JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

M. Tech. (Artificial Intelligence)
EFFECTIVE FROM ACADEMIC YEAR 2020 - 21 ADMITTED BATCH
R19 REGULATIONS
COURSE STRUCTURE AND SYLLABUS

I YEAR I – SEMESTER

Course Code	Course Title	L	T	P	Credits
Professional Core – I	Artificial Intelligence and Intelligent Systems	3	0	0	3
Professional Core – II	Statistical Foundations for Artificial Intelligence	3	0	0	3
Professional Elective – I	1. Advanced Data Structures 2. Machine Learning 3. Ad-hoc and Sensor Networks	3	0	0	3
Professional Elective – II	1. Cognitive Systems 2. Game Theory and Applications 3. Computer Vision	3	0	0	3
Lab – I	Artificial Intelligence and Intelligent Systems Lab	0	0	4	2
Lab – II	*Professional Elective- I Lab	0	0	4	2
	Research Methodology & IPR	2	0	0	2
Audit – I	Audit Course – I	2	0	0	0
	Total	**16**	**0**	**8**	**18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – CSE-AI – I Year – I Semester

ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS (PC- I)

Pre-Requisites: UG level course in Mathematics, Data Structures

Course Objectives:

- To impart knowledge about Artificial Intelligence.
- To give understanding of the main abstractions and reasoning for intelligent systems.
- To enable the students to understand the basic principles of Artificial Intelligence in various applications.

Course Outcomes: After completion of course, students would be able to:

- Solve basic AI based problems.
- Define the concept of Artificial Intelligence.
- Apply AI techniques to real-world problems to develop intelligent systems.
- Select appropriately from a range of techniques when implementing intelligent systems.

UNIT - I

Introduction: Overview of AI problems, AI problems as NP, NP-Complete and NP Hard problems. Strong and weak, neat and scruffy, symbolic and sub-symbolic, knowledge-based and data-driven AI.

UNIT - II

Search Strategies: Problem spaces (states, goals and operators), problem solving by search, Heuristics and informed search, Minmax Search, Alpha-beta pruning. Constraint satisfaction (backtracking and local search methods).

UNIT - III

Knowledge representation and reasoning: propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem. Totally-ordered and partially-ordered Planning. Goal stack planning, Nonlinear planning, Hierarchical planning.

UNIT - IV

Knowledge representation and reasoning: propositional and predicate logic, Resolution and theorem proving, Temporal and spatial reasoning. Probabilistic reasoning, Bayes theorem. Totally-ordered and partially-ordered Planning. Goal stack planning, Nonlinear planning, Hierarchical planning.

UNIT - V

Agents: Definition of agents, Agent architectures (e.g., reactive, layered, cognitive), Multi-agent systems-Collaborating agents, Competitive agents, Swarm systems and biologically inspired models. Intelligent Systems: Representing and Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition. Key Application Areas: Expert system, decision support systems, Speech and vision, Natural language processing, Information Retrieval, Semantic Web.

References:

1. Artificial Intelligence by Elaine Rich, Kevin Knight and Shivashankar B Nair, Tata McGraw Hill.
2. Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, Pearson Education.
3. Artificial Intelligence: A Modern Approach by S. Russell and P. Norvig, Prentice Hall

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – CSE-AI – I Year – I Semester

STATISTICAL FOUNDATIONS OF ARTIFICIAL INTELLIGENCE (PC - II)

Pre-Requisites: UG level course in Mathematics, Probability and Statistics

Course Objectives:

- The course provides comprehensive introduction to probabilistic graphical models.

Course Outcomes: After completion of course, students would be able to:

- To model problems using graphical models
- Design inference algorithms
- Learn the structure of the graphical model from data.

UNIT - I

Fundamentals: Introduction to regression and classification, Formalizing a learning task, experience, reward, Gaussian noise and linear least-square fit, A taste of Bayesian learning, Hypothesis, prior and posterior distributions, Posterior distribution and prediction, Point estimates of posterior e.g. MAP Minimum description length and MAP, Back to regression: linear least-square with square regularizer.

