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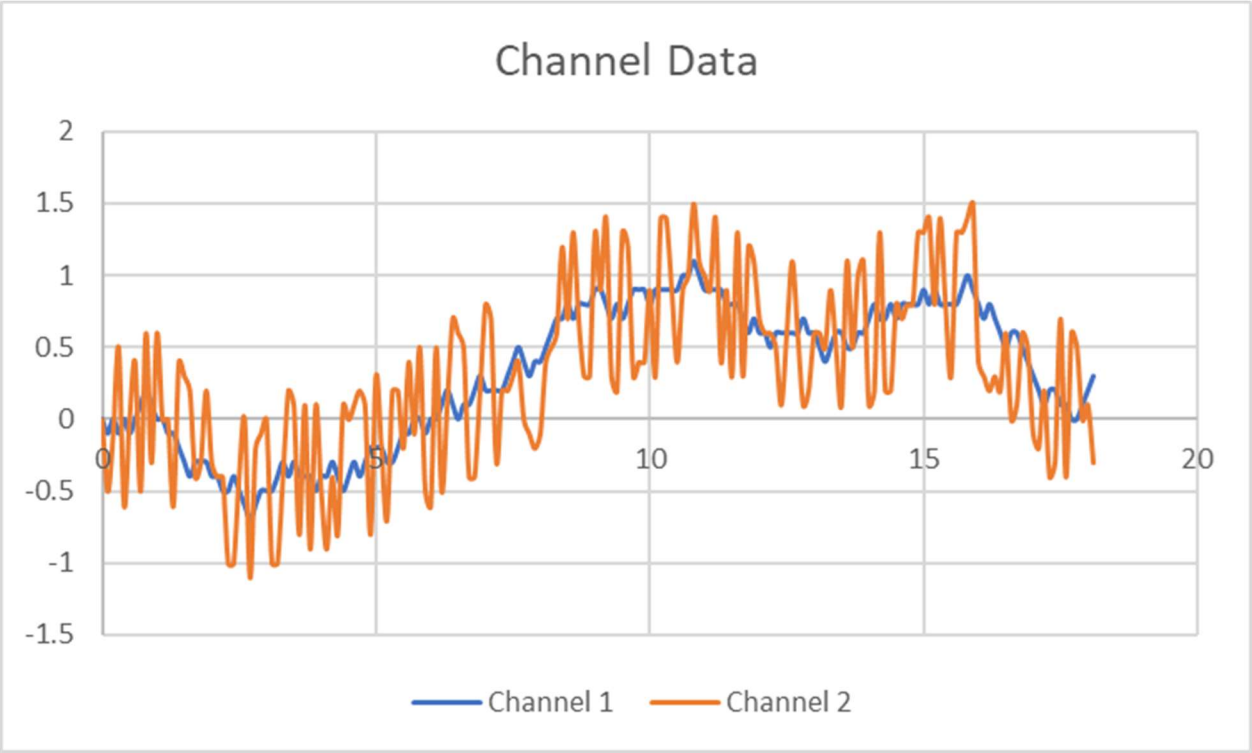
10.22.24
SFE 340
Prof. Meyer
Assignment 6

Focusing input, formatting output: (10%):

1. Using this input training data: (see also **csv** attached below)…



…a system is looking for pattern in a 1.5 second sample (n.b., beware of scale!) from both channels. Assume input array is 6x1 to a 2-layer neural network, each layer of 10 nodes, that results in these possible choices:

1. both are trending up in the next sample
2. Channel 1 is trending up but Channel 2 is trending down in the next sample,
3. Channel 2 is trending up but Channel 1 is trending down in the next sample,
4. both are trending down in the next sample

(Note also: this is what QUANT software does to make money in the market.) The goal is that given any 1.5 second sample in the future of both channels, I can predict the next sample to trade on that prediction.

2. **Describe and show math functions (with an example from data) that could be used to fit the data into the input array.**

time (s)	Channel 1	Channel 2	CH 1 Slope	CH 2 Slope	CH1 Time Decreasing (time spent with slope below 0)	CH1 Time Increasing (time spent with slope above 0)	CH 1 Average Slope during Time	CH2 Time Decreasing (time spent with slope below 0)	CH2 Time Increasing (time spent with slope above 0)	CH 2 Average Slope during Time
0	0	0	-0.1	-0.5	0.533333333	0.333333333	-0.02	0.466666667	0.466666667	-0.006666667
0.1	-0.1	-0.5	0.1	0.4						
0.2	0	-0.1	-0.1	0.6						
0.3	-0.1	0.5	0.1	-1.1						
0.4	0	-0.6	-0.1	0.6						
0.5	-0.1	0	0.1	0.4						
0.6	0	0.4	0.1	-0.9						
0.7	0.1	-0.5	0.1	1.1						
0.8	0.2	0.6	-0.1	-0.9						
0.9	0.1	-0.3	-0.1	0.9						
1	0	0.6	0	-0.6						
1.1	0	0	-0.1	0						
1.2	-0.1	0	0	-0.6						
1.3	-0.1	-0.6	-0.1	1						
1.4	-0.2	0.4	-0.1	-0.1						

I took the slopes between each value per tenth of second for Channel 1 and 2 to find the percentage of time that Channel's 1 and 2 were increasing and decreasing per 1.5 seconds.

The 6 input values will be:

1. percentage of time Channel 1 is increasing
    a. =COUNTIF(D2:D16, ">0")/15
2. percentage of time Channel 2 is increasing
    a. =COUNTIF(E2:E16, ">0")/15
3. percentage of time Channel 1 is decreasing
    a. =COUNTIF(D2:D16, "<0")/15
4. percentage of time Channel 2 is decreasing
    a. =COUNTIF(E2:E16, "<0")/15
5. Average slope for Channel 1 during that time
    a. =AVERAGE(B2:B16)
6. Average slope for Channel 2 during that time
    a. =AVERAGE(C2:C16)

3. **Describe and show math functions (with an example from data) that would take the output from the neural network and fit it to the output results. Define the output array too.**

The output array $\{o\}_2$ would be a 10x1 array that was computed by using the following

$$\{o\}_2 = f([W]_2^T \times (f_1([W]_1^T \times \{u\}_1)))$$

where $\{u\}_1$ is the 6x1 input matrix, W^T_1 is the weights matrix for the first layer, W^T_2 is the weights matrix for the last layer, f_1 is the function used to get $\{o\}_1$ from the first layer, and f is the function used to get $\{o\}_2$ from the second layer. These values would get adjusted by *a* (averaging vector), to create a 2x1 matrix that would show a 1 if a channel is likely to trend up in the next sample, and a 0 if a channel is likely to trend down in the next sample. For example: if your *r* was this:

1	0

then channel 1 would be likely to trend up in the next sample, and channel 2 would be likely to trend down in the next sample.

4. **Put all results into a single PDF and load it onto Canvas.**
    1. **Channel Input File: Hwk6InputData.csv**