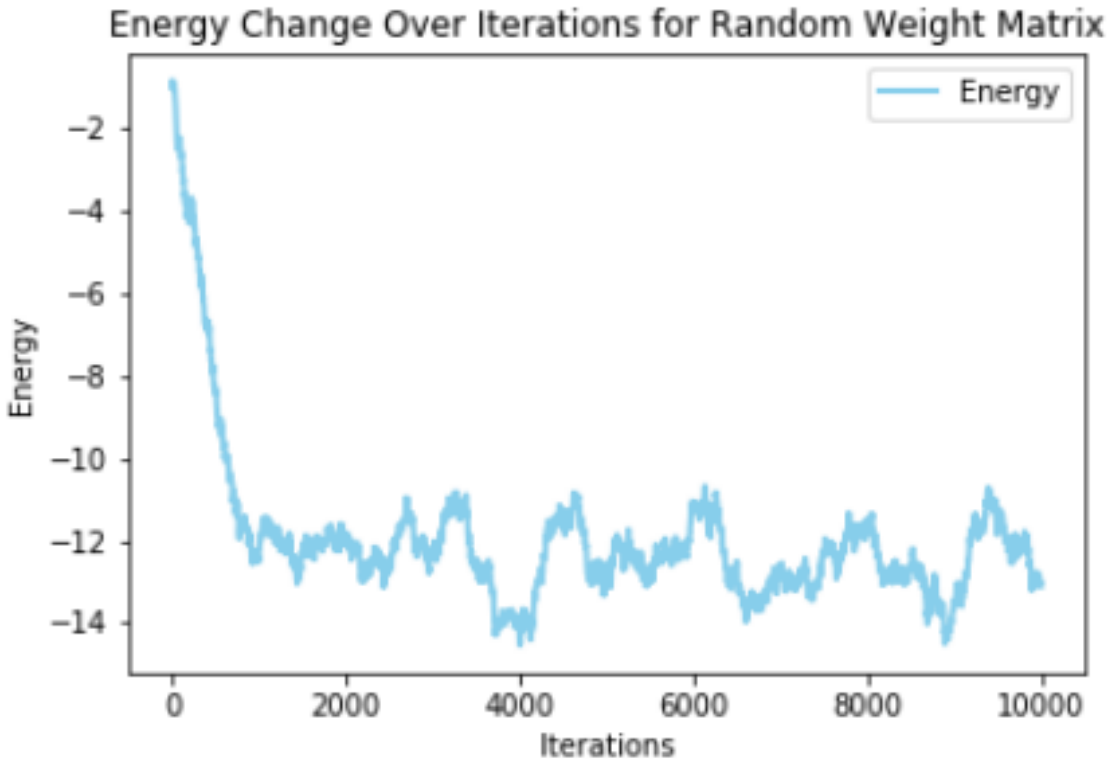


Energy

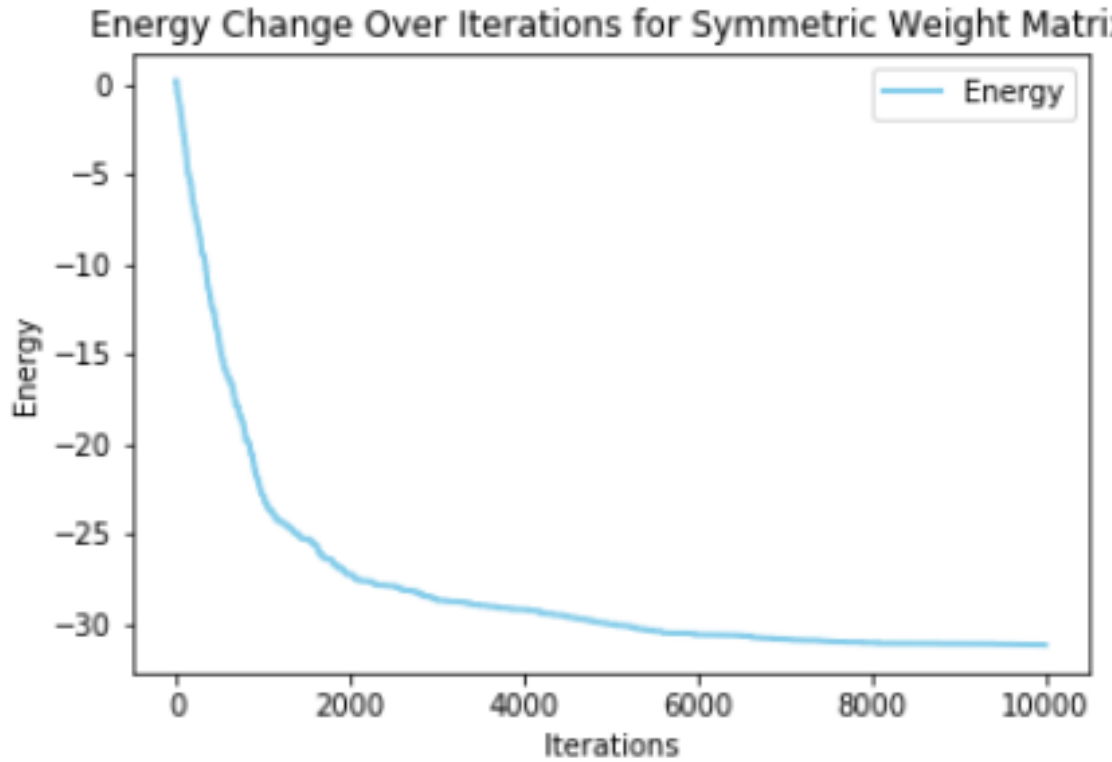
Image	Type	Energy
p1	Attractor	-1439.390625
p2	Attractor	-1365.640625
p3	Attractor	-1462.25
p10	Distorted	-1596.011718
p11	Distorted	-173.5



