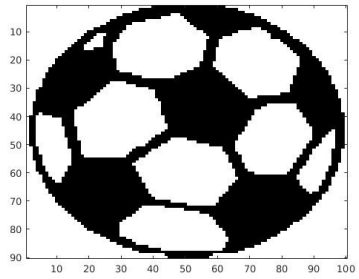
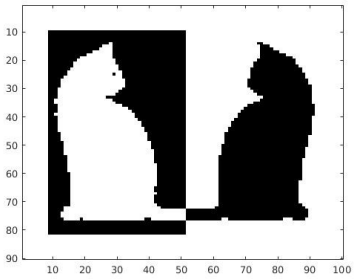
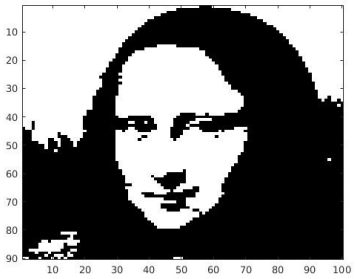
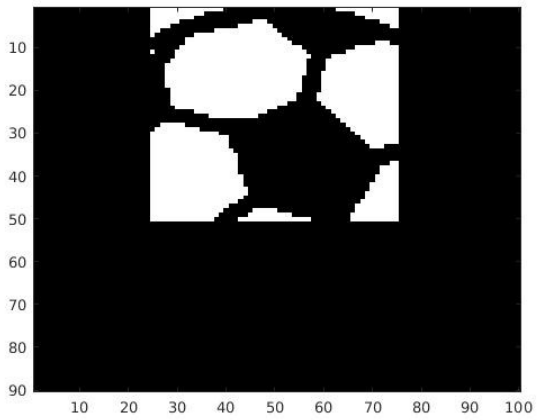
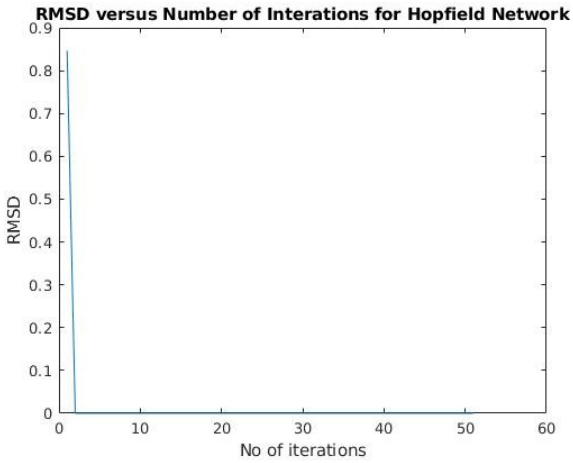
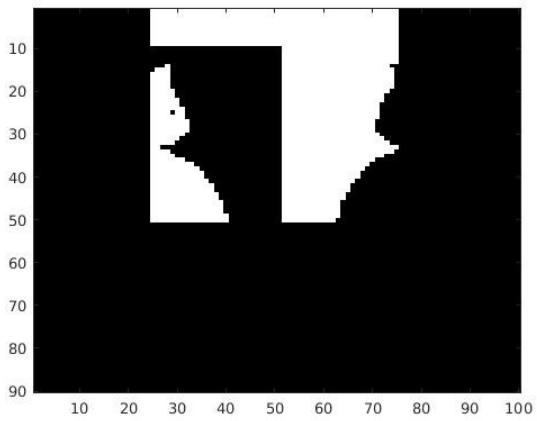
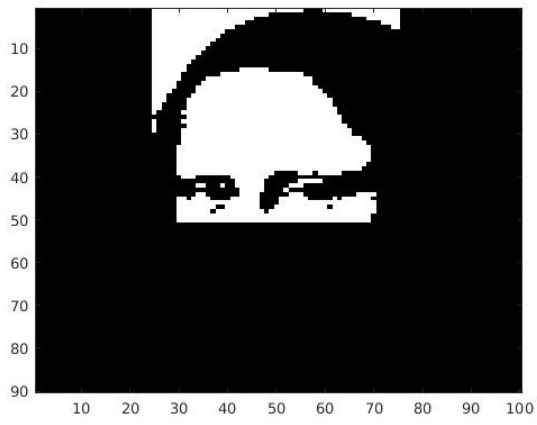
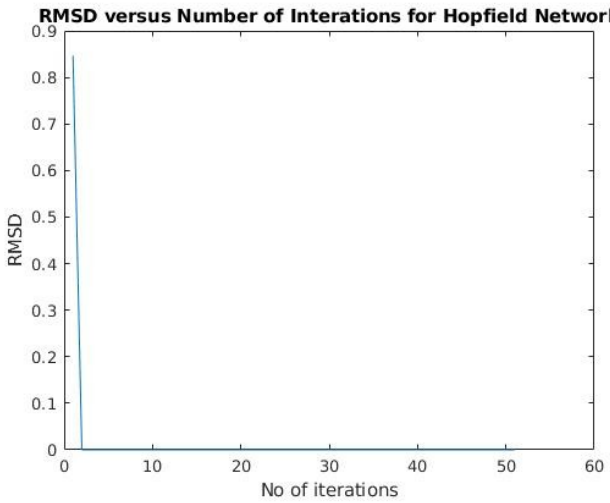
Assignment – Hopfield Network – Computational Neuroscience

