Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science & Information Technology

NOTIFICATION

Applications are invited from eligible candidates approved by the RRC Committee (Computer Science and IT) for the admission to **PhD Course Work: May/June-2013** (Ref. no. PG/PhD/2013/624-63 Dated: 10/04/2013). The candidates should submit their applications along with fees receipt (Rs. 2000/-) and necessary documents to the Head, Department of Computer Science and IT, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad on or before 30th April 2013. The detailed schedule of the course is as follow:

Sr. No.	Activity	Date
1	Enrollment for the course	22/4/2013 to 30/4/2013
2	Address by HOD and Commencement of the Classes	2/5/2013
3	Last instructional Day	31/5/2013
4	Examination	3/6/2013 to 5/6/2013
5	Declaration of Results	8/6/2013
6	Submission of the Query on the result by the students *(if any)*	10/6/2013
7	Award of Course Completion Certificate	11/6/2013

Important Note:

1) The detailed course structure and format of application form is available at www.bamu.net or www.csit.bamu.net.
2) M. Phil qualified students from the recognized University are exempted from the PhD Course Work as per the UGC norms and Guidelines.

Reference: CSIT/2013/**37**
Date: 20/4/2013
Place: Aurangabad

-Sd-
Head of the Department

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD-431 004 Maharashtra (India)

Department of Computer Science & Information Technology

PhD (Computer Science and IT) Course Structure:

Pre PhD Course Work
Research Methodology
Elective I (Select any one from list of electives)
1. Advanced Pattern Recognition and Neural Network 2. Remote Sensing and GIS 3. Multi-biometrics 4. Data Mining 5. Advanced Image Processing 6. Advanced Digital Speech Signal Processing 7. Human Computer Interactions 8. Advance Computer Networks 9. Foundation of Statistical NLP

Course Code	Course Title	No. of Credits	No. of Hours /Week	Total Marks
CSC701	**Research Methodology (Theory + Seminars)**	**(2+2)=4**	**4**	**100**
	Elective I	**4**	**4**	**100**

Elective I (Select any one from the list of below)

Course Code	Course Title	No. of Credits	No. of Hours /Week	Total Marks
CSC702	Advanced Pattern Recognition and Neural Network	**4**	**4**	**100**
CSC703	Remote Sensing and GIS	**4**	**4**	**100**
CSC704	Multibiometrics	**4**	**4**	**100**
CSC705	Data Mining	**4**	**4**	**100**
CSC706	Advanced Image Processing	**4**	**4**	**100**
CSC707	Advanced Digital Speech Signal Processing	**4**	**4**	**100**
CSC708	Human Computer Interactions	**4**	**4**	**100**
CSC709	Advance Computer Networks	**4**	**4**	**100**
CSC710	Foundation of Statistical NLP	**4**	**4**	**100**

-Sd-
Head of the Department

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Department of Computer Science & Information Technology

Application Form for **PhD Course Work: May/June-2013** in Computer Science and IT

ENROLLMENT FORM FOR PhD Course Work: May/June - 2013

Affix your Passport size Photograph and Attested by your Principal or Head of the Department

THIS FROM SHOULD Submit in the Department of Computer Science & Information Technology, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad-431004 (MS) INDIA (www. bamu.net//department/csit)

To,

Head,

Department of Computer Science and IT,

Dr. Babasaheb Ambedkar Marathwada University,

Aurangabad.

Sir,

I would like to enroll myself for the admission to **PhD Course Work: May/June-2013** conducted by **Department of Computer Science & Information Technology**, Dr. Babasaheb Ambedkar Marathwada University, Aurangabad in Computer Science and Information Technology.

