

# A handshake is available on request

## Introduction

This is the beginning of my understanding of Machine Learning. Machine Learning comprises of any sub disciplines like , Supervised Learning, Unsupervised learning, Re-inforcement learning etc. On the other quadrant the semi-independent topics are optimization , parametric and non-parametric model , Statistical Learning Theory etc. This document will be mainly the scribble coming out when I am learning these theories. I will keep revising this document.

## Starting

Machine learning has its roots in statistics. Almost everything I am encountering from the maximum likelihood estimator to deep learning layer design, the drive from the statistical inference theory. Lets start from somewhere ..

## Random Variable

To answer what is a random variable lets first check what is a variable. Whenever the name variable comes into my mind, I think of  $x$  in the context of

$$x + 6 = 18 \tag{1}$$

but when I pondered over the above equation yields to  $x = 18 - 6 \Rightarrow x = 12$

Lol , so  $x$  comes out to be a constant , NOT a variable. So what is a variable ? A variable means that it varies [digression, show-off] The famous sentence "Change is the only constant" fails miserably in math context. Here some varies because some other things varies and that modeling in math is called *Function* so a variable is essentially a function like  $y = f(x)$  here  $x$  is a variable so as  $y$  So random variable is also a function. The random-ness comes from experiments that determines the random variable.

In probability context , Sample Space is the set of all events. A Random variable is a function which maps Sample Space to a Real number. In rigorous terms ,

$$RandomVariable : SampleSpace \rightarrow \mathbb{R}$$

Random variable (r.v.) could be discrete or continuous.

- Discrete: face of a coin once it settles , number of key you pressed in your keyboard per hour , number of emails you got at time  $t$  , number of words you read per minute when you are reading a book , number of youtube video you watch without clicking skip ads etc.
- Continuous: Selling price of a house in a country , the length of time you stare at your phone deciding what to watch on Apple TV, amount of time projects GA get delayed per manager etc.

## Probability Distribution

A distribution is a measure of likelihood of a random variable over its domain. For discrete r.v. we call it probability mass function (pmf) and for continuous r.v. we call it probability density function (pdf)

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