



ENGINEERING STATISTICS

PROF. MANJESH KUMAR HANAWAL

Department of Multidisciplinary
IIT Bombay

PRE-REQUISITES : Basic Probability

INDUSTRY SUPPORT : This is a basic course and will be recognized by all

COURSE OUTLINE :

We have to deal with data all the time and it has to be analyzed in a systematic way to extract information. This course introduces all basic concepts in statistics and prepares one to use statistics in many engineering applications. Sound knowledge of statistics is important to develop good machine learning and artificial algorithms. This course will also focus giving exposure various statistical tools available in Python.

ABOUT INSTRUCTOR :

Prof. Manjesh K. Hanawal received the M.S. degree in ECE from the Indian Institute of Science, Bangalore, India, in 2009, and the Ph.D. degree from INRIA, Sophia Antipolis, France, and the University of Avignon, Avignon, France, in 2013. After two years of postdoc at Boston University, he is now an Assistant Professor in Industrial Engineering and Operations Research at the Indian Institute of Technology Bombay, Mumbai, India. His research interests include performance evaluation, machine learning and network economics. He is a recipient of Inspire Faculty Award from DST and Early Career Research Award from SERB

COURSE PLAN :

Week 1: Revising probability: Axioms of probability, Conditional probability, Baye's theorem, Random Variable, commonly used distributions (continuous and discrete), Cumulative Distribution Function (CDF) and Probability Density Function (PDF) their properties

Week 2: Revising probability: Joint distributions, Function of random variables. Independence of Random Variables, Correlation of Random Variables, Correlation coefficient, Markov and Chebyshev inequality, Convergence of RVs, Limit theorems.

Week 3: Introduction to python. Data visualization and fitting data to a given distribution.

Week 4: Exponential Family of Distributions, Population and Random Sampling, Sample mean, variance and standard deviation, Sampling from Normal distribution, Student's t-distribution, F-distributions

Week 5: Order Statistics, Generating Random Samples: Direct and Indirect methods, Accept Reject method,

Week 6: Metropolis Hastings algorithm, Generation of random samples using Python

Week 7: Data reduction principles, Sufficiency principle, Sufficient statistics, factorization theorem

Week 8: Point estimators: Likelihood functions, maximum likelihood estimator, Method of moments, Bayes method, Expectation Maximization (EM) methods, Consistency of estimators

Week 9: Bias, Mean squared error, Evaluating Estimators, Cramer's Rao inequality, Information inequality, Fischer Information

Week 10: Hypothesis testing, Likelihood Ratio Test (LRT), Type-I and Type-II errors, Method of Evaluating Tests

Week 11: Interval Estimators, Confidence intervals, Simple Linear regression, multivariate regression, logistic regression, Goodness of fit,

Week 12: p-test, Kolmogorov-Smirnoff test, f-score and other statistical tests. Application of tests on sample datasets using Python.