

DEPARTMENT OF INFORMATION TECHNOLOGY

FACULTY OF COMPUTING

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| MODULE OUTLINE | | | | | |
| Module Name | **Machine Learning** | | | | |
| Module Code | IT4060 | | Version No. | XXXX-X | |
| Year/Level | 4 | | Semester | 1 | |
| Credit Points | XX | | | | |
| Pre-requisites | Basic linear algebra, Calculus, Python | | | | |
| Co-requisites |  | | | | |
| Methods of Delivery | | Lectures (Face-to-face)  Tutorials  Labs | | | 2 Hours/Week  1 Hour/Week  2 Hour/Week |
| Course Web Site | | http://courseweb.sliit.lk/ | | | |
| Date of Original Approval | | <Month, Year> | | | |
| Date of Next Review | | <Month, Year> | | | |

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| MODULE DESCRIPTION | | | | | |
| Introduction | This module intends to familiarize students with the concepts and applications of Machine Learning. It will discuss why machine learning is important in the current applications of Information Technology and different Machine learning algorithms and techniques that may be applied to solve real-world problems that cannot be solved with deterministic algorithms. It will also discuss the limitations and possible future research directions in machine learning. | | | | |
| Learning Outcomes | At the end of the module student will be able to:  **LO1** : Understand the history and background of Machine learning and why they are applicable to solve real-world problems.  **LO2** : Gain an understanding on unsupervised learning techniques.  **LO3** : Gain an understanding on the supervised learning techniques.  **LO4** : Gain an understanding on the reinforcement learning techniques.  **LO5:** Gain an understanding on large scale machine learning systems.  **LO6:** Gain an insight on possible research directions in machine learning | | | | |
| Assessment Criteria | During the semester, there will be one programming assignment and a final exam. The programming assignment will be a mini-project based on a real-world Machine learning problem. The final examination will be a comprehensive exam based on the lecture materials covered during the semester. In addition to that, the weekly lab classes, which are designed to give the students hands on experience on implementing Machine learning algorithms will also be evaluated. | | | | |
| * Continuous Assessments   + Labs | | 10% | | LO2-LO6 |
| * + Assignments | |  | |  |
| * + - Assignment 1 | | 30% | | LO2-LO6 |
|  | |  | |  |
| * End Semester Assessment   + Final Examination | | 60% | | LO1-LO6 |
| TOTAL | | 100% | |  |
| Module Requirement | To pass this module, students need to obtain a pass mark in both “Continuous Assessments” and “End of the Semester Examination” components which would result in an overall mark that would qualify for a “C” grade or above. | | | | |
| Learning Resources | Recommended Texts Python Machine Learning by Sebastian Raschka  * Machine learning by Andrew Ng (online course) | | | | |
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| MODULE ADMINISTRATION PROCEDURE | | | | | |
| **Contact Information** | | | | | |
| Lecturer-in-charge | [dharshana.k@sliit.lk](mailto:dharshana.k@sliit.lk) | | | | |
| Telephone | 0117544140 | E-mail | | [dharshana.k@sliit.lk](mailto:dharshana.k@sliit.lk) | |
| Location | Malabe | | | | |
| Consultation Time | With prior appointment | | | | |

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| **CONTENTS OF THE MODULE** |
| **1. Introduction to Machine Learning**   * Why do we need Machine learning? * Applications of Machine Learning * Supervised and Unsupervised Machine Learning * Classification and Clustering * Reinforcement learning * Basic classification techniques * Regression and Classification * Introduction to scikit-learn toolkit |
| **2. Regression Analysis**   * Linear Regression as a supervised learning technique * Linear Regression with one variable * Linear Regression with Multiple variables * Overfitting and Underfitting * Logistic Regression * Applications of Regression analysis |
| **3. Neural Networks**   * Introduction to Neural Networks as a supervised Learning technique * Representation of Neural Networks * Training Neural Networks * Tuning Neural Networks * Introduction to the backpropagation algorithm * Applications of Neural Networks |
| **4. Deep Neural Networks**   * Convolutional neural networks * Recurrent Neural networks * LSTM * Training DNNs with GPU computing |
| **5. Support Vector Machines**   * Support vector machines as a supervised Machine learning technique * Applications of support vector machines * Kernel Machines * Dimensionality reduction with Principle component analysis |
| **6. Decision trees**   * Univariate trees * Pruning * Rule extraction from trees * Learning rules from data * Random Forest algorithm |
| **7. Unsupervised learning**   * Clustering as a unsupervised learning technique * K-means clustering * Self organizing maps * Deep belief networks |
| **8. Bayesian Models**   * Introduction to Bayesian models * Bayesian estimation of the Parameters of a function * Bayesian classification * Naïve Bayesian classification |
| **9. Hidden Markov Models**   * Introduction to Hidden Markov models * Discrete Markov models * Hidden Markov models * Continuous Observations |
| **10. Combining multiple learners**   * Generating multiple learners * Model combination schemes * Fine-tuning an ensemble |
| **11. Time series analysis**   * ARIMA model |
| **12. Reinforcement learning**   * Elements of reinforcement learning * Model based learning * Temporal difference learning |
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| **13. Large Scale Machine learning**   * Design considerations in large scale machine learning systems * Introduction to apache spark * Machine learning in the Cloud |
| **14. Working with Ontologies**   * Introduction to ontologies * OWL * Querying ontologies * Combining ontologies in Natural Language Processing |

**Generic Information**

Any type of plagiarism is not allowed.

Plagiarism: Academic honesty is crucial to a student’s credibility and self-esteem, and ultimately reflects the values and morals of the Institute as whole. A student may work together with one or a group of students discussing assignment content, identifying relevant references, and debating issues relevant to the subject. Plagiarism occurs when the work of another person, or persons, is used and presented as one’s own.

--------------------------End of Module Outline--------------------------