Probability vs Statistics

"An abstract mathematical framework for describing random quantities or stochastic models of the world"

"Use of probability to summarize, analyze, and interpret data"

Eero Simoncelli / Mike Landy Math tools 2019 slides

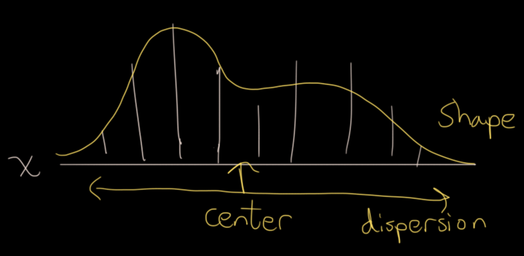
Descriptive vs inferential statistics

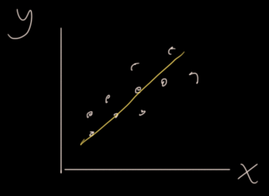
- Summarizing data
- Trying to guess underlying probability distributions

Descriptive statistic: number that communicates useful info about data (summary statistic)

Key types:

- Measures of central tendency: mean, mode, median
- Measures of dispersion: range, standard deviation, variance, quantiles
- Measures of shape: Kurtosis, skewness
- Measures of statistical dependence: correlation coefficient





Moments

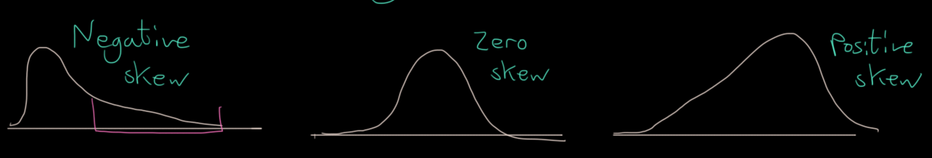
i^{th} moment of distribution $= \frac{x_1^i + x_2^i + \ldots + x_N}{N}$

1^{st} moment $\frac{\Sigma x_i}{N} = \bar{x}$, mean

2^{nd} normalized moment $\frac{\Sigma (x_i - \bar{x})^2}{N} = \sigma^2$, variance

3^{rd} standardized moment $\frac{\Sigma (x_i - \bar{x})^3}{\sigma^3}$, skewness

skewness: how asymmetric the data is



4^{th} standardized moment $\frac{\Sigma (x_i - \bar{x})^4}{\sigma^4}$, kurtosis

Kurtosis: measure of tailedness of a distribution