RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

CSE-Artificial Intelligence and Machine Learning/ Artificial Intelligence and Machine Learning, V-Semester

Open Elective AL504 (A) AI in Health Care

Course Objective: The students should be able to understand how AI is transforming the practice of medicine. The students should learn the practical experience in applying machine learning to concrete problems in medicine. Detailed contents:

Unit I: Disease detection with computer vision Medical Image Diagnosis, Eye Disease and Cancer Diagnosis, Building and Training a Model for Medical Diagnosis, Training, prediction, and loss, ImageClassification and Class Imbalance, Generating More Samples, Model Testing

Unit II: Evaluating models Sensitivity, Specificity, and Evaluation Metrics, Accuracy in terms of conditional probability, Confusion matrix, ROC curve and Threshold Image segmentation on MRI images Medical Image Segmentation, MRI Data and Image Registration, Segmentation, 2D U-Net and 3D U-Net Data augmentation and loss function for segmentation, Different Populations and DiagnosticTechnology, External validation.

Unit III: Linear prognostic models Medical Prognosis, Atrial fibrillation, Liver Disease Mortality, Risk of heart disease, Evaluating Prognostic Models, Concordant Pairs, Risk Ties, Permissible Pairs. Prognosis with Tree-based models Decision trees for prognosis, fix overfitting, Different distributions,Missing Data example, Imputation.

Unit IV: Survival Models and Time Survival Model, Survival function, collecting time data, estimating the survival function. Build a risk model using linear and tree-based models Hazard Functions, Relativerisk, Individual vs. baseline hazard, Survival Trees, Nelson Aalen estimator.

Unit V: Medical Treatment Effect Estimation Analyze data from a randomized control trial, Average treatment effect, Conditional average treatment effect, T-Learner, S-Learner, C-for-benefit.

Text Books/Suggested References:

1. https://www.coursera.org/learn/ai-for-medical-diagnosis
2.https://www.coursera.org/learn/ai-for-medical-prognosis#syllabus
3. https://www.coursera.org/learn/ai-for-medical-treatment#syllabus
4. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, BasicBooks, 1st edition 2019.
5. Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st ed. Edition, 2019. 6. Artificial Intelligence in Healthcare, 2020, ISBN 978-0-12-818438-7,Elsevier Inc

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Open Elective AL 504 (B) Natural Language Processing

COURSE OBJECTIVES: Students should develop a basic understanding in natural language processing methods and strategies and to evaluate the strengths and weaknesses of various Natural Language Processing (NLP) methods & technologies and gain an insight into the application areas of Natural language processing.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Define different data models used in Information Retrieval using NLP.
2. Demonstrate current methods for statistical approaches to machine translation.
3. Apply syntactic parsing and semantic analysis on text.
4. Solve and implement real world problems using NLP.

Detailed Contents:

UNIT I:Introduction: Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance.

UNIT II:Word Level Analysis: Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models,Viterbi algorithms and EM training.

UNIT III:Syntactic Analysis: Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs – Feature structures, Unification of feature structures.

UNIT IV:Semantics and Pragmatics: Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.Compositional semantics.

UNIT V:Application of NLP: intelligent work processors: Machine translation, user interfaces,Man-Machine interfaces, natural language querying, tutoring and authoring systems, speechrecognition, and commercial use of NLP.

Text Books:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, OReilly Media.
3. Manning and Schutze "Foundations of Statistical Natural Language Processing", MIT Press.

Reference Books:

1. Breck Baldwin, Language Processing with Java and LingPipe Cookbook, Atlantic Publisher.
2. Richard M Reese, Natural Language Processing with Java, OReilly Media.
3. Nitin Indurkhya and Fred J. Damerau, Handbook of Natural Language Processing, Chapman and Hall/CRC Press.
4. Tanveer Siddiqui, U.S. Tiwary, Natural Language Processing and Information Retrieval, Oxford University Press.

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CSE-Artificial Intelligence and Machine Learning/ Artificial Intelligence and Machine Learning, V-Semester

Open Elective AL 504 (C) Computational Intelligence

COURSE OBJECTIVES:

1. To introduce basic concepts, theories and techniques of computational intelligence.
2. Help students to learn the applications of computational intelligence techniques in the diverse fields of science, engineering, medicine, finance etc.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Describe in-depth about theories, methods, and algorithms in computational Intelligence.
2. Compare and contrast traditional algorithms with nature inspired algorithms.
3. Examine the nature of a problem at hand and determine whether a computational intelligent technique/algorithm can solve it efficiently enough.
4. Design and implement Computation Intelligence algorithms and approaches for solving real-life problems.

Unit1: Introduction to Computational Intelligence (CI): Basics of CI, History of CI, Adaptation, Learning, Self-Organization, State Space Search and Evolution, CI and Soft Computing, CI Techniques; Applications of CI; Decision Trees: Introduction, Evaluation, Different splitting criterion, Implementation aspect of decision tree. Neural Network: Introduction, types, issues, implementation, applications.

Unit II: Fuzzy Set Theory: Fuzzy Sets, Fuzzy Set Characteristics, Basic Definition and Terminology, Fuzzy Operators,Fuzzy Relations and Composition, Member Function Formulation, Fuzzy Rules and Fuzzy Reasoning, Extension, Fuzzy Inference Systems, Input Space Partitioning and Fuzzy Modeling. Fuzziness and Defuzzification, Fuzzy Controllers, Different Fuzzy Models: Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models etc. Neuro Fuzzy Modeling, Introduction to Neuro Fuzzy Control.

Unit III: Rough Set Theory: Introduction, Fundamental Concepts, Knowledge Representation, Set Approximations and Accuracy, Vagueness and Uncertainty in Rough Sets, Rough Membership Function, Attributes Dependency and Reduction, Application Domain, Hidden Markov Model (HMM), Graphical Models, Variable Elimination, Belief Propagation, Markov Decision Processes.

Unit IV: Evolutionary Computation: Genetic Algorithms: Basic Genetics, Concepts, Working Principle, Creation of Offsprings, Encoding, Fitness Function, Selection Functions, Genetic Operators-Reproduction, Crossover, Mutation; Genetic Modeling, Benefits; Problem Solving; Introduction to Genetic Programming, Evolutionary Programming, and Evolutionary Strategies.

Unit V: Swarm Intelligence: Introduction to Swarm Intelligence, Swarm Intelligence Techniques: Ant Colony Optimization (ACO): Overview, ACO Algorithm; Particle Swarm Optimization (PSO): Basics, Social Network Structures, PSO Parameters and Algorithm; Grey wolf optimization(GWO); Application Domain of ACO and PSO; Bee Colony Optimization etc.; Hybrid CI Techniques and applications; CI Tools.

Reference Books:

1. Russell C. Eberhart and Yuhui Shi, Computational Intelligence: Concepts to Implementations, Morgan Kaufmann Publishers.
2. Andries P. Engelbrecht, Computational Intelligence: An Introduction, Wiley Publishing.
3. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning, Pearson Education.
4. Jagdish Chand Bansal, Pramod Kumar Singh, Nikhil R. Pal, Evolutionary and Swarm Intelligence Algorithms, Springer Publishing.
5. S. Rajasekaran, G.A. VijayalakshmiPai, "Neural Networks, Fuzzy Logic, Genetic Algorithms Synthesis and Applications", PHI.
6. Fuzzy Logic with Engineering Applications, Timothy J. Ross,McGraw-Hill.
7. NeuralNetworks: A Comprehensive Foundation, SimonHaykin, Prentice Hall