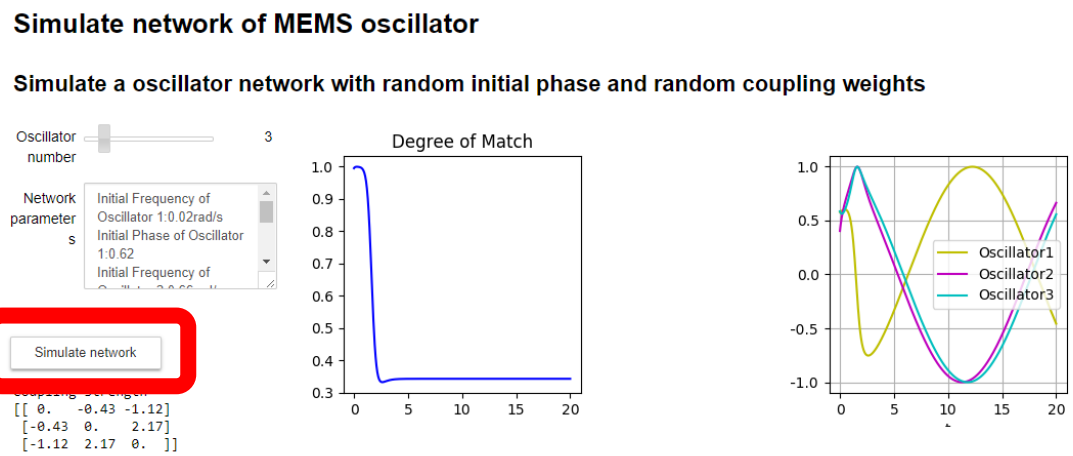
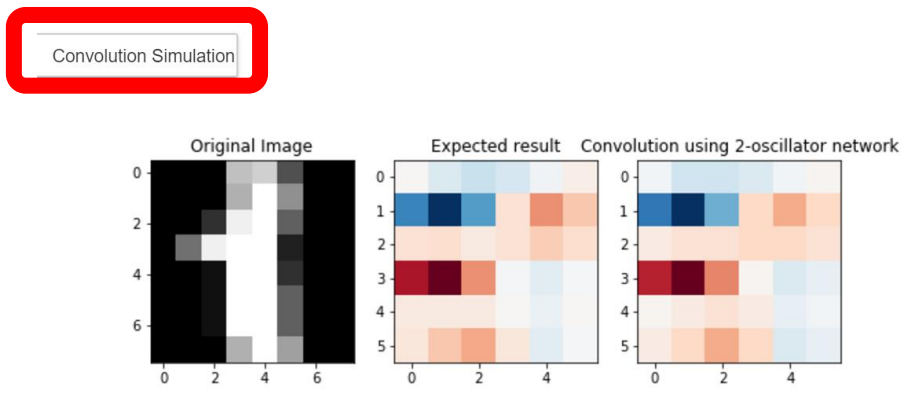
Section 1: Try oscillator network solver

- Select oscillator and press button in red rectangle.
- The oscillation state and initial random conditions will be shown.



Section 2: Image convolution

- Press the convolution simulation button to simulate convolution using oscillator network.



Section 3: Pattern recognition

- Step 1: Select the patterns to be remembered by the network. Interact with the red area

from up to down.

Pattern recognition

This following is for testing pattern recognition.

- Execute cells one by one!!!

1 Select patterns to remeber(Use Ctrl and shift key to select mutiple patterns)

Select picture index to remeber

1
2
3
4
5
6

2 Confirm selected pattern indexes (execute the cell and click the button)

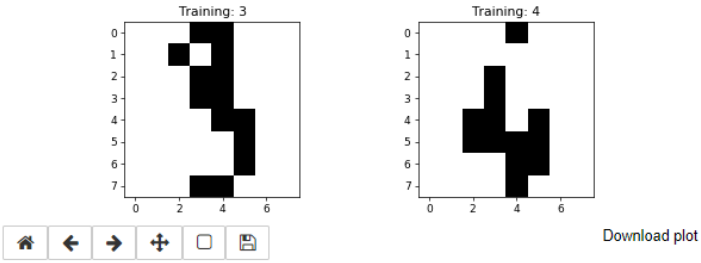
Confirm

```
You have selected index:
[3, 4]
```

3 Preview patterns to be remembered

Preview

Preview



Download plot

4 Select the image to be reconstructed

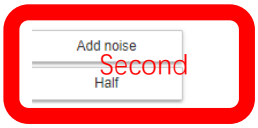
Select image to reconstruct

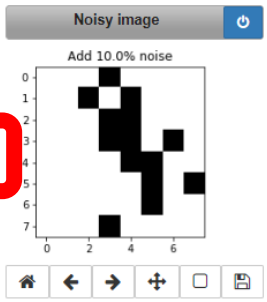
4
3

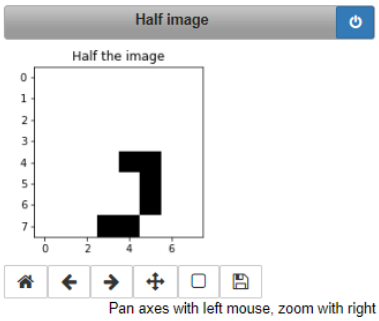
- Step 2:
- Reconstruct the noisy image or half of the image.

5 Select image to modify before reconstructing

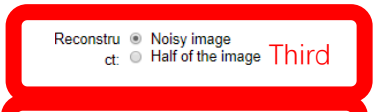
6 Select the noise percent to add

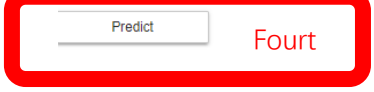


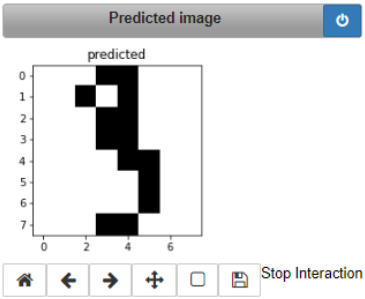




7 Show the reconstruced image







- Play with the network energy function.
- The pattern is located at the local minimum of the energy function.

Hopfield energy function:

$$E = -\frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij} x_i x_j$$

Let's pretend that vector a = (a1,a2) and b = (b1,b2) is stored in the network.

And as you can see in the figure, a and b are located as the local minimum.