

MATH 1180
MATHEMATICS FOR LIFE SCIENTISTS
Computer Assignment XII

Today's topic is linear regression.

PROBLEMS

- **1.** A scientist working in the laboratory wants to know the relationship between the rate, r , that action potentials are emitted from a neuron and the amount of current, I , that has been injected into the neuron. He records the following data for r and I

```
> r := [188.67, 191.4082, 190.05, 193.59, 194.45, 195.30, 194.88, 196.95,
196.13, 197.35]; action potentials per second
> I := [4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8, 4.9, 5.0]; in micro-amps
```

Use linear regression to find a relationship to predict the firing rate from the amount of current injected. Plot both the data and the line you found. What is the coefficient of determination? Is the line a good fit to the data? Is there anything odd about the line you found? What is the firing rate of the neuron if no current is injected?

- **2.** Our scientist doesn't like this result since neurons do not fire if no current is applied. He decides the problem is that the currents he used are too large. He repeats the experiment to find this new data:

```
> r := [17.10, 20.83, 23.75, 25.27, 33.55, 34.60, 39.60, 38.45, 40.21,
44.89]; action potentials per second
> I := [1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2.0]; again in microamps
```

Repeat the linear regression analysis. Again plot both the data and the line you found. How well does the data fit this data? Does this line serve well to predict the results of the first experiment? What if no current is applied?

- **3.**

Combine the two experiments and try again. Plot the data and your line together. Now by hand try and draw a curve that is always increasing, saturates, and appears to fit the data. To find the real relationship between these 2 numbers we would need to use nonlinear regression.