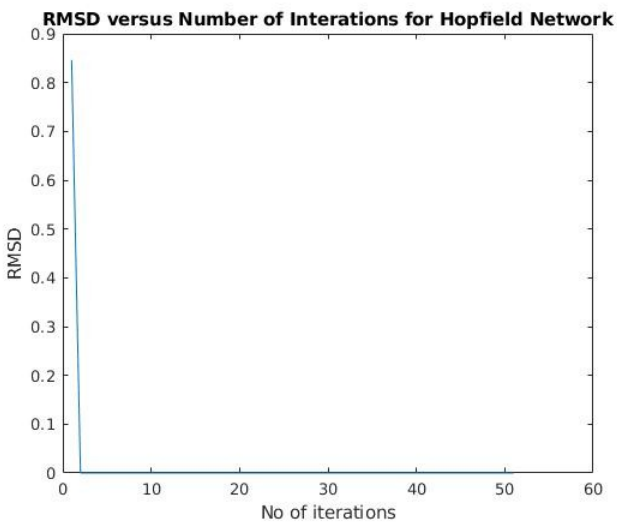
1. The three binary text files are visualized as seen below		
		
ball.txt	cat.txt	mona.txt

2. The patch used as a cue to retrieve the rest of the image is seen below from a neural network trained on the image of the ball; the image was successfully retrieved in one step, as can be seen from the RMSD plot.	
	

3. The patches used as cues for retrieving the cats and the Mona Lisa image are shown below. These two images, along with the patch image of the ball, are used to retrieve the images from a neural network trained on all three patterns, with weight distortion percentages of 0%, 25%, 50% and 80%.	
	