Figur 2: p10 Energy vs Iterations

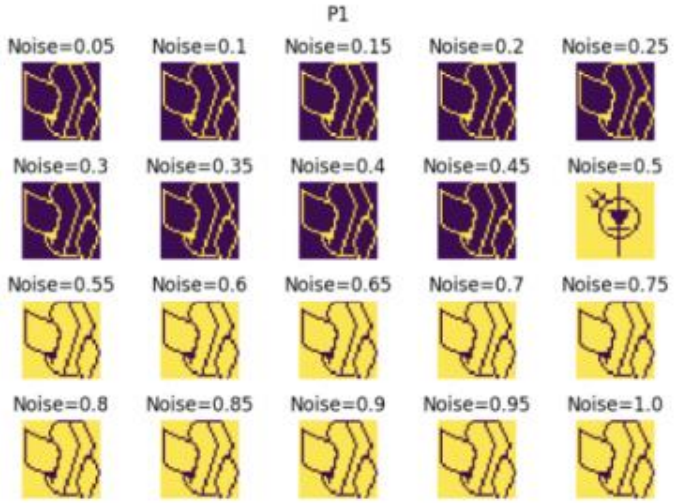


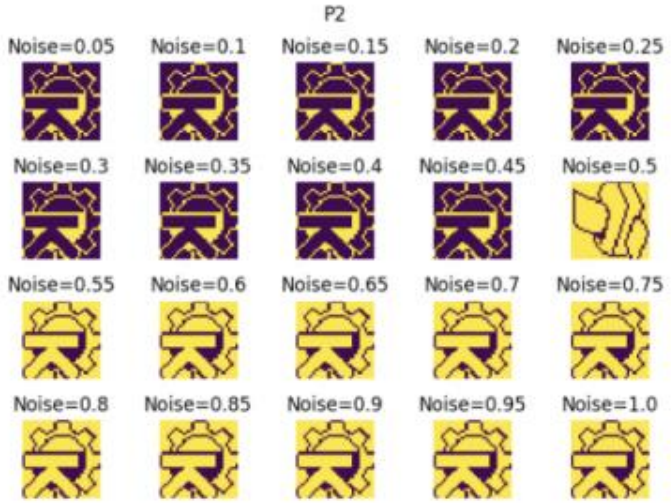
Figur 3: Random Weights

