L03 Advanced Probability and Linear Algebra

### Objectives

Our learning objective is to refresh some essential concepts from Statistics, Linear Algebra, Calculus and Probability using R. Empirical not theoretical.

Linear Algebra

* + Matrix: positive definite, semi-positive, rectangular,square, Identity, diagonal
  + Multiplication,determinant,Inverse, transpose, Decomposition, cholesky,eigen,svd
  + Vector, dot product, cross product,length Calculus:derivative,partial derivative, integration,log,min,max Statistics
  + Sample (statistic)mean,variance,Sampling distribution of Sample statistic
  + Population(parameters)
  + Accuracy, precision, bias
  + CLT Central Limit Theorem, LLN Law of Large Numbers
  + Probability:probablity distribution of discrete/continuous variables,pmf,pdf,cdf.
  + Joint/Conditional/Independent events, their probabilities and Bayes Theorem.

### [Lecture Notes:L03-Stats and Math you need](https://github.com/samriti0202/DATA622/blob/main/L03%20Advanced%20Probability%20and%20Linear%20Algebra/L03.pdf)

### [Reading Materials and Resources](https://bbhosted.cuny.edu/webapps/blackboard/content/listContent.jsp?course_id=_1915134_1&content_id=_49455044_1)

Reading Materials and Resources

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[**Probability Distributions in R (Stat 5101, Geyer)**](http://www.stat.umn.edu/geyer/old/5101/rlook.html)

[**Probability**](https://github.com/jbryer/DATA606Fall2019/blob/master/Textbook/os4.pdf)

[**Machine Learning, Neural and Statistical Classification**](http://www1.maths.leeds.ac.uk/~charles/statlog/)

**References**

* + An introduction to ROC analysis,Tom Fawcett
  + An empirical study of the naive Bayes classifier, I. Rish
  + An Analysis of Bayesian Classifiers, Pat Langley, Wayne Iba, Kevin Thompson
  + Performance Evaluation of the Machine Learning Algorithms Used in Inference Mechanism of
  + Medical Decision Support System, Mert Bal, M. Fatih Amasyali, Hayri Sever, Guven Kose, and Ayse Demirhan
  + Supervised Machine Learning: A Review of Classification Techniques, S. B. Kotsiantis
  + Open Intro Statistics,Fourth Edition,David Diez, Mine Cetinkaya-Rundel, Christopher D Barr
  + <https://en.wikipedia.org/wiki/Support-vector_machine>
  + <https://www.csie.ntu.edu.tw/~cjlin/papers/guide/guide.pdf>
  + <https://math.stackexchange.com/questions/1305925/why-is-the-svm-margin-equal-to-frac2-mathbfw>
  + Machine Learning, Ethem Alpaydin Chapter19 and Appendix A on Probability
  + Chapter 7, Model Evaluation, PDM, Monte F. Hancock, Jr.

### Review Questions and Practice Problems

<Please source this from any basic text or from the internet>

What is SIZE Effect?

What is Power of a Test?