UNIT - II

Linear least square demo, Ridge penalty, Lasso and its quadratic program, Contrast between Ridge and Lasso, model sparsity, From regression to classification, Loss functions for classification and regression "True loss" and various approximations, Square loss and its limitations, Choice of discriminant functions Class density and class discrimination, Discriminants for multivariate Gaussian densities

UNIT - III

Eigen-SVD connection, SVD demo with low-rank plus noise matrix, Connection between SVD and (regularized) least square, Principal Component Analysis, Linear discriminants and fitting criteria Hill-climbing, step size, and Newton method, Derivation of the Perceptron from gradient descent considerations, Kernel regression and kernel density estimation

UNIT - IV

Basic SVM QP for separable problems, scilab, Inseparable problems and hinge loss, Smooth approximations to hinge loss, direct primal optimization, Primal-dual, Gordan's theorem, KKT necessary conditions, Lagrangian saddlepoint, Dual and Lagrangian, dualizing basic SVM

UNIT - V

Dual QP optimization, Using non-linear kernels with the dual formulation, Dual with kernels, scilab demo Lagrangian support vector machines, Lagrangian and proximal support vector machines, Finite Newton optimization

Text Books:

1. The Elements of Statistical Learning, Hastie, Tibshirani, Friedman
2. Pattern Classification, 2nd Edition, Duda, Hart and Stork, Wiley-Interscience

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ADVANCED DATA STRUCTURES (Professional Elective- I)

Pre-Requisites: UG level course in Data Structures
Course Objectives:

- The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
- Students should be able to understand the necessary mathematical abstraction to solve problems.
- To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.
- Student should be able to come up with analysis of efficiency and proofs of correctness.

Course Outcomes: After completion of course, students would be able to:

- Understand the implementation of symbol table using hashing techniques.
- Understand the implementation of symbol table using hashing techniques.
- Develop algorithms for text processing applications.
- Identify suitable data structures and develop algorithms for computational geometry problems.

UNIT - I
Dictionaries: Definition, Dictionary, Abstract Data Type, Implementation of Dictionaries.
Hashing: Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Extendible Hashing.

UNIT - II
Skip Lists: Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists.

UNIT - III
Trees: Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees

UNIT - IV
Text Processing: Sting Operations, Brute-Force Pattern Matching, The Boyer- Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem

UNIT - V
Computational Geometry: One Dimensional Range Searching, Two-Dimensional Range Searching, constructing a Priority, Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees. Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem

References:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – CSE-AI – I Year – I Semester

MACHINE LEARNING (Professional Elective - I)

Course Objectives:

- To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
- To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
- Explore supervised and unsupervised learning paradigms of machine learning.
- To explore Deep learning technique and various feature extraction strategies.

Course Outcomes: After completion of course, students would be able to:

- Extract features that can be used for a particular machine learning approach in various IOT applications.
- To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
- To mathematically analyse various machine learning approaches and paradigms.

UNIT - I

Introduction to Machine Learning: Problems, data, and tools, Visualization tools, Decision Tree Learning, Artificial Neural Networks, Bayesian Learning, Deep Learning, Instance-Based Learning,

UNIT – II

Regression Techniques: Linear regression, SSE, gradient descent, closed form, normal equations, features, Overfitting and complexity, training, validation, test data, Classification problems, decision boundaries, nearest neighbor methods, Probability and classification, Bayes optimal decisions, Naive Bayes and Gaussian class-conditional distribution

UNIT - III

Linear classifiers: Bayes Rule and Naive Bayes Model, Logistic regression, online gradient descent, Kernel Methods, Radial Basis Function Networks, Support Vector Machines, Genetic Algorithms, Reinforcement Learning

UNIT - IV

Ensemble methods: Bagging, random forests, boosting Unsupervised learning: clustering, k-means, hierarchical agglomeration

UNIT - V

Latent space method:, PCA, Text representations, naive Bayes and multinomial models, clustering and latent space models, VC-dimension, structural risk minimization, margin methods and support vector machines (SVM), Machine Learning Applications.

Text Books:

1. Introduction to Machine Learning by Ethem Alpaydin, PHI Learning.
2. Machine Learning: An Algorithmic Perspective by Stephen Marsland, Chapman and Hall/CRC.
3. Pattern Recognition and Machine Learning by Christopher M. Bishop, Springer.
4. Machine Learning by Tom Mitchell, McGraw Hill Education

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M. Tech – CSE-AI – I Year – I Semester

AD-HOC AND SENSOR NETWORKS (Professional Elective - I)

Prerequisites: Computer Networks

Course Objectives:

- To understand the concepts of sensor networks
- To understand the MAC and transport protocols for adhoc networks
- To understand the security of sensor networks
- To understand the applications of adhoc and sensor networks

UNIT - I:

Introduction to Ad Hoc Wireless Networks: Characteristics of MANETs, Applications of MANETs, Challenges. Routing in MANETs: Topology-based versus Position-based approaches, Topology based routing protocols, Position based routing, Other Routing Protocols.