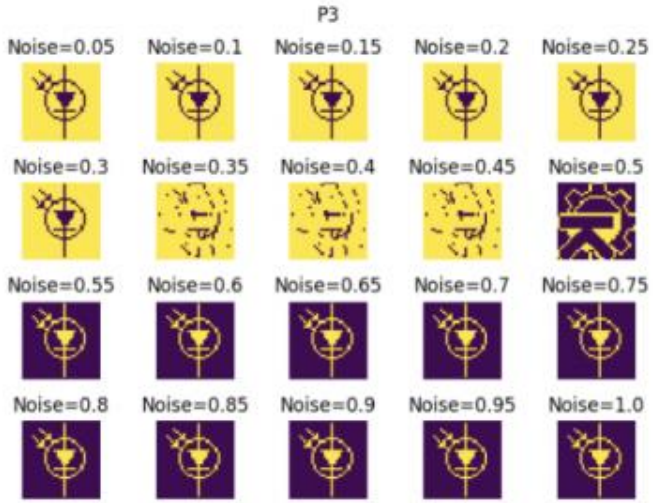


Figur 4: Symmetric Weights

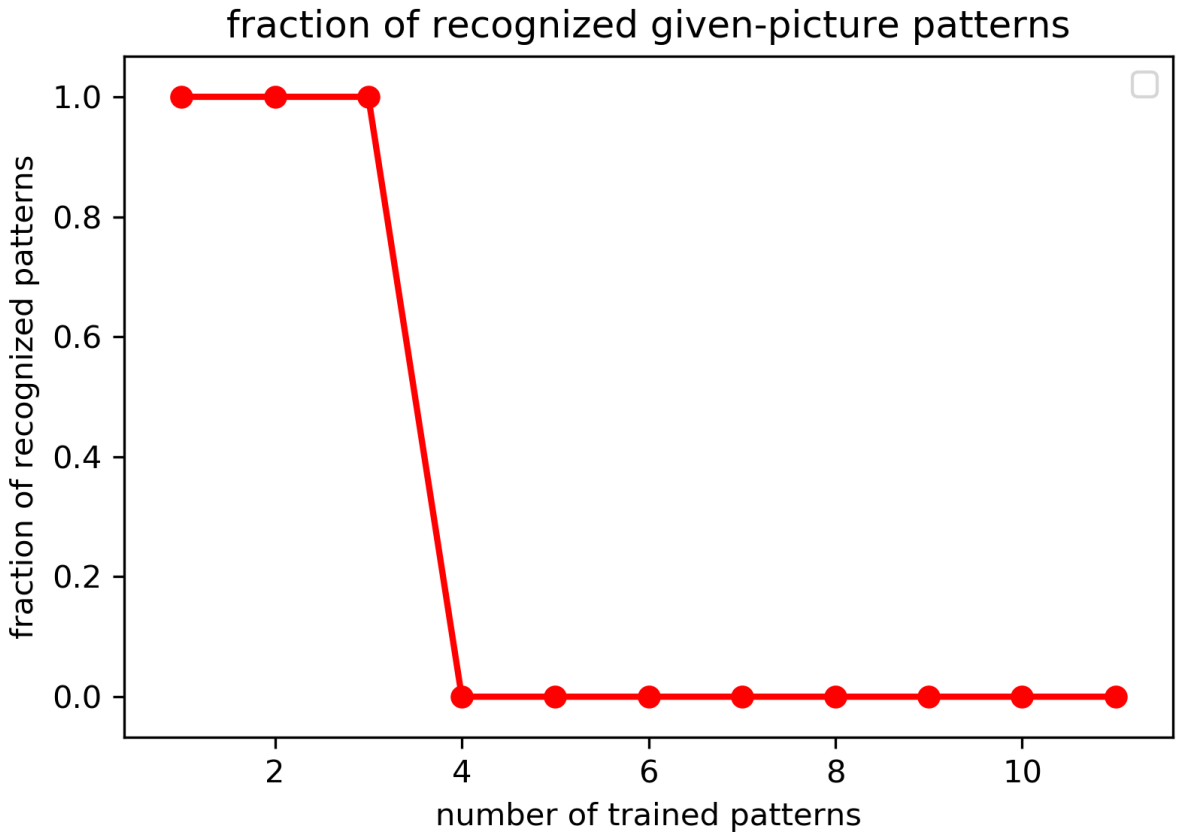
Distortion Resistance



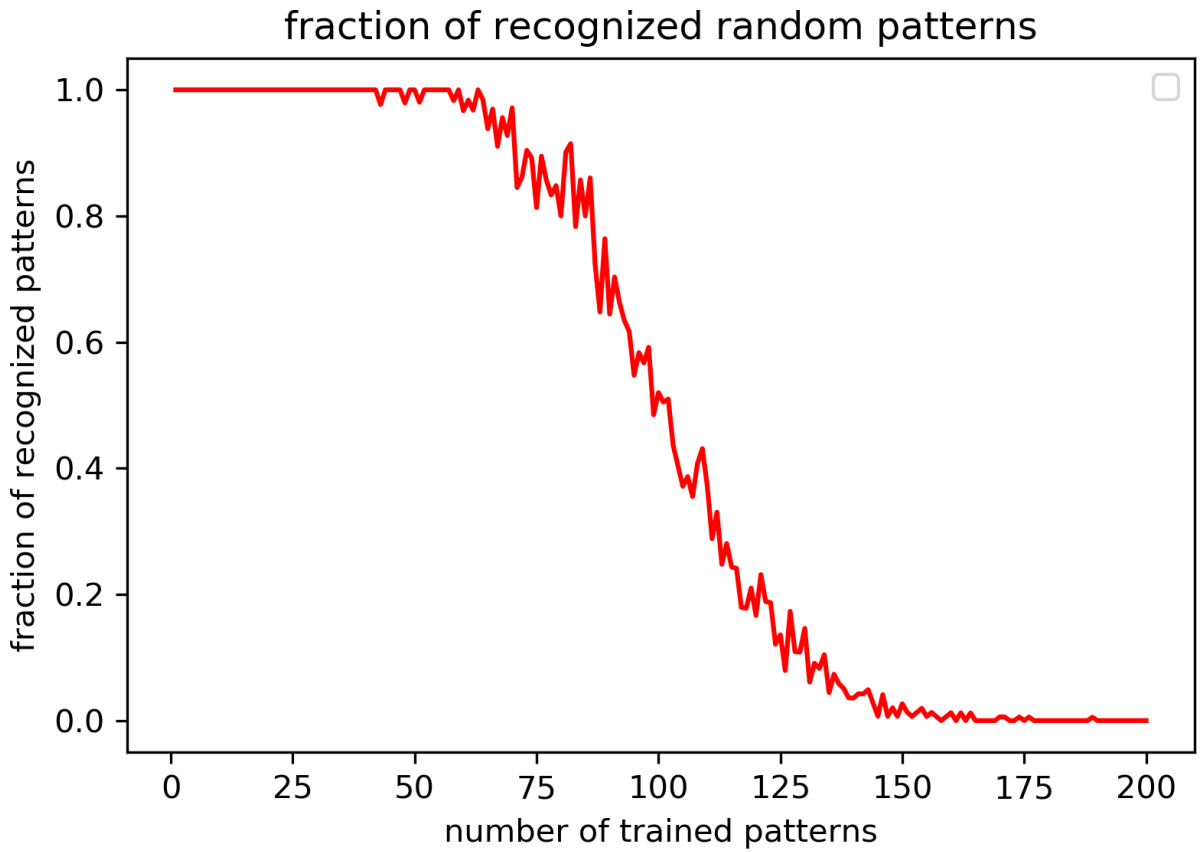




