EE2012/ST2334 Discussion 6

Liu Zichen

April 23, 2019

1. **[Estimation based on Normal Distribution]** Given the observed data $x_1, x_2, \cdots, x_n$, we want to estimate the parameter θ which controls the distribution $f_X(x|\theta)$. A statistic is a function of the random variable which *does not depend on any unknown parameters*. The statistic that one uses to obtain a point estimate is call an **estimator**. Interval estimation is to define two statistics and use their interval to estimate the parameters.

   Unbiased estimator: $E(\widehat{\Theta}) = \theta$.

   Confidence interval for interval estimation[1]. For the given error margin, the sample size is given by $n \geq \left(Z_{\alpha/2}\frac{\sigma}{e}\right)^2$.

   Confidence interval for the mean in 1) known variance case; 2) unknown variance case.

   Confidence interval for the difference between two means. $\overline{X}_1 - \overline{X}_2$ is a point estimator of $\mu_1 - \mu_2$. Also two cases, known variances and unknown variances.

   Confidence interval for the difference between two means for paired data (dependent data).

   Confidence interval for a variance.

   Confidence interval for the ratio of two variances with unknown means.

2. **[Hypotheses testing based on Normal Distribution]**

   - Often, hypothesis is stated in a form that hopefully will be rejected, denoted as H_0 (Null hypothesis); its opposite (the one we need to accept due to insufficient data for concluding false) is denoted as H_1(Alternative hypothesis).
   - Two tailed test and one tailed test.
   - Type I and Type II error.
   - Acceptance and rejection regions, critical value.
   - Hypothesis testing on mean with known/unknown variance.
     - Two-sided
     - One-sided
   - Hypothesis testing on difference between two means.
   - Hypothesis testing on variance.
   - Hypothesis testing on ratio variance.

[1] p21