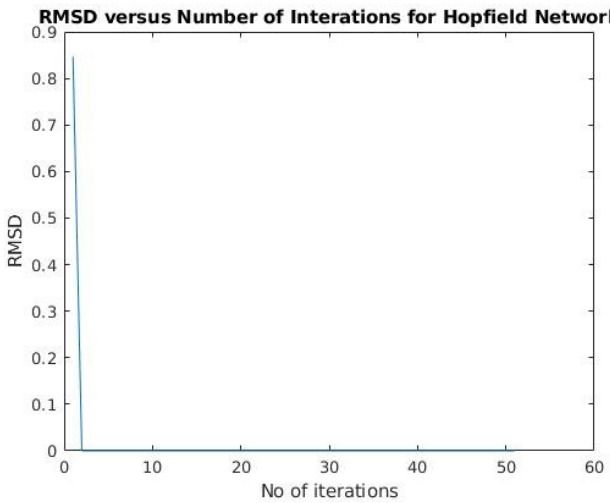
Ball	
0%	25%

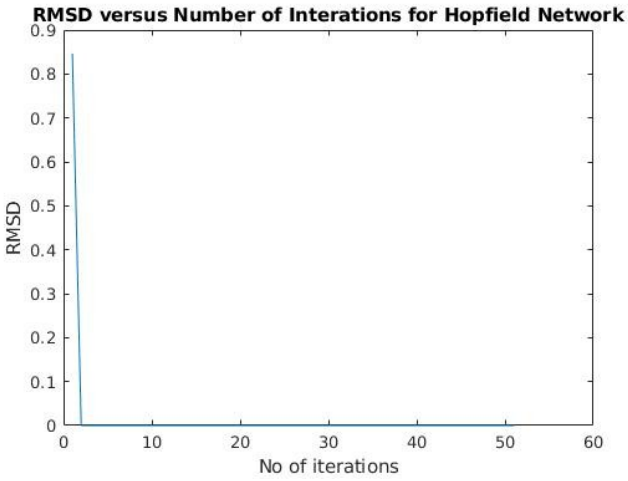

RMSD versus Number of Interations for Hopfield Network
RMSD
No of iterations
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
10
20
30
40
50
60

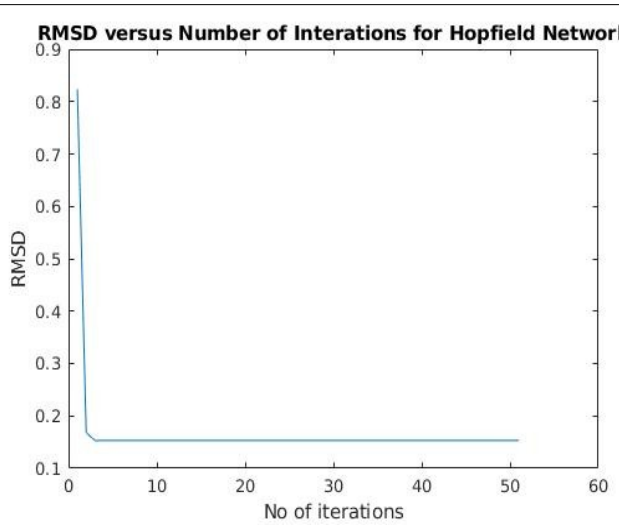
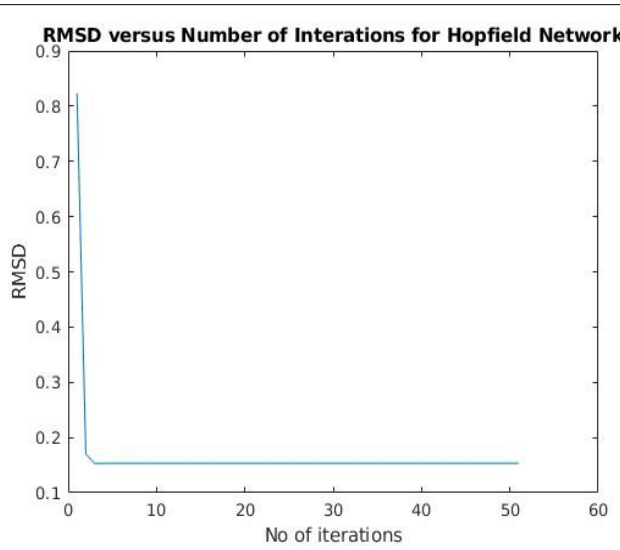
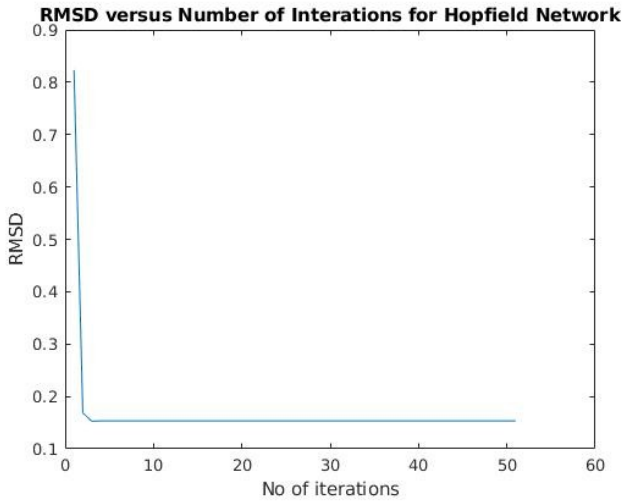
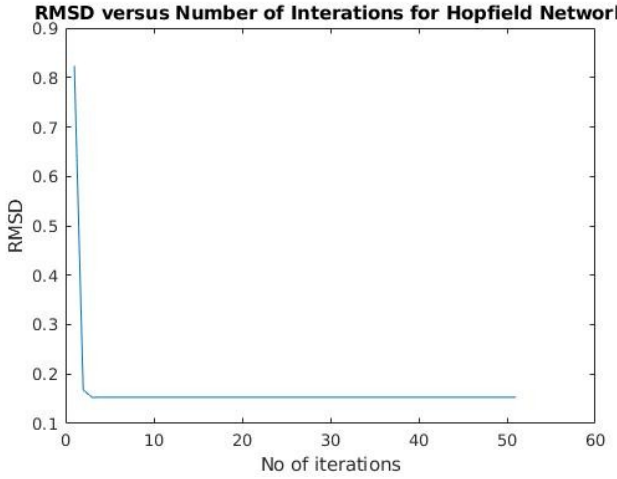