Particulars of Students

Name in CAPITAL LETTERS *Surname*	*First Name*	*Father/Husbands Name*

Gender Male: ☐ Female: ☐	**Date of Birth:**				
Category	**Open :** ☐	**OBC :** ☐	**SC :** ☐	**ST :** ☐	**NT-A :** ☐
	NT-B : ☐	**NT-C :** ☐			

Educational Qualification (Starting from Bachelor's Degree)

Sr. No.	Name of the Examination	Division	Total Marks	% of Marks	Year of Passing	Name of the University	Checklist
1							☐
2							☐
3							☐

Details of PhD Entrance Test (PET) Examination 2010	Passed: ☐ Score: ☐ *(Attach a copy of Mark Memo)*
M. Phil.	Passed: ☐ Year: ☐ *(Attach a copy of Mark Memo and Notification)*

Research Topic	
Date of PhD Registration and Ref. No. of Provisionally Registration Letter	*(Attach a Copy)*
Name and Details of Research Guide	
Elective Subject Name and Code	

Address for Correspondence:	**Phone No with STD Code:**
	E-mail ID:
	Mobile No:
Details of the Fees	**Reciept No:** **Date:**

Further, I declare that the information given above is true to the best of my knowledge.

Signature of the Research Guide_____ Signature of the Candidate_____

(*Enclose necessary documents: PET Score Card, University Provisionally Admitted PhD Registration Letter, and Fees Receipt)

For Office Use Only

Clerk:

Date:

Department of Computer Science and Information Technology,
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
PhD Course Work
Summer 2013

Course Incharge: Dr. K.V.Kalé
E-mail.:kvkale91@gmail.com

Course Title: Research Methodology (for CS and IT)
Credit: 2+2 (Theory + Seminar)
Course Code: CSC701

Aims and Objectives

- To provide a deep and systematic understanding of the nature and conduct of CS research
- To enhance existing transferable key skills
- To develop high order transferable key skills
- To equip students with the ability to undertake independent research
- To remind students of the Legal, Social, Ethical and Professional (LSEP) issues applicable to the computer industry

To achieve these aims the main objective of research is to find out the truth which is hidden and which has not been discovered as yet. Though each research study has its own specific purpose, we may think of research objectives as falling into a number of following broad groupings:

- To gain familiarity with a phenomenon or to achieve new insights into it (studies with this object in view are termed as *exploratory* or *formulative* research studies);
- To portray accurately the characteristics of a particular individual, situation or a group (studies with this object in view are known as *descriptive* research studies);
- To determine the frequency with which something occurs or with which it is associated with something else (studies with this object in view are known as *diagnostic* research studies);
- To test a hypothesis of a causal relationship between variables (such studies are known as *hypothesis-testing* research studies).

Section A (Credit: 2)

Course Code: CSC701 (Theory) **Course Title: Research Methodology** (for CS and IT)

Unit 1: Research Methodology: An Introduction,Defining the Research Problem ,Research Design ,Sampling Design,Measurement and Scaling Techniques
Unit 2: Methods of Data Collection ,Processing and Analysis of Data , Sampling Fundamentals ,Testing of Hypotheses-I ,Chi-square Test ,Analysis of Variance and Covariance ,
Unit 3: Testing of Hypotheses-II , Multivariate Analysis Techniques, Interpretation and Report Writing,The Computer: Its Role in Research

Unit 4: The nature of CS research:Literature searches, information gathering,. Reading and understanding research papers,Technical writing, referencing, bibliographies,Topics in Computer Science,Presentation skills, written and oral.
Unit 5: Choosing or proposing a project, Commercial and economic considerations in CSIT research ,CSIT industry and Professional Organisation.Review of legal, ethical, social and professional (LSEP) issues including data protection and standards,Quality Research Strategies

Books:

Recommended:

1. C. R. Kothari – Research Methodology Methods and Techniques - WishwaPrakashan Publishers – Second Edition.
2. Dr. Rajammal, P. Devadas – A Handbook on Methodology of Research – Sri Ramakrishna Mission Vidyalaya College of Rural Higher Education.
3. "Research Methodology" R. Panneerselvam, PHI, New Delhi 2005

References:

1. Christian W. Dawson: Projects in Computing and Information Systems (A Student's Guide). Addison Wesley, 2005.
2. Justin Zobel: Writing for Computer Science. Springer, 2004.
3. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education 2003.
4. Quantitative Data Analysis in Education: A Critical Introduction Using SPSS - By Paul Connolly
5. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, "Introduction to algorithms" Prentice Hall 1990.
6. Intelligent data analysis: an introduction

Evaluation:

1. Overall class response: Attendance and Involvement.
2. Class Test: (Objective and Subjective) on each Unit.
3. End Term Exam.

