Course: CSC 462: Machine Learning
Academic Year: 1446 (2024)
Semester: Fall
Instructor: Dr. Sultan Alfarhood
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Instructor's office: 2200

Textbooks

- **The Hundred-Page Machine Learning Book by Andriy Burkov.**
- **Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, 3rd Edition, by by Aurélien Géron**
- The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second edition, by Trevor Hastie, Robert Tibshirani, Jerome Friedman
- Introduction to Machine Learning, third edition by Ethem Alpaydin.

Course Description

This course gives an overview of machine learning concepts, techniques, and algorithms. Topics include Linear Regression, Logistic Regression, Support Vector Machine, Decision Tree Learning, k-Nearest Neighbors, Gradient Descent, Feature Engineering, Cross Validation, Underfitting and Overfitting, Regularization, Model Performance Assessment, Neural Networks, Backpropagation, Convolutional Neural Networks, Ensemble Learning, K-Means & DBSCAN Clustering, PCA, and practical examples.

Course Outcomes:

After completing this course successfully, student should have the following capabilities:

1. Understand the fundamentals of machine learning algorithms, including supervised and some unsupervised learning techniques.
2. Understand how to prepare data for machine learning models utilizing techniques such as feature engineering.
3. Identify and address common challenges in machine learning, such as overfitting, underfitting, and biased data.
4. Know how to evaluate the performance of machine learning models using appropriate metrics and techniques.
5. Gain practical experience implementing machine learning algorithms using popular machine learning libraries and frameworks, such as scikit-learn and TensorFlow.

Prerequisite: CSC 361- Artificial Intelligence

Plan

#	Topics
1	Introduction to machine learning
2	Notation and Definitions
3	Anatomy of a Learning Algorithm + Fundamental Algorithms (Linear Regression, Logistic Regression, Decision Tree Learning, Support Vector Machine, k-Nearest Neighbors)
4	Basic Practice (Feature Engineering, Learning Algorithm Selection, Underfitting and Overfitting, Model Performance Assessment, Regularization, Cross Validation)
5	Neural Networks and Deep Learning
6	Problems and Solutions (Multiclass Classification, One-Class Classification, Multi-Label Classification, Ensemble Learning)
7	Advanced Practice (Imbalanced Datasets, Combining Models, Multiple Outputs, Transfer Learning, Working With Text in ML, Large Language Model (LLM), AutoML, Cloud Computing ML Services)
8	Unsupervised Learning: Clustering, PCA

Assessment Methods & Grades

Homework	20%
Course Project	10%
Midterm Exam	30%
Final Exam	40%

Attendance Policy

Attendance will be taken. The student will be denied final exams if he exceeds 25% absence rate (including the lectures and tutorials). Excuses of absence are accepted no later than one week of the absence.

Homework & Projects

Homework and hands-on projects will be assigned and graded. All homework and projects will be given with a strict deadline, and students are required to submit the homework and projects solutions on or before the deadline. Cheating will not be tolerated.

Midterm Exam

A midterm examination will be given. It will be a closed book and closed note exam.

Final Exam

A comprehensive final examination will be given. It will be a closed book and closed note exam and will cover all course material.