

JSS Science and Technology University, Mysuru
Department of Computer Applications

Image Processing and Pattern Recognition

Course Code: CSD01

Total Marks: 100

Total Hours: 45

Exam Duration: 3 Hours

Unit: 1: Introduction to Image Processing

09 Hours

Fundamental Steps in Digital Image Processing, Elements of Visual Perception, Structure of the Human Eye, Image Formation in the Eye, Brightness Adaptation and Discrimination, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations.

Unit: 2: Image Enhancement and Restoration

09 Hours

Background image, Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters, Combining Spatial Enhancement Methods, Image Restoration-Constrained and unconstrained restoration, Restoration in the Presence of Noise Only-Spatial Filtering.

Unit: 3: Color Image processing and Segmentation

09 Hours

Color Fundamentals, Color Models, Pseudo color Image Processing , Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression, Fundamental of segmentation, point, line and edge detection, Thresholding, Region-based Segmentation.

Unit: 4: Pattern Recognition

09 Hours

Basics of pattern recognition, Design principles of pattern recognition system, Learning and adaptation, Pattern recognition approaches, Sensing, Segmentation and Grouping, Feature Extraction, Classification, Post Processing, Design Cycle, Learning and Adaptation.

Unit: 5: Statistical Patten Recognition

09 Hours

Bayesian Decision Theory, Classifiers, Normal density and discriminant functions, Parameter estimation methods: Maximum-Likelihood estimation, Bayesian Parameter estimation, Dimension reduction methods - Principal Component Analysis (PCA), Fisher

Linear discriminate analysis, Expectation-maximization (EM), Hidden Markov Models (HMM), Gaussian mixture models.

Text Books:

1. Digital Image Processing - Gonzalez and Wood, Addison Wesley, 1993.
2. Fundamental of Image Processing - Anil K.Jain, Prentice Hall of India.
3. Pattern Classification - R.O. Duda, P.E. Hart and D.G. Stork, Second Edition John Wiley, 2006

Reference Books:

1. Digital Picture Processing - Rosenfeld and Kak, vol.I & vol.II, Academic,1982
2. An Introduction to Digital Image Processing - Wayne Niblack, Prentice Hall, 1986
3. Pattern Recognition and Machine Learning - C. M. Bishop, Springer, 2009.
4. Pattern Recognition - S. Theodoridis and K. Koutroumbas, 4th Edition, Academic Press,2009

Artificial Intelligence and Machine Learning

Course Code: CAD02

Total Marks: 100

Total Hours: 45

Exam Duration: 3 Hours

Unit: 1: Introduction to Artificial Intelligence

09 Hours

Introduction: What is artificial intelligence?, Problems, problem spaces and search, Heuristic search techniques

Unit: 2: Knowledge representation issues

09 Hours

Knowledge representation issues, Predicate logic, Representation knowledge using rules. Concept Learning: Concept learning task, Concept learning as search, Find-S algorithm, Candidate Elimination Algorithm, Inductive bias of Candidate Elimination Algorithm.

Unit: 3: Decision Tree Learning

09 Hours

Introduction, Decision tree representation, appropriate problems, ID3 algorithm. Artificial Neural Network: Introduction, NN representation, Appropriate problems, Perceptrons, Back propagation algorithm.

Unit: 4: Bayesian Learning

09 Hours

Introduction, Bayes theorem, Bayes theorem and concept learning, ML and LS error hypothesis, ML for predicting, MDL principle, Bates optimal classifier, Gibbs algorithm, Naive Bayes classifier, BBN, EM Algorithm.

Unit: 5: Instance-Base Learning

09 Hours

Instance-Base Learning: Introduction, k-Nearest Neighbour Learning, Locally weighted regression, Radial basis function, Case-Based reasoning. Reinforcement Learning: Introduction, The learning task, Q-Learning.

Text Books:

1. Tom M Mitchell, "Machine Learning", 1st Edition, McGraw Hill Education, 2017.
2. Elaine Rich, Kevin K and S B Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education, 2017.

Reference Books:

1. Saroj Kaushik, *Artificial Intelligence*, Cengage learning, 2011
2. Stuart Rusell, Peter Norving, *Artificial Intelligence: A Modern Approach*, Pearson Education 2nd Edition
3. Thom Mitchell, *Machine Learning*, McGraw Hill Education, 2017
4. Anuradha Srinivasaraghavan, Vincy Elizabeth Joseph, *Machine Learning*, Wiley, 2019

Data Mining and Information Retrieval

Course Code: CAD03

Total Marks: 100

Total Hours: 45

Exam Duration: 3 Hours

Unit: 1: Introduction to Data Mining

06 Hours

Data mining, Text mining, Web mining, Spatial mining, Process mining, Data ware house and data marts.

