assignment-3

SYDE 556: Simulating Neurobiological Systems

Assignment 3: Connecting Neurons

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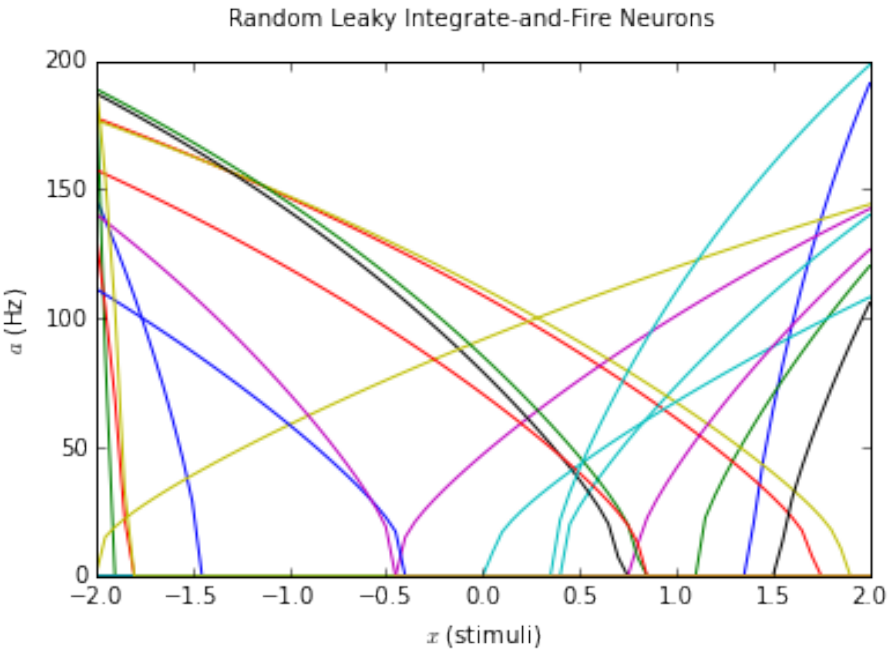
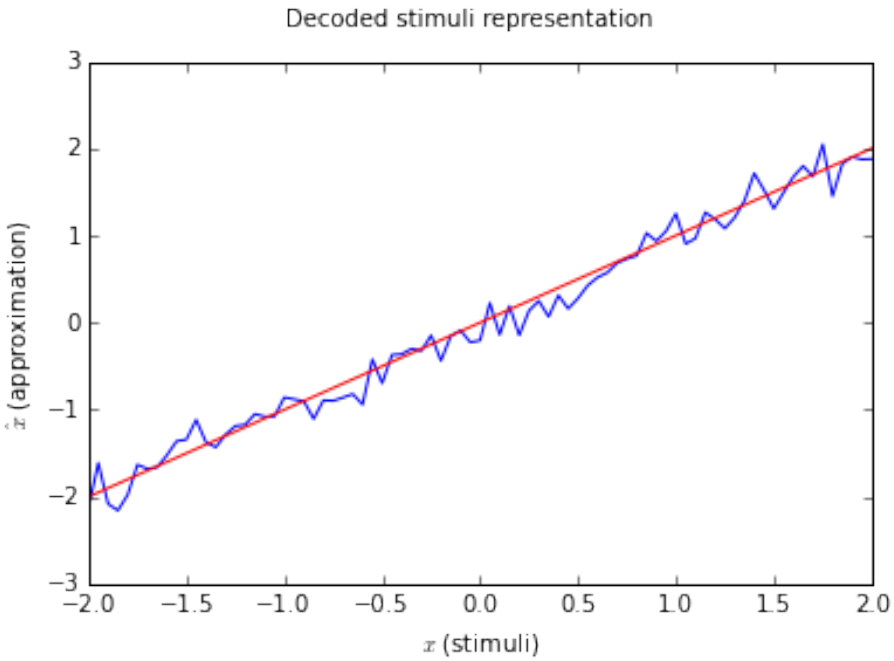
The assignment corresponds to the document hosted at:

http://nbviewer.ipython.org/github/celiasmith/syde556/blob/master/Assignment%203.ipynb

