STATS 205: Homework Assignment 2 (Spring 2019)

4/12/2019

Solve these problems from the textbooks HWC, **W**, and **ET**.

Send your Rmd and PDF files to pjeganat [at] stanford [dot] edu.

Due on 4/19/2019 at 1.30 p.m.

1) **HWC**: page 58, problem 20 (sensitivity to gross errors- mean and HL)

2) **HWC**: age 58, problem 25 (influence by outlying observations - mean and HL)

3) **HWC**: age 79, problem 60 (sensitivity to gross errors- mean and median)

4) (**W**: page 39, problem 11.) Let $X_1, \cdots, X_n \sim \text{Uniform}\,(0, \theta)$. The estimator of interest is $\hat{\theta} = X_{\max} = \max\{X_1, \cdots, X_n\}$. Generate a data set of size 50 with $\theta = 1$.

   (i) Find the distribution of $\hat{\theta}$ by generating 100,000 samples of sample size 50 from $\text{Uniform}\,(0, 1)$ (this will give an approximation to the true distribution of $\hat{\theta}$).

   (ii) Compare the true distribution of $\hat{\theta}$ in (i) to the histogram from the nonparametric bootstraps. Use QQ-plot to compare the true distribution and bootstrap sampling distribution of $\hat{\theta}$.

5) (**W**: page 39, problem 12.) Suppose that 50 people are given placebo and 50 are given a new treatment. Thirty placebo patients show improvement, while 40 treated patients show improvement. Let $\tau = p_1 - p_2$ where p_2 is the probability of improving under treatment and p_1 is the probability of improving under placebo.

   (i) Find the maximum likelihood estimate of τ.

   (ii) Find the standard error of the maximum likelihood estimate $\hat{\tau}$ using the bootstrap.

   (iii) Find the 90% percentile confidence interval for τ using the bootstrap.

6) (**ET**: page 152, problem 11.3.) Generate 100 samples $X_1, \cdots, X_{20}$ from a normal population $\text{N}\,(\theta, 1)$ with $\theta = 1$.

   (i) For each sample compute the bootstrap and jackknife estimate of variance for $\hat{\theta} = \bar{X}$ and compute the mean and standard deviation of these variance estimates over the 100 samples.

   (ii) Repeat (a) for the the statistic $\hat{\theta} = \bar{X}^2$, and compare the results. Give an explanation for your findings.