UNIT - II:

Data Transmission In MANETs: The Broadcast Storm, Multicasting, Geocasting TCP over Ad Hoc Networks: TCP Protocol overview, TOP and MANETs, Solutions for TOP over Ad Hoc

UNIT - III:

Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design issues, Energy consumption, Clustering of Sensors, Applications
Data Retrieval In Sensor Networks: Classification of WSNs, MAC layer, Routing layer, High-level application layer support, Adapting to the inherent dynamic nature of WSNs.

UNIT - IV:

Security: security in ad-hoc wireless networks, key management, secure routing cooperation in MANETs, instruction detection system. Sensor network platforms and tools: Sensor network hardware, sensor network programming challenges, Node-Level software Platforms

UNIT - V:

Operating system-TinyOS Imperative language: nesC, Dataflow style language: TinyGALS, Node-level Simulators, ns-2 and its sensor networks extension, TOSSIM.

Text Books:

1. Ad Hoc and Sensor Networks — Theory and Applications, Car/os Corderlo Dharma R Aggarwal, World Scientific Publications /Cambridge University Press, March 2006
2. Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science imprint, Morgan Kauffman Publishers, 2005, rp 2009.

References:

1. Adhoc Wireless Networks — Architectures and Protocols, C.Siva Ram Murthy, B.S.Murthy, Pearson Education, 2004
2. Wireless Sensor Networks — Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, Taylor & Francis Group, 2010
3. Wireless Ad hoc Mobile Wireless Networks — Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
4. Ad hoc Networking, Charles E.Perkins, Pearson Education, 2001.

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COGNITIVE SYSTEMS (Professional Elective - II)

Prerequisites: Probability theory

Course Objectives:

- To provide an understanding of the central challenges in realizing aspects of human cognition.
- To provide a basic exposition to the goals and methods of human cognition.
- To develop algorithms that use AI and machine learning along with human interaction and feedback to help humans make choices/decisions.
- To support human reasoning by evaluating data in context and presenting relevant findings along with the evidence that justifies the answers.

Course Outcomes:

- Understand what cognitive computing is, and how it differs from traditional approaches.
- Plan and use the primary tools associated with cognitive computing.
- Plan and execute a project that leverages cognitive computing.
- Understand and develop the business implications of cognitive computing.

UNIT - I

Introduction to Cognitive Science: Understanding Cognition, IBM's Watson, Design for Human Cognition, Augmented Intelligence, Cognition Modeling Paradigms: Declarative/ logic-based computational cognitive modeling, connectionist models of cognition , Bayesian models of cognition, a dynamical systems approach to cognition

UNIT - II

Cognitive Models of memory and language, computational models of episodic and semantic memory, modeling psycholinguistics

UNIT - III

Cognitive Modeling: modeling the interaction of language, memory and learning, Modeling select aspects of cognition classical models of rationality, symbolic reasoning and decision making

UNIT - IV

Formal models of inductive generalization, causality, categorization and similarity, the role of analogy in problem solving, Cognitive Development Child concept acquisition. Cognition and Artificial cognitive architectures such as ACT-R, SOAR, OpenCog, CopyCat, Memory Networks

UNIT - V

DeepQA Architecture, Unstructured Information Management Architecture (UIMA), Structured Knowledge, Business Implications, Building Cognitive Applications, Application of Cognitive Computing and Systems

Text Books:

1. The Cambridge Handbook of Computational Psychology by Ron Sun (ed.), Cambridge University Press.
2. Formal Approaches in Categorization by Emmanuel M. Pothos, Andy J. Wills, Cambridge University Press.
3. Cognition, Brain and Consciousness: Introduction to Cognitive Neuroscience by Bernard J. Bears, Nicole M. Gage, Academic Press.
4. Cognitive Computing and Big Data Analytics by Hurwitz, Kaufman, and Bowles, Wiley

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GAME THEORY AND APPLICATIONS (Professional Elective - II)

Prerequisites: Graph Theory

Course Objectives:

- To teach students some strategic considerations to take into account making their choices.
- To learn basic concepts of game theory.
- To apply game theoretic models to real world problems

Course Outcomes:

- Solve strategic games between two and more agents in non-cooperative scenario.
- Analyze and solve both simultaneous-moves and sequential-moves games.
- Learn different methods to solve games.