Capacity

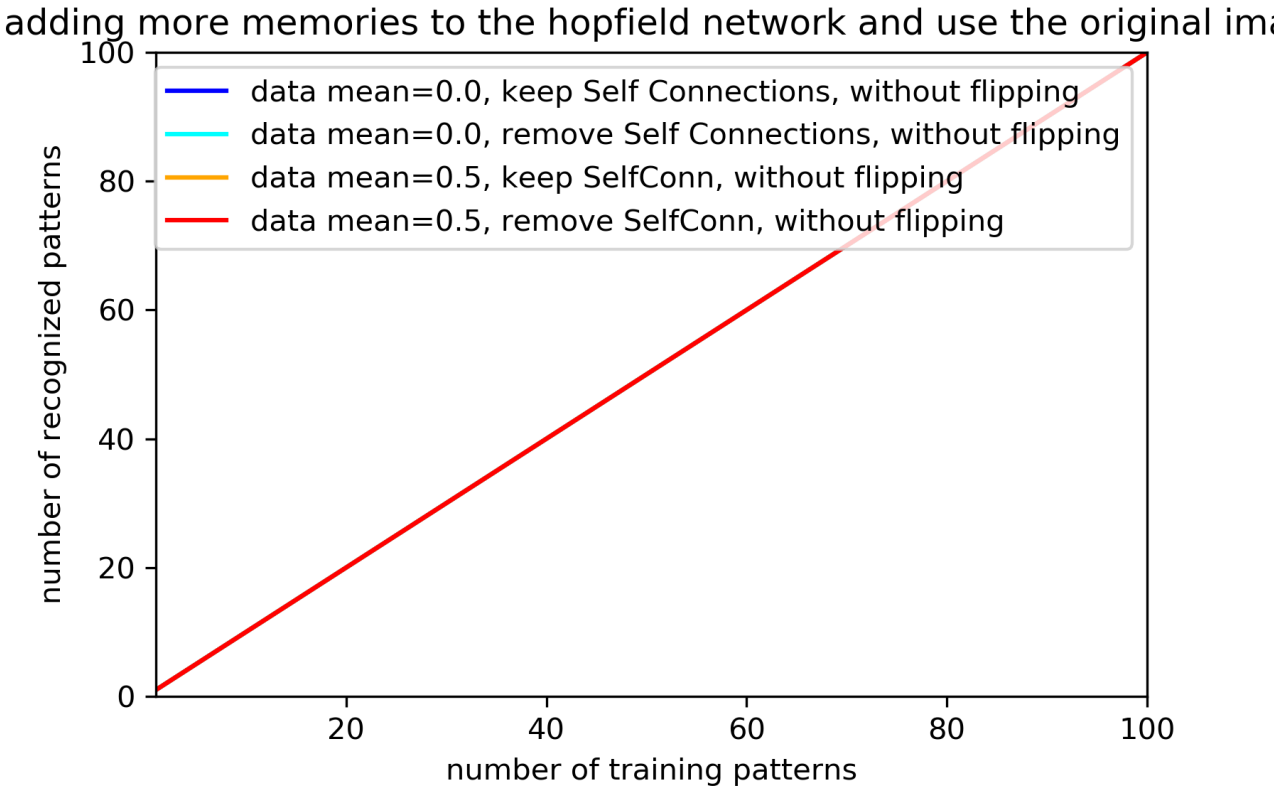


given patterns

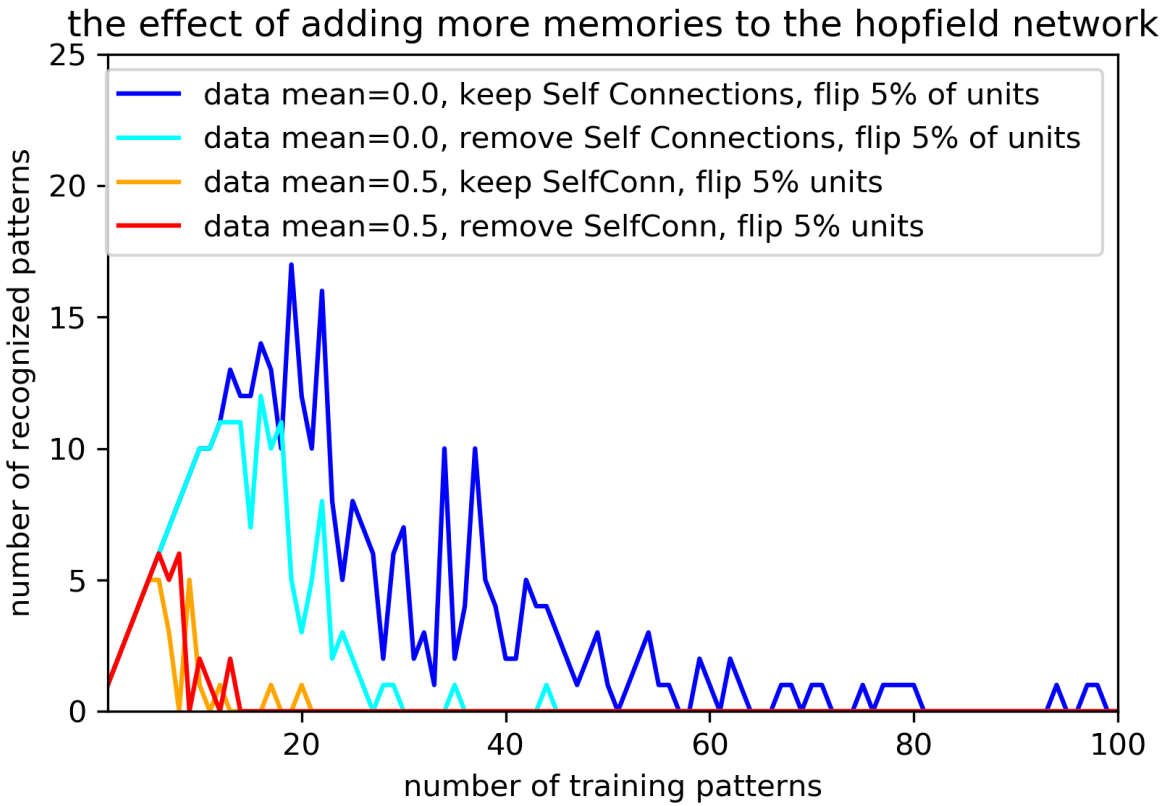


random patterns

Capacity



