

ISYE 4600 METHODS AND APPLICATIONS OF MACHINE LEARNING

Required/Elective: Concentration Depth for Data Sci and Analytics Concentration

Credit: 3-0-3

Prepared Prof. Yao Xie, Fall 2025

Prerequisite(s): ISYE 3030 BASIC STATISTICAL METHODS and ISYE 3133 ENGINEERING OPTIMIZATION

Catalog Description:

This course introduces the available methods in machine learning, which methods are better in what situations, objective functions and errors, and how to tune parameters.

Text:

No formal textbook will be used.

References:

The course material will be based on the lecture slides provided in the course.

Objective

This course develops an understanding of core ML methods and their practical use in ISyE contexts. Upon completion, students will be able to: Gain a thorough understanding of ML algorithms, use machine learning algorithms and choose the correct ones, and gain experience with analyzing real data.

Topical Outline

The topical outline is shown in the table below. The table has 2 columns. The first column lists the topics to be covered. The second column lists the number of weeks these topics will be covered.

Topics	No of Weeks
Introduction and review of basics	1
Clustering: k-means	1
Dimensionality reduction, PCA	1
Recommender systems	1
Variable/feature selection	1
Model assessment, bias-variance tradeoff	1
Optimization for ML	1

Topics	No of Weeks
Classification: General principle, Bayes	1
Classification: KNN, logistic regression	1
Classification: Support Vector Machines	1
Neural networks and intro. to deep learning	1
Anomaly detection	1
Boosting algorithms	1
Trees & Random Forests	1
Final review	1
Total	15

Software

Python (NumPy, pandas, scikit-learn) will be used for assignments/projects. Use of Jupyter/Colab is encouraged.

Course Learning Outcomes

At the end of this course, students will be able to:

1. Formulate ML problems and select appropriate algorithms.
2. Implement and evaluate ML models using software tools.
3. Analyze data and interpret model outputs with statistical rigor.
4. Communicate ML-driven conclusions for engineering decision-making.

The Mapping from the Course Outcomes to ABET Student Learning Outcomes

The table below shows the relationship between course outcomes and ABET student learning outcomes. The table has 8 columns. The first column lists the course learning outcomes listed above. The next 7 columns list the abbreviated ABET Student Learning Outcomes. The entry of H in a row with specific course learning outcome and column with specific ABET Student Learning Outcomes indicate the importance of attaining this outcome is high and will be assessed.

Course outcome \ Program Outcomes	1. identify, formulate solve engg prob by engg, sci & Math	2. produce solutions consider public health, safety, welfare, global, cultural, social, environ & economic	3 communicate with a range of audience	4 recognize ethical & professional responsibilities, make informed judgement consider resolutions in global, economic, environ and societal context.	5. effective on a team provide leadership, collaborative and inclusive envirm, plan tasks & meet objectives	6. develop and conduct experiment, analyze and interpret data & use engineering judgement to draw conclusions.	7. acquire and apply new knowledge using appropriate learning strategies
1. Formulate/select ML algorithms	H					H	M
2. Implement/evaluate with software	H						
3. Analyze & interpret results						H	
4. Communicate conclusions			H				

Evaluation of the important outcomes

- H will be assessed in the final project.