UNIT - I

Introduction: games and decisions, Games Strategies, Costs and Payoff, Basic Solution Concepts, Finding equilibria and Learning in Games

UNIT - II

Zero-Sum Games: secure strategy, Maximin, Maximax, and Minimax Regret Solvability, value of a game. Normal form games: dominance, iterated dominance, Nash equilibrium. N-player games, mixed strategy nash equilibria.

UNIT - III

Graphical Games: Computing Nash, equilibria in Tree Graphical Games, Graphical Games and correlated Equilibria. Extensive form games: subgame perfection, sequential equilibrium, Stackelberg Model of Duopoly, Buying Votes, Committee Decision-Making. Bargaining: Rubinstein bargaining, Nash bargaining.

UNIT - IV

Repeated Games: Folk theorem and repeated prisoner's dilemma. Tacit collusion. Incomplete information games: Bayesian equilibrium, higher order beliefs.

UNIT - V

Auctions and Mechanism Design: Basic auctions, voting, Vickrey-Clarke-Groves Auction. Cryptography and Game theory: cryptographic influence on game theory and Game theoretic influence on cryptography

Text Books:

1. A Course in Game Theory by M. J. Osborne & A. Rubinstein, MIT Press.
2. Algorithmic Game Theory by N. Nisan, T. Rougharden, E. Tardos and V. V. Vazirani, Cambridge University Press.
3. Game Theory and Applications by Tatsuro Ichiishi, Abraham Neyman and Yair Tauman, Elsevier.
4. Essentials of Game Theory: A Concise, Multidisciplinary Introduction by K. Leyton-Brown and Y.Shoham, Morgan & Claypool Publishers.

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COMPUTER VISION (Professional Elective - II)

Prerequisites: Graph Theory

Course Objectives:

- To study the development of algorithms and techniques to analyze and interpret the visible world around us.
- Be familiar with both the theoretical and practical aspects of computing with images.
- To understand the basic concepts of Computer Vision.
- Understand the geometric relationships between 2D images and the 3D world.
- Ability to apply the various concepts of Computer Vision in other application areas.

Course Outcomes:

- Understand the fundamental problems of computer vision.
- Implement various techniques and algorithms used in computer vision.
- Analyze and evaluate critically the building and integration of computer vision algorithms.
- Demonstrate awareness of the current key research issues in computer vision

UNIT - I

Digital Image Formation and low-level processing: Overview and State-of-the-art, Fundamentals of Image Formation, Transformation: Orthogonal, Euclidean, Affine, Projective, etc; Fourier Transform, Convolution and Filtering, Image Enhancement, Restoration, Histogram Processing.

UNIT - II

Depth estimation and Multi-camera views: Perspective, Binocular Stereopsis: Camera and Epipolar Geometry; Homography, Rectification, DLT, RANSAC, 3-D reconstruction framework; Auto-calibration.
Feature Extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF, HOG, GLOH, Scale-Space Analysis- Image Pyramids and Gaussian derivative filters, Gabor Filters and DWT.

UNIT - III

Image Segmentation: Region Growing, Edge Based approaches to segmentation, Graph-Cut, Mean-Shift, MRFs, Texture Segmentation; Object detection.
Clustering: K-Means, K-Medoids, Mixture of Gaussians, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN, ANN models; Dimensionality Reduction: PCA, LDA, ICA; Non-parametric methods.

UNIT - IV

Motion Analysis: Background Subtraction and Modeling, Optical Flow, KLT, Spatio-Temporal Analysis, Dynamic Stereo; Motion parameter estimation.

UNIT - V

Shape from X: Light at Surfaces; Phong Model; Reflectance Map; Albedo estimation; Photometric Stereo; Use of Surface Smoothness Constraint; Shape from Texture, color, motion and edges.
Applications: CBIR, CBVR, activity recognition, computational photography, biometrics, stitching and document processing. Recent Trends: 3-D Printing, 3-D sensing, simultaneous location and mapping, GPU, edge-computing, augmented reality, virtual reality cognitive models, fusion and super resolution.

Text Books:

1. Computer Vision: Algorithms and Applications by Richard Szeliski, Springer-Verlag.

2. Computer Vision: A Modern Approach by D. A. Forsyth and J. Ponce, Pearson Education.
3. Multiple View Geometry in Computer Vision by Richard Hartley and Andrew Zisserman, Cambridge University Press.
4. Introduction to Statistical Pattern Recognition by K. Fukunaga, Academic Press, Morgan Kaufmann.
5. Digital Image Processing by R.C. Gonzalez and R.E. Woods, PHI.