Section B (Credit: 2)

Course Code: CSC701: (Seminar) **Course Title: Research Methodology** (For CS and IT)

Seminar Topics:

All admitted students for Pre PhD Course Work should deliver two seminars during the course.

Note: **1. Seminar topic should be latest and relevance to the field.**

2. The Students should note the following:

- Two seminar topics must be submitted to the concerned teacher(s) and gets teacher(s) approval in writing in the first week.
- After approval, the students should submit the seminar report and deliver a first seminar in second week of the course and subsequently second seminar at the end of the course.
- After the final presentation the grade will be allotted as per the marks obtained in final presentation and reviews by the panel of examiners.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science and Information Technology,

Subject Reference no	**CSC702**	**Subject Title**	**ADVANCED PATTERN RECOGNITION NEURAL NETWORK**
No of Credits	**4**	**Assignment/Sectionals**	
Total Contact Hrs/Week	**4**	**(Internal)**	**100**
		External (Semester Exam)	

Objective:

Pattern recognition deals with automated classification, identification, and / or characterizations of unknown systems. Virtually unlimited number of applications can benefit from pattern recognition techniques. Although it employs elegant and sophisticated mathematical and statistical analysis techniques, pattern recognition is nevertheless a very application driven field. Identification of pathological disorders from various biological indicators, hand written character recognition, finger print analysis, face recognition, iris scan based recognition, financial data pre-dictions, or automated determination of whether one should get a credit card based on his/her past credit history are just a few of such applications that call for pattern recognition techniques

Basic Goals:

1. To equip you with basic mathematical and statistical techniques commonly used in pattern recognition. Achieving this objective will not only help you understand, compare and contrast various pattern recognition techniques that will be discussed in this class, but also provide you with an adequate background on probability theory, statistics, and optimization theory to tackle a wide spectrum of engineering problems.
2. To introduce you to a variety of pattern recognition algorithms, for preparing you to handle the real world problems, specifically, image processing and computer vision.
3. To provide a detailed overview of some advanced topics in pattern recognition and a project opportunity to conduct independent, cutting-edge and publishable research work problem.

Course Prerequisites

- Basic knowledge of probability, statistics and random variables, linear algebra , Calculus III or Math for Engineering Analysis,
- Signals and systems / digital signal processing / AI / Computer Vision
- Expertise of MATLAB or C/C++
- **Enthusiasm, genuine interest, and willingness to put forward extra effort**
- **Time, patience, perseverance**

Course Contents

UNIT I. **Introduction to Pattern Recognition and Neural Network**

UNIT II. **Bayesian decision theory:** Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, Discrete features

UNIT III. **Maximum Likelihood and Bayesian Estimation Parameter estimation methods:** Maximum-Likelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, Computational Complexity and Overfitting, Component Analysis and Discriminants, Principal Component Analysis (PCA, Expectation Maximization (EM),

Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning

UNIT IV. **Non-parametric techniques:** Density estimation, Parzen-window method for Probabilistic Neural Networks (PNNs), K-Nearest Neighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification.

UNIT V. **Linear Discriminant function based classifiers:** Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)

UNIT VI. **Multilayer Neural Network:** Feed Forward Classification, Back Propagation Algorithm, Error Surface

UNIT VII. **Stochastic Data:** Stochastic search, Boltzmann Learning, Evolutionary method and Genetic Programming

UNIT VIII. **Non-metric methods for pattern classification:** Decision trees, Classification and Regression Trees (CART) and other tree methods, String recognition and Rule Based method.

UNIT IX. **Unsupervised learning and clustering:** Mixture Densities and Identifiability, Maximum Likelihood estimation, Application Normal Mixture, Unsupervised Bayesian Learning, Data Description and Clustering, Hierarchical Clustering, Graph theory method, Problem of validity, Component analysis

UNIT X. **Fuzzy Neural Systems:** Fuzzy sets, Fuzzy approaches, Neuro-Fuzzy systems

Books: (Recommended)

1. R.O.Duda, P.E.Hart and D.G.Stork, "Pattern Classification 2nd Edition", John Wiley, 2007
2. Christopher M. Bishop, "Neural Network for Pattern Recognition", Oxford Ohio Press.

