# LAB 1 - Estimators

2020/10/09

# LAB 1

- Deadline: October, 20.
- To: adv.statistics.2020@gmail.com.
- Subject: LAB 1.
- Report file name: LAB1_LastName1_LastName2

For this lab:

- You'll solve all the exercises on the slides 4 to 8 (included) from "PART B-Applications"

- You'll include in the report all the empirical verifications that follow

Guidelines: We expect a self-contained report with answers, figures and results. You can use RMarkdown, it is not mandatory. Additionally, you will send the code (.R) or the file that builds the report (.Rmd), we only want to look at it if there is a mistake on the report. If you are not confortable writing equations in LaTeX you can add a hand-written appendix with the exercises that need a derivation with formulas.

# EX 1: Rayleigh distribution

- (a) Estimate the parameter of the Maximum height random variable H (Rayleigh distribution).
- (b) Randomly generate more samples from the parameter estimation in (a) (assuming it is the true value of the parameter). Do it in 2 different ways.

Note: the nominal value of the true parameter is not important (you could choose your favourite positive number), we just want to verify properties of the estimator.

- (c) Empirically verify the property "unbiasedness" for the MLE estimator of the Rayleigh distribution.
- (d) Empirically verify the property "efficiency"" for the MLE estimator of the Rayleigh distribution.
- (e) Empirically verify with a plot the property "asymptotic normality" for the MLE estimator of the Rayleigh distribution.

# EX 2: Geometric distribution

- (a) Estimate the fraud probability.
- (b) Generate more samples based on the estimator (assuming it is the true value of the parameter).
- (c) Empirically verify with a plot the property "asymptotic normality" for the estimator.
- (d) Compute the confidence interval and validate it with simulations.

# Next course

- We'll code the EM algorithm
- We'll apply it to images