RMSD versus Number of Interations for Hopfield Network
RMSD
No of iterations
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
10
20
30
40
50
60

50%

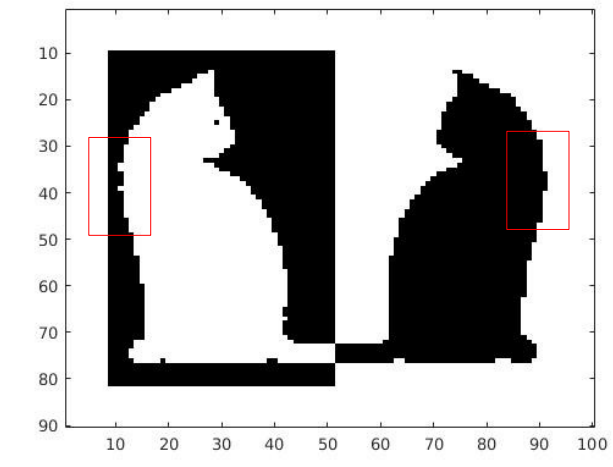
80%

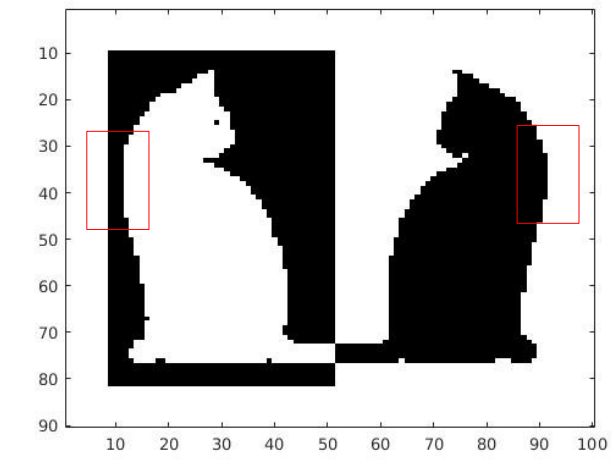

RMSD versus Number of Interations for Hopfield Network
RMSD
No of iterations
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
10
20
30
40
50
60

