

DRAFT

Syllabus
CIEG 642010: Advanced Data Analysis
Spring 2019

Instructor: Dr. Nii Attoh-Okine, Dupont Hall 354 (Civil Eng Dept), email:okine@udel.edu.

The class will use **R-software** or **Python [Jupyter Notebook]**

Material: Instructors Notes

Grading: There will be weekly assignments and projects. They will count towards the grade as follows.

Assignments 40 %
Project – 60%

Description of the Course

The course presents a comprehensive introduction to the principles and practices of emerging advanced data analysis with particular focus to engineering science. The course will attempt to provide insight to advanced statistical techniques and methods of analyzing BIG DATA will be the main focus.

Outline

1. Introduction
 - Fast Computation on Massive Data Sets
 - Data Types and Management
 - Linear Algebra Quick Review
 - Probability and Statistical Distributions –Quick Review
2. Data Analysis – Basic Overview
 - Exploratory Data Analysis (EDA)
 - Symbolic Data Analysis
 - Building Symbolic Data
 - Advantages of Symbolic Data
 - Imputation
3. Machine Learning Background
 - Classification, Regression, Clustering, Nearest Neighbor, EM Algorithm
 - Spectral Methods -SVD, PCA
 - Graphical Probabilistic Models (Influence Diagrams, Bayesian Networks, Factor Graph)
 - Belief Propagation, Junction Tree
4. Big Data in Multidimensional Setting (Tensors)
 - Introduction
 - Notations and Definitions
 - Tensor Decomposition Models
 - Non-negative Tensor Factorization

5. Bayesian Statistical Inference
 - Posterior, Prior and Predictive Distribution
 - Priors
 - MCMC (Gibbs Sampling, Metropolis-Hasting Algorithm)
 - Approximate Bayesian Computation
 - Bayesian Nonparametrics**
 - Dirichlet Family
 - Dirichlet Process
 - Stick Breaking Construction
 - Chinese Restaurant Process
 - Chinese Restaurant Process (CPR) for Infinite Mixture
6. Differential Privacy
 - General
 - Differential Privacy
 - Differential Privacy – Hypothetical Track Application
7. Introduction to Blockchain Technology
 - Basic Terminology
 - Implementation
 - Smart Contracts
 - Applications