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ARTIFICIAL INTELLIGENCE AND INTELLIGENT SYSTEMS LAB

Course Objectives:

- To provide skills for designing and analyzing AI based algorithms.
- To enable students to work on various AI tools.
- To provide skills to work towards solution of real-life problems

Course Outcomes:

- Elicit, analyze and specify software requirements.
- Simulate given problem scenario and analyze its performance.
- Develop programming solutions for given problem scenario.

List of Programs

1. Installation and working on various AI tools viz. Python, R tool, GATE, NLTK, MATLAB, etc.
2. Data preprocessing and annotation and creation of datasets.
3. Learn existing datasets and Treebanks
4. Implementation of searching techniques in AI.
5. Implementation of Knowledge representation schemes.
6. Natural language processing tool development.
7. Application of Machine learning algorithms.
8. Application of Classification and clustering problem.
9. Working on parallel algorithms.
10. Scientific distributions used in python for Data Science - Numpy, scify, pandas, scikitlearn, statmodels, nltk.

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M. Tech – CSE-AI – I Year – I Semester

ADVANCED DATA STRUCTURES LAB

Prerequisites: A course on Computer Programming & Data Structures

Course Objectives:

- Introduces the basic concepts of Abstract Data Types.
- Reviews basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs, and B-trees.
- Introduces sorting and pattern matching algorithms.

Course Outcomes:

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and pattern matching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and B-trees.

List of Programs

1. Write a program to perform the following operations:
   a) Insert an element into a binary search tree.
   b) Delete an element from a binary search tree.
   c) Search for a key element in a binary search tree.

2. Write a program for implementing the following sorting methods:
   a) Merge sort b) Heap sort c) Quick sort

3. Write a program to perform the following operations:
   a) Insert an element into a B- tree.
   b) Delete an element from a B- tree.
   c) Search for a key element in a B- tree.

4. Write a program to perform the following operations:
   a) Insert an element into a Min-Max heap
   b) Delete an element from a Min-Max heap
   c) Search for a key element in a Min-Max heap

5. Write a program to perform the following operations:
   a) Insert an element into a Lefiist tree
   b) Delete an element from a Leftist tree
   c) Search for a key element in a Leftist tree

6. Write a program to perform the following operations:
   a) Insert an element into a binomial heap
   b) Delete an element from a binomial heap.
   c) Search for a key element in a binomial heap

7. Write a program to perform the following operations:
   a) Insert an element into a AVL tree.

b) Delete an element from a AVL search tree.
c) Search for a key element in a AVL search tree.

8. Write a program to perform the following operations:
   a) Insert an element into a Red-Black tree.
   b) Delete an element from a Red-Black tree.
   c) Search for a key element in a Red-Black tree.

9. Write a program to implement all the functions of a dictionary using hashing.

10. Write a program for implementing Knuth-Morris-Pratt pattern matching algorithm.

11. Write a program for implementing Brute Force pattern matching algorithm.

12. Write a program for implementing Boyer pattern matching algorithm.

Text Books:

1. Fundamentals of Data structures in C, E. Horowitz, S. Sahni and Susan Anderson Freed, 2nd Edition, Universities Press
2. Data Structures Using C – A.S. Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.
3. Introduction to Data Structures in C, Ashok Kamthane, 1st Edition, Pearson.

References:

1. The C Programming Language, B.W. Kernighan, Dennis M. Ritchie, PHI/Pearson Education
2. C Programming with problem solving, J.A. Jones & K. Harrow, Dreamtech Press
3. Data structures: A Pseudocode Approach with C, R.F. Gilberg And B. A. Forouzan, 2nd Edition, Cengage Learning.

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MACHINE LEARNING LAB

Course Objective:

1. The objective of this lab is to get an overview of the various machine learning techniques and can able to demonstrate them using python.

Course Outcomes: After the completion of the "**Machine Learning**" lab, the student can able to:

1. Understand complexity of Machine Learning algorithms and their limitations;
2. Understand modern notions in data analysis-oriented computing;
3. Be capable of confidently applying common Machine Learning algorithms in practice and implementing their own;
4. Be capable of performing experiments in Machine Learning using real-world data.