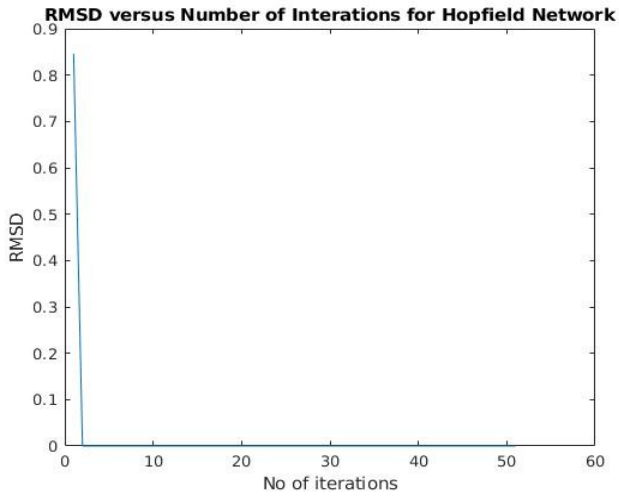
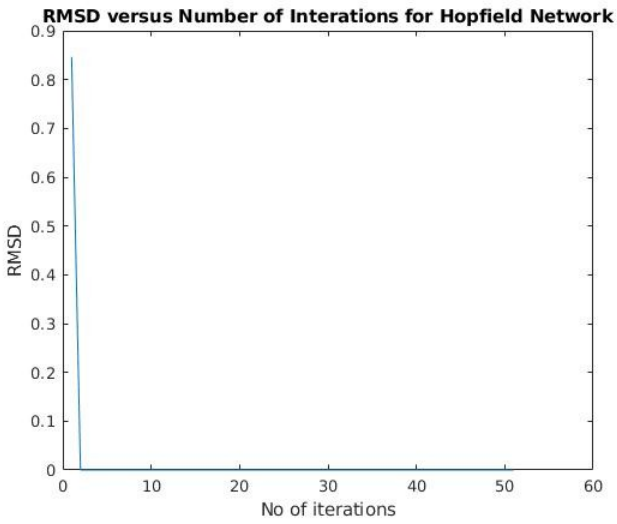
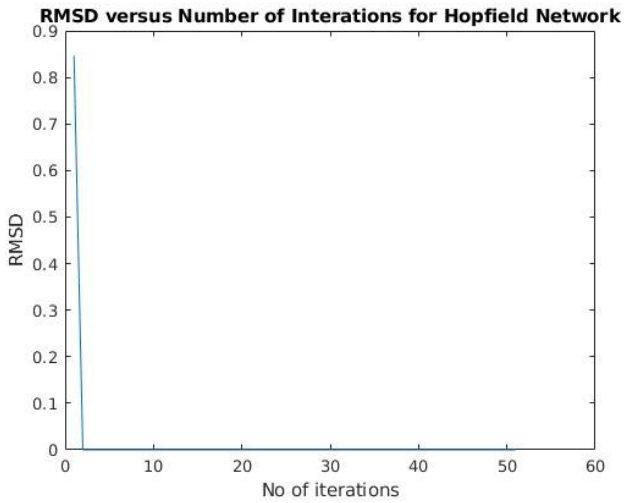
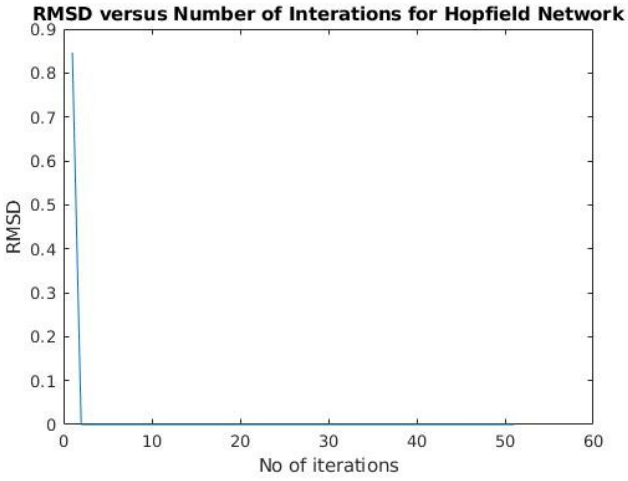