Section 1: Decoding from a Population

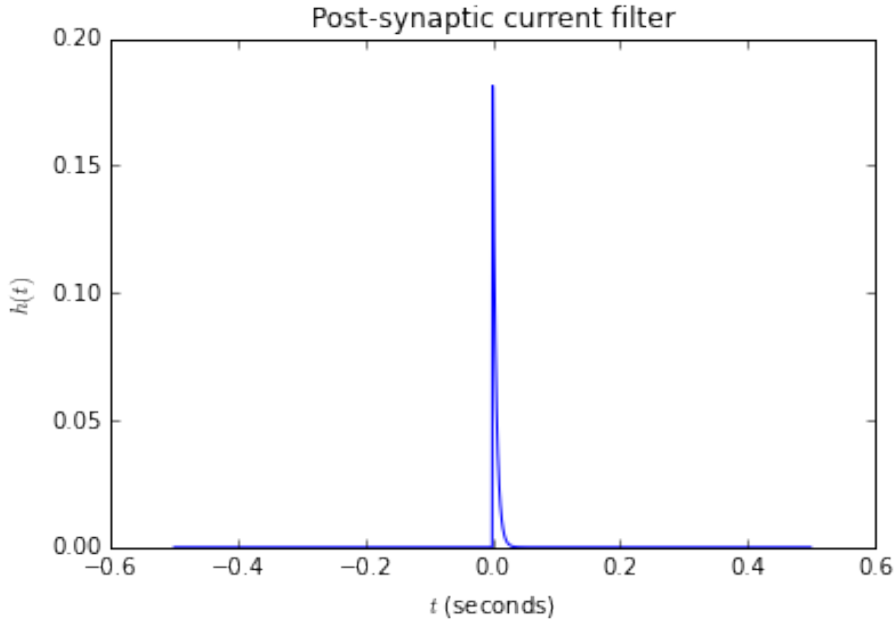


Part A

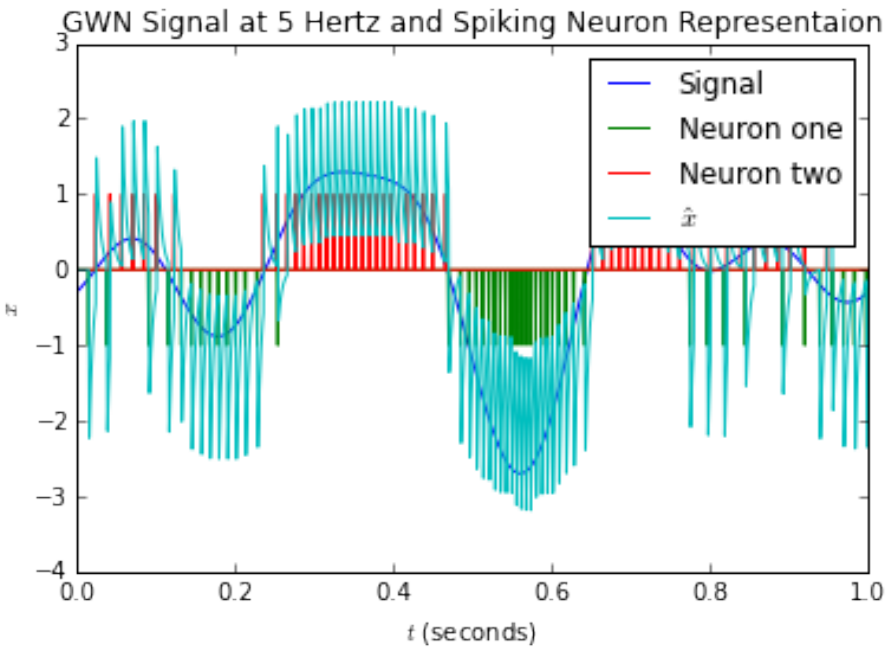


Part B

Section 2: Decoding from Two Spiking Neurons



Part A



Part B

Part C

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RMSE: 0.7550433333
