Addis Ababa Science and Technology University

College of Electrical and Mechanical Engineering

Department of Software Engineering

I. Course Title: Introduction to Machine Learning

II. Course Code: SWEG4112

III. Course Description: Machine learning is an exciting and fast-moving field of Software Engineering with many recent consumer applications (e.g., Microsoft Kinect, Google Translate, Iphone's Siri, digital camera face detection, Netflix recommendations, Google news) and applications within the sciences and medicine (e.g., predicting proteinprotein interactions, species modeling, detecting tumors, personalized medicine). This course broadly introduces undergraduate Software Engineering students to the field of machine learning. Students learn about the theoretical foundations of machine learning and how to apply machine learning to solve new problems.

IV. Outline

1. **Overview**
2. **Fundamentals of Machine Learning**
   - Supervised Learning
   - Unsupervised Learning
   - Reinforcement Learning
   - Machine Learning Glossary
   - Categories of supervised and unsupervised algorithms
   - Regression Analysis
3. **Common Issues in machine Learning**
   - Training, Validation and Test datasets
   - Data preprocessing and Feature Engineering
   - Generalization
   - Overfitting and Underfitting

- Techniques to Overcome Overfitting and Underfitting
- Bias and Variance
- Precision and Recall

4. Machine Learning Algorithms for Classification, Non-Linearity and Perceptron in Machine Learning

- Logistic Regression
- Decision Trees
  - ✓Entropy
  - ✓ Information Gain
  - ✓Gini Index
- Naïve Bayes Algorithm
- Support vector machine
- Non-**Linearity and**
- **Perceptron in Machine Learning**

5. Neural Networks

V. Assessments

Test: 15%
Assignments and Practical works: 15%
Project: 20%
Final Exam: 50%

VI. References

1. Pattern Recognition and Machine Learning, Christopher M. Bishop, 2006
2. Understanding Machine Learning: From Theory to Algorithms, Cambridge University Press, Shai Shalev-Shwartz and Shai Ben-David, 2014
3. Bayesian Reasoning and Machine Learning, David Barber, 2014
4. Neural Networks and Deep Learning, Michael Nielsen, 2014
5. Deep Learning, Ian Goodfellow, Yoshua Bengio and Aaron Courville, 2016
6. Dive into Deep Learning, Aston Zhang, Zachary C. Lipton, Mu Li, and Alexander J. Smola, 2022