MACHINE LEARNING

CourseCode: 20CS1107

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Course Outcomes: At the end of the course, the student will be able to:

CO1: Understand the Basics of Learning methods in Machine learning.(L2)
CO2: Interpret various Supervised and statistical Learning techniques. (L3)
CO3: Apply techniques for Feature extraction. (L3)
CO4: Construct models for Classification. (L3)
CO5: Build neural network models. (L3)

UNIT-I: (12 Lectures)

Machine Learning Basics: The Need for Machine Learning. Understanding Machine Learning, Computer Science, Data Science, Artificial Intelligence, Natural Language Processing, Deep Learning, Machine Learning Methods, Semi-Supervised Learning, Reinforcement Learning, Model Based Learning, The CRISP-DM Process Model, Building Machine Intelligence, Real-World Case Study. [Text Book 1]

At the end of the module, students will be able to:

1. Summarize different learning problems with examples. (L2)
2. Explain various forms of learning. (L2)
3. Understand the entire cycle of Learning Process (L2)

UNIT-II (10 Lectures)

Supervised Learning: Learning from Observations, Bias and Variance, Occam's Razor Principle and Overfitting Avoidance, Heuristic Search in Inductive Learning, Estimating Generalization Errors , Statistical Learning: Machine Learning and Inferential Statistical Analysis, Descriptive Statistics in Learning Techniques. .[Text Book 2]

At the end of the module, students will be able to:

1. Understand the concepts of bias and variance.(L2)
2. Understand Descriptive Statistics in Learning Techniques.(L2)
3. Apply Inferential Statistical Analysis

UNIT-III: (10 Lectures)

Feature Engineering: Feature Extraction and Engineering, Feature Engineering on Numeric Data, Feature Engineering on Categorical Data, Feature Engineering on Text Data, Feature Engineering on Temporal Data, Feature Engineering on Image Data, Feature Scaling, Feature Selection.

Dimensionality Reduction: Feature extraction with Principal Component Analysis

[Text Book 1]

Learning Outcomes: At the end of the unit, student will be able to

1. Discuss multiple Feature Extraction Techniques (L2)
2. Apply PCA for Dimensionality reduction(L3)
3. Explain Feature Engineering on Image Data(L2)

UNIT-IV: **(12 Lectures)**

Learning with Support Vector Machines: Introduction, Linear Discriminant Functions for binary classification, Linear maximal margin classifier for linearly separable data, Linear soft margin classifier for overlapping classes, kernel induced feature spaces, nonlinear classifiers, Regression by Support Vector Machines, Decomposing Multiclass Classification Problem into Binary Classification Tasks, Variants of Basic SVM Techniques. .[Text Book 2]

ENSEMBLE METHODS: Bagging, Committee Machines & Stacking, Boosting, Gradient Boosting, Random Forest .[Text Book 2]

At the end of the module, students will be able to:

1. Understand the basics of SVM techniques.(L2)
2. Apply Ensemble methods (L3)
3. Understand the Feature Engineering on Image Data(L2)

UNIT-V **(10 Lectures)**

Learning With Neural Networks:

Towards Cognitive Machine, Neuron Models: Biological Neuron, Artificial Neuron, Mathematical Model, Network Architectures: Feed forward Networks, Recurrent Networks, Perceptron's, Linear Neuron and the Widrow-Hoff Learning Rule, The Error-Correction Delta Rule, Multi-Layer Perceptron (MLP) Networks and the Error-Backpropagation Algorithm, Multi-Class Discrimination with MLP Networks.[Text Book 2]

At the end of the module, students will be able to:

1. Differentiate biological and artificial neurons. (L2)
2. Explain different Neural network architectures.(L2)
3. Apply Back propagation algorithm.(L3)

TEXT BOOKS:

1. Dipanjan Sarkar, Raghav Bali ,Tushar Sharma, *Practical Machine Learning with Python A Problem-Solver's Guide to Building Real-World Intelligent Systems, 2018*
2. Dr. M Gopal, *Applied Machine Learning, 1st Edition, McGraw-Hill,2018*

REFERENCE BOOKS:

1. Tom M. Mitchell, *Machine Learning, McGraw-Hill, 2010*
2. Bishop, Christopher, *Neural Networks for Pattern Recognition ,Oxford University Press, 1995*
3. Ethem Alpaydin, *Introduction to Machine Learning (Adaptive Computation and Machine Learning, The MIT Press,2004*
4. T. astie, R. Tibshirani, J. H. Friedman, *The Elements of Statistical Learning, Springer(2nd ed.), 2009*
5. Aurelien Geron, *Hands-On Machine Learning with Scikit-Learn and TensorFlow, Oreilly, March 2017*

WEB REFEREFENCES:

1. https://www.coursera.org/learn/machine-learning-with-python