North South University
Department of Electrical and Computer Engineering
Course outline of Machine Learning
Course Code: **CSE 445**

Course Title: Machine Learning
Course Number: CSE 445

Number of Credits: 3
Type: Elective, Lecture, Programming, Design, Engineering
Contact Hours:

Class	Initial	Day/Time	Room No
CSE445.4	SLB	MW 8:00 AM ~9:30 AM	SAC402
CSE445.5	SLB	MW 11:10 AM ~12:50 AM	NAC992
Counseling Time	SLB	MW 10:00 AM ~11:00 AM	SAC923

Course Teacher:
Sarnali Basak
Associate Professor, Department of Computer Science and
Engineering, Jahangirnagar University
&
Adjunct faculty, Department of ECE, North South University
Email: sarnali.basak@northsouth.edu

Pre-requisites:
You should understand basic probability and statistics, and college-level algebra and calculus. For example it is expected that you know about standard probability distributions (Gaussians, Poisson), and also how to calculate derivatives. Knowledge of linear algebra is also expected, and knowledge of mathematics underlying probability models will be useful. For the programming assignments, you should have some background in programming, and it would be helpful if you know Python.

Course Description:
Machine learning is an exciting interdisciplinary field, with historical roots in computer science, statistics, pattern recognition, and even neuroscience and physics. In the past 15 years, many of these approaches have converged and led to rapid theoretical advances and real-world applications. Machine learning research aims to build computer systems that learn from experience. Learning systems are not directly programmed by a person to solve a problem, but instead they develop their own program based on examples of how they should behave, or from trial-and-error experience trying to solve the problem. These systems require learning algorithms that specify how the system should change its behavior as a result of experience. Researchers in machine learning develop new algorithms, and try to understand which algorithms should be applied in which circumstances.

Course Objectives:

The objectives of the course are:

 i. To expose the students to the basic machine learning tools and techniques;
 ii. To understand, implement and apply the machine learning techniques on solving real problems, designing a novel algorithm for supervised or unsupervised learning;
 iii. Implement various types of classification methods including SVM, Naive bayes, decision tree, and random forest.
 iv. Interpret Unsupervised learning and learn to use clustering algorithms.

North South University
Department of Electrical and Computer Engineering
Course outline of Machine Learning
Course Code: **CSE 445**

Course Outcomes (COs):

Upon successful completion of this course, students will be able to,

Sl.	CO Description	Weightage (%)
1	Explain the procedures for the machine learning algorithms.	20
2	Strategically find the best solution for a problem.	20
3	Apply and analyze appropriate data sets to the Machine Learning algorithms.	20
4	Identify and apply Machine Learning algorithms to solve real world problems.	25
5	Demonstrate experience in building different project-based solutions.	15

Mapping of CO-PO:

Sl.	CO Description	POs	Bloom's taxonomy domain/level	Delivery methods and activities	Assessment tools
CO1	Explain the procedures for the machine learning algorithms.	b	Cognitive/ Apply	Lectures	Quiz, Project
CO2	Strategically find the best solution for a problem.	c	Cognitive/ Create	Lectures	Quiz
CO3	Apply and analyze appropriate data sets to the Machine Learning algorithms.	n	Cognitive/ Understand	Lectures	Quiz
CO4	Identify and apply Machine Learning algorithms to solve real world problems.	f	Cognitive/ Create	Lectures	Project,Dem-onstration
CO5	Demonstrate experience in building different project-based solutions.	a	Cognitive/ Apply	Lectures	Quiz/Exam

Resources:
Textbook:

- **The hundred-page machine learning book** by Andriy Burkov (Andriy Burkov-publisher, 1st Edition), ISBN-13 : 978-1999579500

  - **Reference Books:**

- **Data Mining: Practical Machine Learning Tools and Techniques** by Ian H. Witten, Eibe Frank, and Mark A. Hall (Morgan Kaufmann), 4th Edition, ISBN-13 : 978-0128042915
- **Introduction to Machine Learning with Python: A Guide for Data Scientists** by Andreas C. Müller & Sarah Guido (O'Reilly Media), ISBN-13 : 978-1449369415
- **The Elements of Statistical Learning: Data Mining, Inference, and Prediction** by Trevor Hastie, Robert Tibshirani, and Jerome Friedman (Springer), ISBN-13 : 978-0387848570

North South University
Department of Electrical and Computer Engineering
Course outline of Machine Learning
Course Code: **CSE 445**

- **Pattern Recognition and Machine Learning** by Christopher M. Bishop. (Springer); ISBN-13: 978-0387310732

** Other online resources and supplementary material will be uploaded on the CANVAS/Google Classroom during the relevant class lectures.

Grading policy:
> http://www.northsouth.edu/academic/grading-policy.html

Weightage Distribution among Assessment Tools

Evaluation Type	Marks
Attendance/ participation	05%
Quiz	15%
Project, Presentation and Report	15%
Midterm	30%
Final	35%
Total	100%

[N.B] *This is the conventional (expected) marks distribution of our course. We shall strictly follow the university provided guidelines for Midterm and Final Exam. About quizzes, assignments and project, we shall discuss in the class and figure out the convenient way of assessment.*

North South University

Department of Electrical and Computer Engineering
Course outline of Machine Learning
Course Code: **CSE 445**

Course Outline:

Lecture No.	Topic
1	Introduction
2	Project based ML
3	Multinomial Nayes Bayes Classification
4	Linear Classification
5	Linear Regression and its model
	Tutorial 01
6	Decision trees- PART 1
7	Decision trees- PART 2, Random forest
8	Bias and Variance
9	Validation and CM
10	Logistic Regression
	Tutorial 02
11	**Mid-Term Exam**
12	Multi-class Classification
13	Instance Based Learning
14	K-Nearest Neighbor Algorithm
15	Hierarchical clustering
16	PCA & Autoencoders
17	Kernels and Margins
	Tutorial 03
18	Dimensionality reduction
19	Support Vector Machines
20	Anomaly detection
21	Time-Series Models
	Tutorial 04
22	Reinforcement Learning
23	Review Class
24	**Final Exam**

[N.B] *This does not necessarily mean that, these materials will be covered in the particular lectures. Most likely there are some overlaps. Materials and topics constantly change, and in this class will be no exception. Though quiz schedule has been given by simply dividing the course material into parts but it will be held based on schedule and the topics will be only the studied topics immediately finished before the quiz.*

North South University
Department of Electrical and Computer Engineering
Course outline of Machine Learning
Course Code: **CSE 445**

Assessments: Quizzes >= 3/4, Project/ Presentation => 1, Midterm => 1, Final => 1

Learning Activities: The course will be conducted by following activities

- ✓ Lectures
- ✓ Oral Presentations
- ✓ Group study
- ✓ Assignment
- ✓ Class test
- ✓ Surprise test or Pop Up Quiz **(!!!)**
- ✓ Observation
- ✓ Open discussion
- ✓ Problem solving

Document upload: Class lectures (PPT) and Reference materials will be uploaded in the Google Classroom Group. They can post their queries and discuss about the problem statement. Students are responsible to make them update by following the classroom.