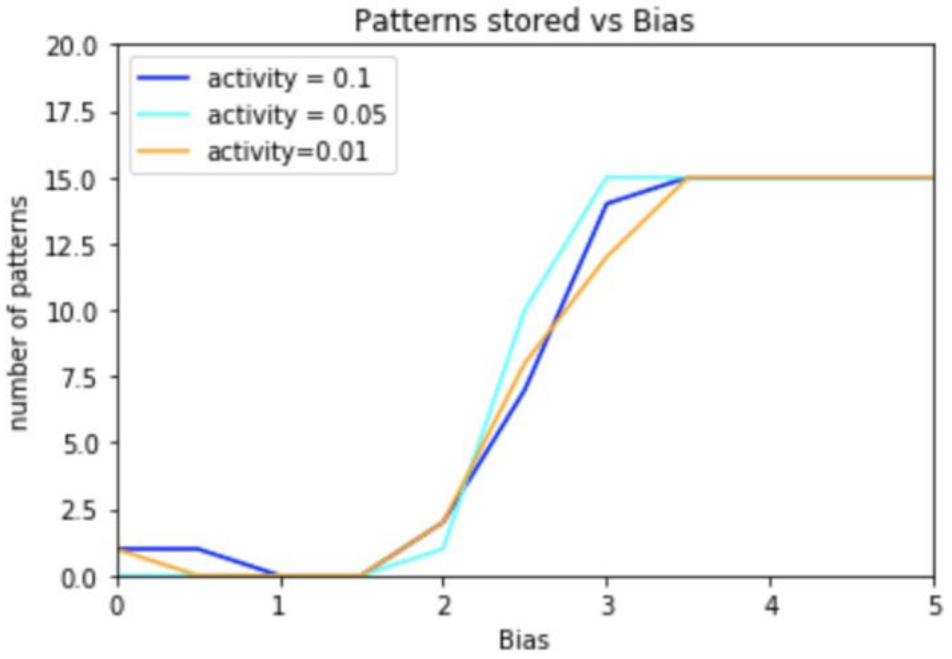
recover patterns from undistorted arrays



recover patterns from distorted arrays
(5 percent of units are flipped)

Sparse Patterns

- The highest number of patterns that can be stored (15) can be seen at a bias of around 3.4 for each activity level.



Figur 10: Capacity vs Activity vs Bias