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

Departmental Elective AL503 (A) Information Retrieval

UNIT-I: Introduction - History of IR- Components of IR - Issues -Open source Search engine Frameworks - The Impact of the web on IR - The role of artificial intelligence (AI) in IR – IR Versus Web Search - Components of a search engine, Characterizing the web.

UNIT –II: Boolean and Vector space retrieval models- Term weighting - TF-IDF weighting-cosinesimilarity - Preprocessing - Inverted indices - efficient processing with sparse vectors LanguageModel based IR - Probabilistic IR -Latent Semantic indexing - Relevance feedback and queryexpansion.

UNIT- III: Web search overview, web structure the user paid placement search engine optimization, WebSearch Architectures - crawling - meta-crawlers, Focused Crawling - web indexes - Nearduplicate detection - Index Compression - XML retrieval.

UNIT –IV: Link Analysis -hubs and authorities - Page Rank and HITS algorithms -Searching and Ranking -Relevance Scoring and ranking for Web - Similarity - Hadoop & Map Reduce - Evaluation -Personalized search - Collaborative filtering and content-based recommendation of documentsAnd products - handling invisible Web - Snippet generation, Summarization. Question
Answering, Cross-Lingual Retrieval.

UNIT –V: Information filtering: organization and relevance feedback - Text Mining- Text classification andclustering - Categorization algorithms, naive Bayes, decision trees and nearest neighbor -Clustering algorithms: agglomerative clustering, k-means, expectation maximization (EM).

References:

1. C. Manning, P. Raghvan and H Schutze: Introduction to Information Retrieval, Cambridge University Press.
2. Ricardo Baeza Yates and Berthier Ribeiro Neto, Modern Information Retrieval :The Concepts and Technology behind Search, ACM Press Books.
3. Bruce Croft, Donald Metzler and Trevor Strohman,Search Engines Information Retrieval in Practice, Addison Wesley.
4.Mark Levene, An Introduction to Search Engines and Web Navigation, Wiley.

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

Departmental Elective AL 503 (B) Deep Learning

COURSE OBJECTIVES: Introduce deep learning fundamentals and major algorithms, the problem settings, and their applications to solve real world problems.

COURSE OUTCOMES:

After completing the course student should be able to:

1. Describe in-depth about theories, fundamentals, and techniques in Deep learning.
2. Identify the on-going research in computer vision and multimedia field.
3. Evaluate various deep networks using performance parameters.
4. Design and validate deep neural network as per requirements.

Unit I: Introduction History of Deep Learning, McCulloch Pitts Neuron, Multilayer Perceptions (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed Forward Neural Networks, Back propagation, weight initialization methods, Batch Normalization, Representation Learning, GPU implementation, Decomposition – PCA and SVD.

Unit II: Deep Feedforward Neural Networks, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, Adam, RMSProp, Auto-encoder, Regularization in auto-encoders, Denoising auto-encoders, Sparse auto-encoders, Contractive auto-encoders,Variational auto-encoder, Auto-encoders relationship with PCA and SVD, Dataset augmentation.Denoising auto encoders,

Unit III: Introduction to Convolutional neural Networks (CNN) and its architectures, CCN terminologies: ReLu activation function, Stride, padding, pooling, convolutions operations, Convolutional kernels, types of layers: Convolutional, pooling, fully connected, Visualizing CNN, CNN examples: LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, RCNNetc. Deep Dream, Deep Art. Regularization: Dropout, drop Connect, unit pruning, stochastic pooling, artificial data, injecting noise in input, early stopping, Limit Number of parameters, Weight decay etc.

Unit IV: Introduction to Deep Recurrent Neural Networks and its architectures, Backpropagation Through Time (BPTT), Vanishing and Exploding Gradients, Truncated BPTT, Gated Recurrent Units (GRUs), Long Short Term Memory (LSTM), Solving the vanishing gradient problem with LSTMs, Encoding and decoding in RNN network, Attention Mechanism, Attention over images, Hierarchical Attention, Directed Graphical Models. Applications of Deep RNN in Image Processing, Natural Language Processing, Speech recognition, Video Analytics.

Unit V: Introduction to Deep Generative Models, Restricted Boltzmann Machines (RBMs), Gibbs Sampling for training RBMs, Deep belief networks, Markov Networks, Markov Chains, Auto-regressive Models: NADE, MADE, PixelRNN, Generative Adversarial Networks (GANs), Applications of Deep Learning in Object detection, speech/ image recognition, video analysis, NLP, medical science etc.

TEXT BOOKS RECOMMENDED:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville; Deep Learning, MIT Press.
2. Charu C. Aggarwal "Neural Networks and Deep Learning: A Textbook", Springer.
3. Francois Chollet, "Deep Learning with Python", Manning Publications.

REFERENCE BOOKS:

1. Aurelien Geon, “Hands-On Machine Learning with Scikit-Learn and Tensorflow: Concepts, Tools, and Techniques to Build Intelligent Systems”, O'Reilly.
2. Andreas Muller, "Introduction to Machine Learning with Python: A Guide for Data Scientists", O'Reilly.
3. Adam Gibson, Josh Patterson, "Deep Learning: A Practitioner's Approach", O'Reilly.

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

Departmental Elective AL503(C) Optimization Techniques in Machine Leaning

Course Objective: The students will be able to understand and analyze how to deal with changing data. They will also be able to identify and interpret potential unintended effects in your project. They will understand and define procedures to operationalize and maintain your applied machine learning model.Detailed Contents:

Unit I: Introduction What is optimization, Formulation of LPP, Solution of LPP: Simplex method, Basic Calculus for optimization: Limits and multivariate functions, Derivatives and linear approximations: Singlevariate functions and multivariate functions.

Unit II: Machine Learning Strategy ML readiness, Risk mitigation, Experimental mindset, Build/buy/partner, setting up a team, Understanding and communicating change.

Unit III: Responsible Machine Learning AI for good and all, Positive feedback loops and negative feedback loops, Metric design and observing behaviours, Secondary effects of optimization, Regulatoryconcerns.

Unit IV: Machine Learning in production and planning Integrating info systems, users break things, time and space complexity in production, when to retain the model? Logging ML model versioning, Knowledge transfer, Reporting performance to stakeholders.

Unit V: Care and feeding of your machine learning model MLPL Recap, Post deployment challenges, QUAM monitoring and logging, QUAM Testing, QUAM maintenance, QUAM updating, Separating Datastack from Production, Dashboard Essentials and Metrics monitoring.

Books/Suggested References:

1. Jeeva Jose, Introduction to Machine Learning, Khanna Book Publishing 2020.
2. Rajiv Chopra, Machine Learning, Khanna Book Publishing 2021
3. Optimization for Machine Learning, SuvritSra, Sebastian Nowozin and Stephen J. Wright, MITPress, 2011.
4. Optimization in Machine Learning and Applications, Suresh Chandra Satapathy, Anand J. Kulkarni,Springer, 2019