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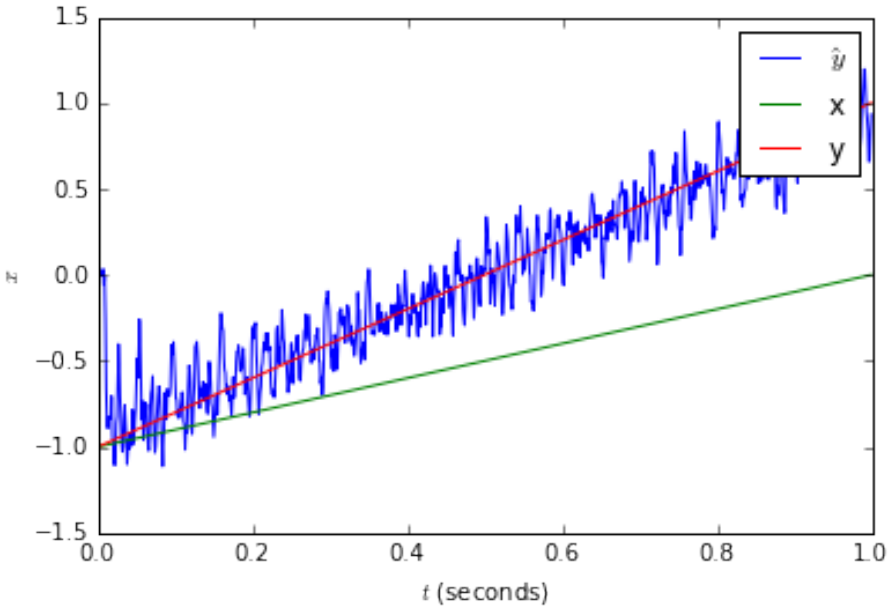
Section 3: Decoding from Many Neurons

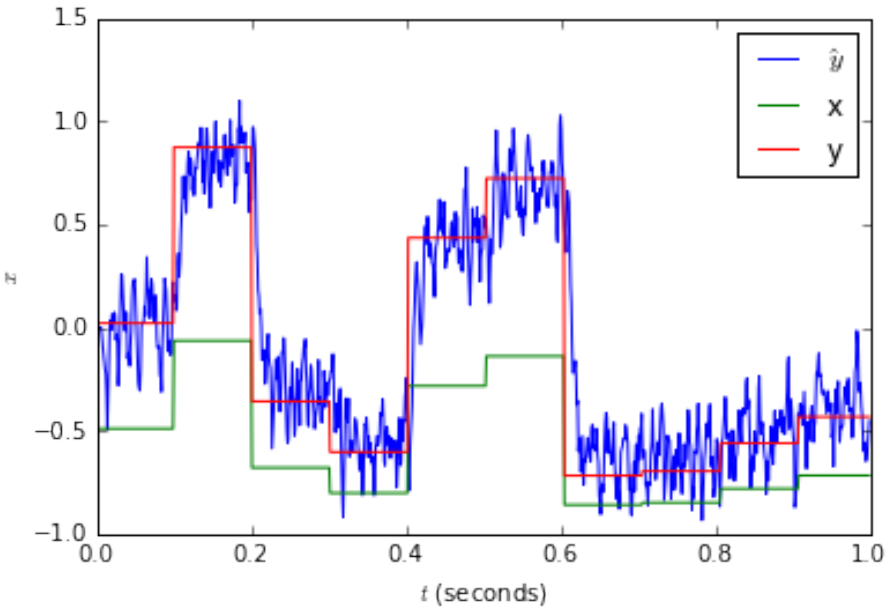
Part A

```
RMSE
0.508870263144
0.350816300398
0.267718190933
0.234003096225
0.181380044589
0.14759624691
```

