Multivariate statistics
Lecture 01:
Multivariate data and descriptive statistics

Literature and Problems: See course schedule

Agenda (preliminary):

SLIDE: Review of 1D (univariate)

- **random variables**
- **population moments**
- **descriptive statistics and sample moments**

2D (bivariate) random variables

- **simultaneous and marginal pdf's**
- **population moments μ, $\sum$, ρ**

Generalization to pD (p-dimensional) random variables and moments

- **population moments μ, $\sum$, ρ**
- **linear combinations and moments**
- **generalized and total population variance**
- **DEMO: bivariate normal distribution**

Sampling --> (n x p) data matrix, X

- **n points (rows of X) in p-dimensional space**
- **p points (columns of X) in n-dimensional space**

Descriptive statistics

- **sample moments $\bar{x}$, S, R and properties for estimation of μ, $\sum$, ρ**
- **generalized and total sample variance**

Visualization of 1D samples

- **histogram and boxplots**
- **KDE, Kernel Density Estimation of 1D pdf**
- **DEMO: Kernel Density Estimation of Gaussian Mixture Model**

Visualization of 2D and pD samples

- **scatter matrix plots and marginal histograms and boxplots**
- **2D and pD Kernel Density Estimation and product kernels**
- **DEMO: Visualization of 2D data and 3D data**