Unit: 2: Data Mining Process

09 Hours

Data mining process KDD, CRISP-DM, SEMMA and Domain-Specific, Classification and Prediction performance measures -RSME, MAD, MAP, MAPE, Confusion matrix, Receiver Operating Characteristic curve & AUC; Validation Techniques - hold-out, k-fold cross-validation, LOOCV, random subsampling, and bootstrapping

Unit: 3: Prediction, Classification and Clustering Techniques

12 Hours

Data visualization, Time series ARIMA, Winter Holts, Vector Autoregressive analysis, Multivariate regression analysis. Classification- Decision trees, k nearest neighbour, Logistic regression, Discriminant analysis; Clustering; Market basket analysis;

Unit: 4: Introduction to Information Retrieval

09 Hours

Early Developments - The IR Problem - The Users Task - Information versus Data Retrieval - The IR System - The Software Architecture of the IR System - The Retrieval and Ranking Processes - The Web - The e-Publishing Era - How the web changed Search - Practical Issues on the Web - How People Search - Search Interfaces Today - Visualization in Search Interfaces.

Unit: 5: Modelling and Retrieval Evaluation

09 Hours

Basic IR Models - Boolean Model - TF-IDF (Term Frequency/Inverse Document Frequency) Weighting - Vector Model - Probabilistic Model - Latent Semantic Indexing Model - Neural Network Model - Retrieval Evaluation - Retrieval Metrics - Precision and Recall - Reference Collection - User-based Evaluation - Relevance Feedback and Query Expansion - Explicit Relevance Feedback.

Text Books:

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Ricardo Baeza-Yates and Berthier Ribeiro-Neto, —Modern Information Retrieval: The Concepts and Technology behind Search, Second Edition, ACM Press Books, 2011.

Reference Books:

1. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 2nd Edition, 2011
2. C. Manning, P. Raghavan, and H. Schütze, —Introduction to Information Retrieval, Cambridge University Press, 2008.

Cryptography and Cyber Security

Course Code: CAD04

Total Marks: 100

Total Hours: 45

Exam Duration: 3 Hours

Unit: 1: Introduction and Classical Encryption Technique **09 Hours**

Computer Security Concepts, OSI Security Architecture, Security Attacks, Security Services, Security Mechanism, Model for Network Security. Symmetric Cipher Model, Substitution Techniques, Transposition Techniques.

Unit: 2: Block Ciphers, Public Key Cryptography and Key Management **09 Hours**

Traditional Block Cipher Structure, The Data Encryption Standard, A DES Example, The strength of DES, Block Cipher Design Principles, AES Structure, AES Transformation Functions, AES Key Expansion, An AES Example, Principles of Public Key Cryptosystem, The RSA Algorithm, Key Management, Diffie Hellman Key Exchange.

Unit: 3: Cryptographic Hash Functions, Message Authentication Codes **09 Hours**

Applications of Cryptographic Hash Functions, Message Authentication, Digital Signatures, Two Simple Hash Functions, Requirements and Security, Security Requirements for Cryptographic Hash Functions, Brute-Force Attacks, Cryptanalysis, Hash Functions Based on Cipher Block Chaining, Secure Hash Algorithm (SHA), SHA-3, Message Authentication Requirements, Message Authentication Functions, Requirements for Message Authentication Codes, Security of MACs.

Unit: 4: Privacy, Legal Issues and Ethics **09 Hours**

Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Data Mining, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies, **Legal Issues and Ethics:** Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics, Situation I: Use of Computer Services, Situation II: Privacy Rights, Situation III: Denial of Service, Situation IV: Ownership of Programs, Situation V: Proprietary Resources, Situation VI: Fraud, Situation VII: Accuracy of Information, Situation VIII: Ethics of Hacking or Cracking, Situation IX: True Representation, Conclusion of Computer Ethics

Unit: 5: Malware and Phishing **09 Hours**

Programs and Programming: Unintentional (Nonmalicious) Programming, Oversights, Malicious Code—Malware, Countermeasures, **The Web—User Side:** Browser Attacks, Browser Attack Types, How Browser Attacks Succeed: Failed, Identification and Authentication. Web Attacks Targeting Users: False or Misleading Content, Malicious Web

Content, Protecting Against Malicious Web Pages. Obtaining User or Website Data: Code Within Data, Website Data: A User's Problem, Too, Foiling Data Attacks, Email Attacks: Fake Email, Fake Email Messages as Spam, Fake (Inaccurate) Email Header Data, Phishing, Protecting Against Email Attacks

Text Books:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 6th Edition, Pearson Education, 2014.
2. Behrouz A. Forouzan and Debdeep Mukhopadhyay: "Cryptography and Network Security", 2nd Edition, Tata McGraw-Hill, 2014.
3. Pfleeger, C.P., "Security in Computing", 5th Edition, Prentice Hall, Copyright 2015.

Reference Books:

1. Atul Kahate, "Cryptography and Network Security" 2nd Edition, Tata McGraw-Hill Publishing Company, 2010.
2. Network Security Private Communication in a public world, Charlie Kaufman, Radia Perlman & Mike Speciner, Prentice Hall of India Private Ltd., New Delhi, 2011.
3. Gaurav gupta and Garima gupta, "Cyber Unsafe: A Handbook for Preventing Computer Frauds and Cyber Crimes", First Edition, Vilvan publications, 2021.
4. Schneier, Bruce, "Applied Cryptography", Second Edition, John Wiley and Sons, 1996.