Section 4: Connecting Two Groups of Neurons



Part A



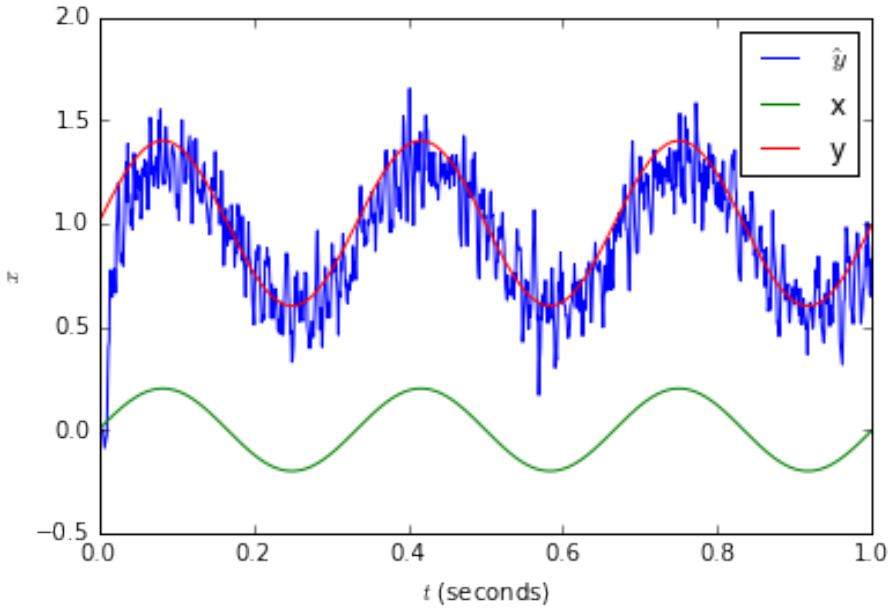
Part B

Part C

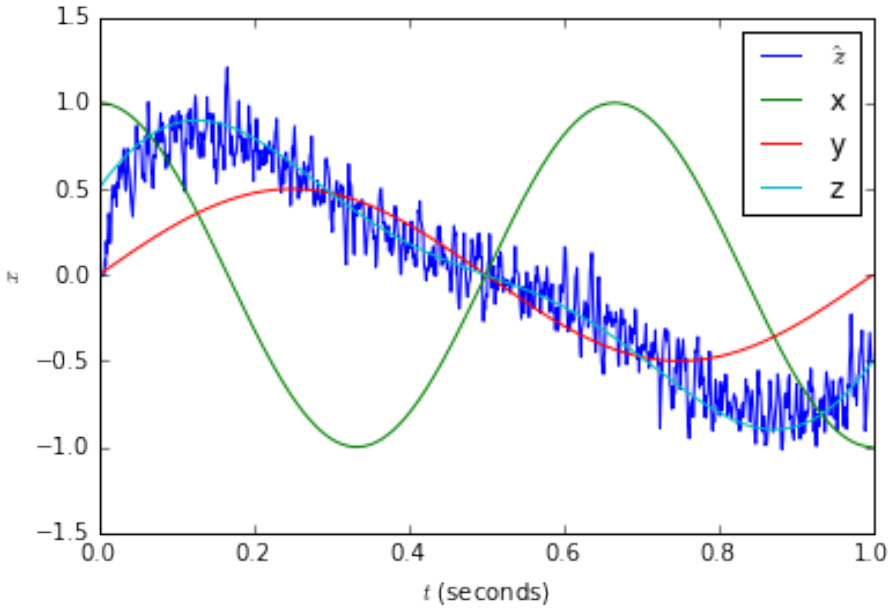
- The representation approximation always begins at zero, which makes

sense because it is not prescient (it has to gather information with a small reaction time)

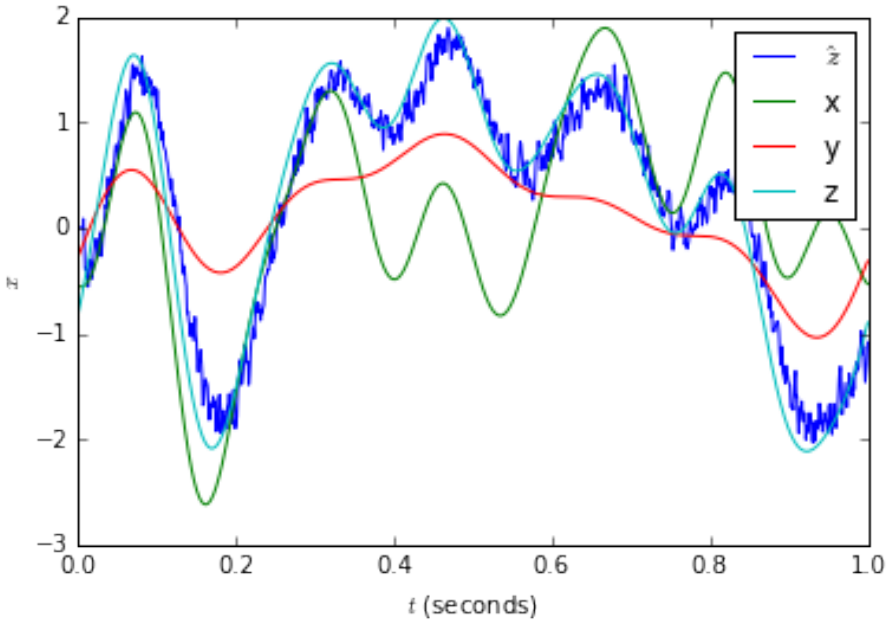
- Representation was fairly spiky and noisy
- Represents sudden jumps fairly well with very little lag time
- The neuron groups did fairly well considering that they were originally decoded for transformations (not decoded for the inputs given)
- The xhat was noisy, then was fed into the second neuron population, which produced yhat, a less noisy approximation!



