AI1110 Assignment 11

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LATEX

Outline

Abstract

- This document contains the solution to Question of Chapter 8 in the Papoulis Textbook.

Ex 8.18

The random varible x_i are i.i.d and $\mathcal{N}(0, \sigma)$ We observe that $x_1^2 + x_2^2 + \ldots x_{10}^2 = 4$ .Find the 0.95 confidence intervel of σ.

Theory

confindence interval

The 95% confidence interval is a range of values that you can be 95% certain contains the true mean of the population.

chi squared distribution

the chi-squared distribution (also chi-square distribution) with k degrees of freedom is the distribution of a sum of the squares of k independent standard normal random variables.

LAT_EX

Solution

The RVx x_i/σ are $\mathcal{N}(0,1)$ hence,the sum $z = \left(x_1^2 + x_2^2 + ...x_{10}^2\right)/\sigma^2$ has a $\chi^2(10)$ This yeilds:

$$\Pr\left(\chi_{0.025}^2(10) < z < \chi_{0.975}^2(10)\right) = 0.95 \tag{1}$$

$$\chi_{0.025}^2(10) = 3.25, \chi_{0.975}^2(10) = 20.48 \tag{2}$$

$$3.25 < \frac{4}{\sigma^2} < 20.48 \tag{3}$$

$$0.442 < \sigma < 1.109 \tag{4}$$

L^AT_EX

Output of Code

Figure 1: chi square critical values