List of Experiments

1. The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is theprobability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. (Ans: 15%)
2. Extract the data from database using python
3. Implement k-nearest neighbours classification using python
4. Given the following data, which specify classifications for nine combinations of VAR1 and VAR2 predict a classification for a case where VAR1=0.906 and VAR2=0.606, using the result of k-means clustering with 3 means (i.e., 3 centroids)

VAR1	VAR2	CLASS
1.713	1.586	0
0.180	1.786	1
0.353	1.240	1
0.940	1.566	0
1.486	0.759	1
1.266	1.106	0
1.540	0.419	1
0.459	1.799	1
0.773	0.186	1

5. The following training examples map descriptions of individuals onto high, medium and low credit-worthiness.

medium skiing designsingle twenties no -> highRisk
high golf trading married forties yes -> lowRisk
low speedway transport married thirties yes -> medRisk
medium football banking single thirties yes -> lowRisk
high flying media married fifties yes -> highRisk
low football security single twenties no -> medRisk
medium golf media single thirties yes -> medRisk
medium golf transport married forties yes -> lowRisk
high skiing banking single thirties yes -> highRisk
low golf unemployed married forties yes -> highRisk

Input attributes are (from left to right) income, recreation, job, status, age-group, home-owner. Find the unconditional probability of `golf' and the conditional probability of `single' given `medRisk' in the dataset?

6. Implement linear regression using python.
7. Implement Naïve Bayes theorem to classify the English text
8. Implement an algorithm to demonstrate the significance of genetic algorithm
9. Implement the finite words classification system using Back-propagation algorithm

Text Books:

1. Machine Learning – Tom M. Mitchell, MGH
2. Fundamentals of Speech Recognition By Lawrence Rabiner and Biing – Hwang Juang.

Reference Book:

1. Machine Learning: An Algorithmic Perspective, Stephen Marsland, Taylor & Francis

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ADHOC AND SENSOR NETWORKS LAB (Professional Elective Lab - I)

Course Outcomes: At the end of this course, students will be able to
Implement the advanced digital modulation techniques.

1. Design Convolutional encoder and decoder for error control coding techniques.
2. Calculate path loss for Free space, Okumura and Hata models for outdoor propagation.
3. Comprehend Cellular concepts of GSM and CDMA networks.
4. Simulate RAKE receiver for CDMA with MATLAB.

List of Experiments:

1. FSK Modulation and Demodulation technique.
2. QPSK Modulation and Demodulation technique.
3. DQPSK Modulation and Demodulation technique
4. 8-QAM Modulation and Demodulation technique.
5. Implementation of Convolutional Encoder and Decoder.
6. Simulation of the following Outdoor Path loss propagation models using MATLAB.
    a. Free Space Propagation model b. Okumura model
    b. Hata model
7. Simulation of Adaptive Linear Equalizer using MAT LAB software.
8. Measurement of call blocking probability for GSM &CDMA networks using Netsim software.
9. Study of GSM handset for various signalling and fault insertion techniques (Major GSM handset sections: clock, SIM card, charging, LCD module, Keyboard, User interface).
10. Study of transmitter and receiver section in mobile handset and measure frequency band signal and GMSK modulating signal.
11. Simulation of RAKE Receiver for CDMA communication using MAT LAB software.
12. Simulate and test various types of PN codes, chip rate, spreading factor and processing gain on performance of DSSS in CDMA.
13. Simulate and test the 3G Network system features using GSM AT Commands. (Features of 3G Communication system: Transmission of voice, video calls, SMS, MMS,TCP/IP,HTTP,GPS)
14. Modelling of communication system using Simulink.

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RESEARCH METHODOLOGY & IPR

Prerequisite: None

Course Objectives:

- To understand the research problem
- To know the literature studies, plagiarism and ethics
- To get the knowledge about technical writing
- To analyze the nature of intellectual property rights and new developments
- To know the patent rights

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT- I:
Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT- II:
Effective literature studies approaches, analysis, Plagiarism, Research ethics

UNIT- III:
Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

UNIT- IV:
Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT- V:
Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Text Books:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”

References:

1. Ranjit Kumar, 2nd Edition, “Research Methodology: A Step by Step Guide for beginners”
2. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
3. Mayall, “Industrial Design”, McGraw Hill, 1992.
4. Niebel, “Product Design”, McGraw Hill, 1974.
5. Asimov, “Introduction to Design”, Prentice Hall, 1962.
6. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “Intellectual Property in New Technological Age”, 2016.
7. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008