RMSD versus Number of Interations for Hopfield Network
RMSD
No of iterations
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
0
10
20
30
40
50
60

Cat	
0%	25%
	
50%	80%
	

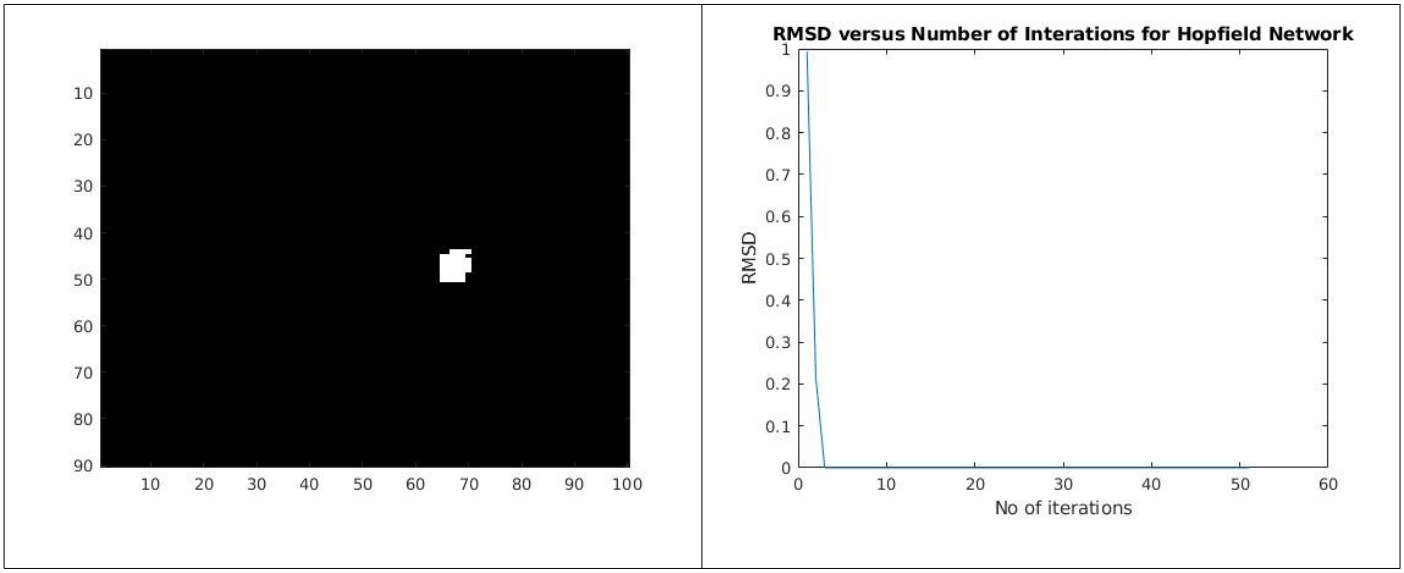
As can be seen from the RMSD graph, although it converges quickly, it does not converge to 0. There are some differences between the retrieved image (right) and the original (left).





Mona Lisa	
0%	25%
	
50%	80%
	

The RMSD graph is seen to converge quickly in all the cases studied, even when 80% of the weights are distorted randomly; however, this is not the case when the weights are distorted over a contiguous chunk – only a patch of the image forms, then – in the positions where the weights are not distorted. Going back to the random weight distortion, if we take a much smaller patch size, we can see that it takes longer for the RMSD to converge to 0, this has been done for the image of the Mona Lisa


RMSD versus Number of Interations for Hopfield Network
RMSD
No of iterations
10
20
30
40
50
60
70
80
90
100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1