Section 5: Connecting Three Groups of Neurons

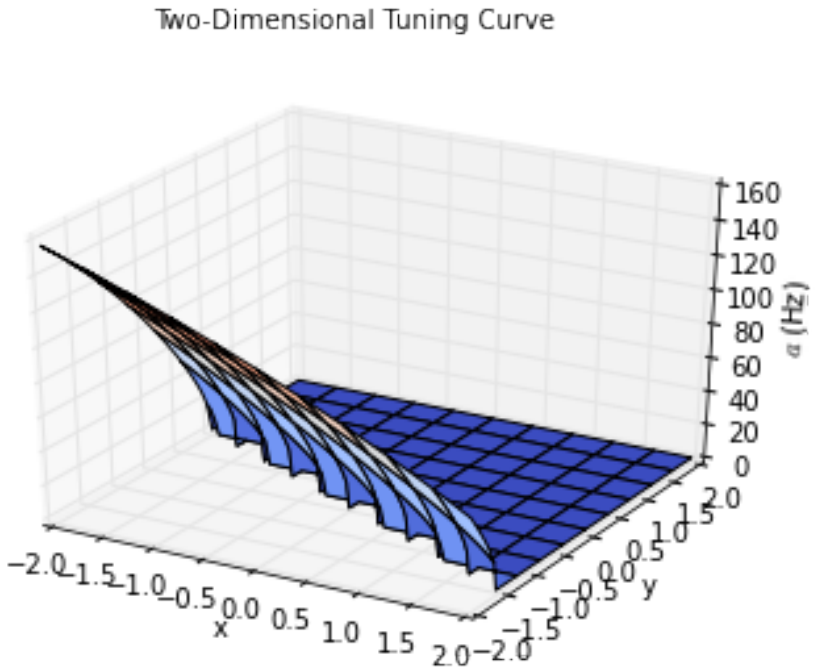


Part A

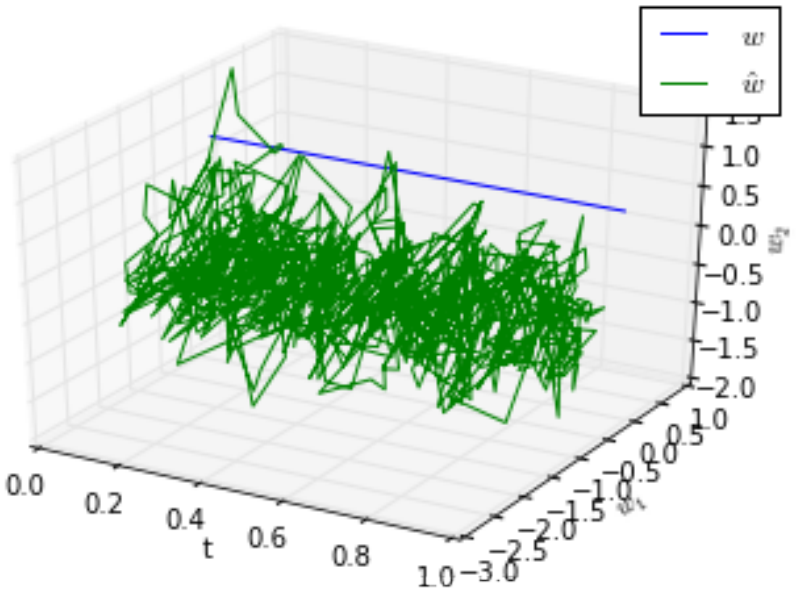


Part B

Section 6: Computing with Vectors


Two-Dimensional Tuning Curve
160
140
120
100
80
60
40
20
0
a (Hz)
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0
1.5
2.0
x
y

Part A


w
ŵ
1.0
0.5
0.0
−0.5
−1.0
−1.5
−2.0
0.0
0.2
0.4
0.6
0.8
1.0
t
−3.0
−2.5
−2.0
−1.5
−1.0
−0.5
0.0
0.5
1.0