CSCI 350: Data Analytics Spring 2017

HW#1: Stability of Statistical Estimators

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After a little study and research on-line I was able to find my way through and understand the proof of sample variance being an unbiased estimator of variance. Its apparent through out the proof that by subtracting 1 from the sample total in the calculation of the sample variance it makes up the difference for a smaller size. Although I am not clearly going to explain here, I tried to clearly state and explain the steps in my proof on the pdf labeled: Morris\_SampleVar\_Proof. I will admit I still do not fully understand the proof for consistency nor do I think mine is correct. I was able, even after working through and understanding the proof, to fully see the consistency when I coded this in Matlab. In order to create a clear visual that presents this data. My code design is as follows:

First, it starts with randomly generating a population of weights for 100,000 individuals. It then calculates the mean and variance of the weights In the overall population. Then it conducts a test of 10 different previously selected sample sizes from the population. For each sample size, a 1000 trials are conducted in which the program calculates the sample size mean and variance, recording each value during each trial. At the end of each trial the overall sample variance mean, sample variance max out-lier, and sample variance min out-lier of the trials are recorded. After the trials are ran for each previously selected sample size, the results are displayed in a figure for comparison. As the sample size grows larger the out-liers of the sample variance tests converge closer and closer to the overall population weight variance.

When testing sample variance starting with sample size N=10 it is clear to see that it is susceptible to outliers due to the fact that as this trial is ran 1000 times, the max an min sample variance numbers of those tests are always further away from the original variance. As the sample sizes grow larger, they become less and less susceptible.