ST501 Group Project

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Introduction

Part 1 Convergences

A

B

C

Derrive the CDF of the double exponential distribution.

$$f_Y(y) = \frac{1}{2b} * e^{-(\frac{|y-\mu|)}{b})}$$

This yields two cases for the CDF:

$$F_Y(y) = \begin{cases} \int_{-\infty}^{t} f_Y(Y)dt & \text{for } y \leq \mu \\ \int_{t}^{\infty} f_Y(Y)dt & \text{for } y \geq \mu \end{cases}$$

Solving for these leaves us with the following:

For $y \leq \mu$:

$$\int_{-\infty}^{t} f_Y(Y)dt$$
$$\int_{-\infty}^{t} \frac{1}{2b} * e^{-(\frac{t-\mu}{b})}dt$$

We know that in this case we are solving for when the exponent is positive.

$$\int_{-\infty}^{t} \frac{1}{2b} * e^{(\frac{|t-\mu|)}{b})}dt$$

$$\frac{1}{2b} * e^{(\frac{t-\mu}{b})} * b|_{-\infty}^{t} = \frac{1}{2}e^{(\frac{t-\mu}{b})} - 0 = \frac{1}{2}e^{(\frac{t-\mu}{b})}$$

For the case where $y \geq \mu$

$$\int_{-\infty}^{t} f_Y(Y)dt$$

$$\int_{-\infty}^{t} \frac{1}{2b} * e^{-(\frac{t-\mu}{b})}dt$$

This must be further split into:

$$\int_{-\infty}^{\mu} \frac{1}{2b} * e^{-(\frac{t-\mu}{b})} dt + \int_{\mu}^{t} \frac{1}{2b} * e^{-(\frac{t-\mu}{b})} dt$$

$$\frac{1}{2b} * e^{(\frac{-t+\mu}{b})} * -b|_{-\infty}^{\mu} + \frac{1}{2b} * e^{(\frac{-t+\mu}{b})} * -b|_{\mu}^{t}$$

$$\frac{1}{2} - e^{\frac{\mu-t}{b}} + \frac{1}{2}$$

Thus for this case:

$$1 - e^{\frac{\mu-t}{b}}$$

In conclusion the CDF for the double exponential distribution is:

$$F_Y(y) = \begin{cases} \frac{1}{2} e^{(\frac{t-\mu}{b})} & \text{for } y \leq \mu \\ 1 - e^{\frac{\mu-t}{b}} & \text{for } y \geq \mu \end{cases}$$

D

E