16-722 Sensing and Sensors
Homework Assignment 2

Sensor fusion and error propagation

In class we collected indoor, "outdoor," and humidity data from 10 different meters. These data have been posted on Canvas, in the "homework assignments" folder. We will use these data as if they were 10 sequential readings from the same sensor, rather than from 10 separate sensors.

1. The number of data points we collected is rather small to easily histogram the data, but if you are judicious in how you create your bins you can create a reasonable-looking histogram. Try it for the two temperature columns on a graph with "indoor" and "outdoor" represented by different symbols, and separately for the relative humidity data.

2. What are the mean values of the indoor temperature readings, the outdoor temperature readings, and the relative humidity readings?

3. What are the variances of the indoor temperature readings, the outdoor temperature readings, and the relative humidity readings?

4. What are the standard deviations of the indoor temperature readings, the outdoor temperature readings, and the relative humidity readings?

5. **Sensor Fusion:** What are the mean, variance, and standard deviation of all your temperature measurements when the indoor data are optimally fused with the "outdoor" data?

6. **Error Propagation:** Weather reports usually give an "adjusted temperature" that purports to tell you what temperature it "feels like" at the actual ("dry bulb") temperature and relative humidity. Refer to the first formula for heat index (HI) listed on the Wikipedia page for "Heat index," and use it to find the "adjusted temperature" and its variance using the mean optimally-fused temperature, the mean relative humidity, and their variances.