# Computer Science and Engineering

1. Subject Code:

TCS 509

1. Contact Hours: L:

3

1. Semester: V

Course Title:

T: P:

2

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**Machine Learning**

1. Pre-requisite: TCS201, TCS421
2. Course Outcomes: After completion of the course students will be able to
   1. Have a good understanding of the fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
   2. Have an understanding of the strengths and weaknesses of many popular machine learning approaches.
   3. Appreciate the underlying relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
   4. Utilize the structure and design concepts of neural networks applications to solve real life problems
   5. Plan and execute successful machine learning and big data projects, including selecting an adequate process for thespecific task and avoiding the machine learning pitfalls.
   6. Understand the issues raised by current research in the field of machine learning
3. Detailed Syllabus

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| **UNIT** | **CONTENTS** | **Contact**  **Hrs** |
| **Unit – I** | **Review of Statistical Concepts:** Mean, Median, Mode, Outliers, Range, Average Deviation, Absolute Deviation, Squared Deviation, Standard Deviation, Total Sum of Squares.  **Review of Linear Algebra:** Vectors and Matrices, Addition and Multiplication of Scalars, Matrix Multiplication Properties, Inverse and Transpose.  **Introduction to Machine Learning:** What is Machine Learning, Introduction to ML's three approaches: Supervised, Unsupervised and Reinforcement Learning.  **Introduction to Matlab/Octave:** Basic Operations, Moving Data Around, Flow Control, Vectorization.  **Introduction to Python:** Basic Operations**,** Lists, Tuples, Dictionaries, Flow  Control, Strings, File handling, Numpy, Scikit-learn, Orange. | **10** |
| **Unit - II** | **Supervised Learning Algorithms:** Linear Regression, Logistic  Regression, Decision Tree, Support Vector Machine, k-NN, Naive Bayes  **Validation Techniques:**  K-Fold Cross Validation, Bootstrapping. | **10** |

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| **Unit – III** | **Ensemble Learning:** Bagging, Random Forest, Boosting - AdaBoost  **Clustering:** K-means, Hierarchical Clustering, Fuzzy c- means, DB Scan  **Feature Engineering:** Dimensionality issues, feature selection & extraction, Low Variance Filter, High Correlation Filter, Feature selection - Component Analysis: PCA, IDA, Discriminant analysis | **8** |
| **Unit – IV** | **Deep Learning:** Introduction to Neural networks,Artificial Neural Networks, CNN, R-CNN, Yolo, Alex Net, Mobile Net, Autoencoder. | **10** |
| **Unit – V** | **Reinforcement Learning:** Agent, Environment, Rewards, States, Actions, Policy, Value, Q-value, Trajectory, Three approaches to Reinforcement Learning, Markov Decision Process, Q - Learning, State-Action-Reward | **10** |
|  | **Total** | **48** |

# Text and Reference Books

1. "Machine Learning For Dummies", John Paul Mueller and Luca Massaron
2. "A Course in Machine Learning", Hal Daumé III.
3. "Programming Collective Intelligence: Building Smart Web 2.0 Applications", Toby Segaran
4. "Building Machine Learning Systems with Python", WilliRichert and Luis Pedro Coelho
5. "Learning scikit-learn: Machine Learning in Python", Raúl Garreta and Guillermo Moncecchi
6. "Machine Learning in Action", Peter Harrington