References:

1. E. Gose, R. Johansonbargh, "Pattern Recognition and Image Analysis", PHI
2. Ethen Alpaydin, "Introduction to Machine Learning", PHI
3. Satish Kumar,"Neural Network- A Classroom Approach", McGraw Hill.
4. Dr. Rao & Rao,Neural Network & Fuzzy Logic
5. S.Theodoridis and K.Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press,
6. C.M.Bishop, "Pattern Recognition and Machine Learning", Springer, 2006
7. Introduction to neural networks using MATLAB 6.0 by Sivanandam, S Sumathi, S N Deepa, TATA McGraw HILL
8. Neural networks: A comprehensive foundations, Simon Hhaykin, Pearson Education 2nd edition 2004
9. Artificial neural networks - B. Yegnanarayana, Prentice Hall of India P Ltd 2005.
10. Neural Networks in Computer Intelligence, Li Min Fu, TMH 2003.
11. Neural networks, James A Freeman David M S Kapura, Pearson education 2004.
12. C++ Neural Network and Fuzzy Logic 2nd Edition, Valluru B. Rao,Hayagriva V. Rao, Henry Holt and Co.
13. Neural Networks and Fuzzy Systems: A Dynamical Systems Approach to Machine Intelligence, Bart Kosko

Web:

1. http://www.rii.ricoh.com/~stork/DHS.html

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Department of Computer Science and Information Technology,

Subject Reference no	**CSC703**	**Subject Title**	**REMOTE SENSING AND GIS**
No of Credits	**4**	**Assignment/Sectionals**	
Total Contact Hrs/Week	**4**	**(Internal) External (Semester Exam)**	**100**

Goal and Objectives:
Introducing Remote Sensing & GIS with various techniques for handling remotely sensed images

Course Contents

Unit 1 Introduction to Remote sensing and models & Methods for image processing: The Nature of Remote sensing, Optical Radiation model, Sensor, Data models, Spectral transform spatial transform, correction & calibration, Registration & fusion, Thematic Classification

Unit2 Introduction to Geographic Information System: Introduction, Coordinate system, Geo-relational vector Data model, Object based vector Data model, Raster Data model.

Unit 3 Data input, transformation, editing & Cartography: Data input, Geometric transformation, Spatial Data Editing Attribute Data input & Management, Data display & Cartography.

Unit 4 Data Exploration & Analysis: Data Exploration, Vector Data Analysis, Raster Data Analysis, Terrain Mapping & analysis, DEM, TIN.

Unit 5 Spatial interpolation, Geo-coding & Modeling: View sheds & Watersheds, spatial interpolation, Geo-coding & Dynamic segmentation, Path analysis & Network Application, GIS model & modeling.

Text Books

- Remote sensing models & methods for image processing, third edition, Robert's A. Schowengerdt
- Digital Analysis of Remotely sensed Imagery, Jay Gao, McGraw Hill
- Remote sensing Digital image Analysis An Introduction, John A. Richards, Xiuping Jia
- Geographic Information System, Kang-tsung Chang, fourth edition
  Tata McGraw-Hill.
- An Introduction to Geographic Information Technology, Sujit Choudhary, Deepankar Chakrabarty, Suchandra Choudhary,IK international.

Web Resources

- http://www.gis.com/whatisgis/index.html
- http://www.gis.nic.in
- http://www.esriindia.com
- http://www.qgis.org
- http://www.exelisvis.com/ProductsServices/ENVI.aspx
- http://rst.gsfc.nasa.gov/start.html
- http://www.isro.org

Journals

- IEEE Transactions on Geo-science and Remote sensing.
- GeoCarto International.
- ITC Journal.
- International journal of Geoinformatics
- ISPRS Journal of Photogrammetry and advances in space research.

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Department of Computer Science and Information Technology,

Subject Reference no	**CSC704**	**Subject Title**	**MULTIBOMETRICS**
No of Credits	**4**	**Assignment/Sectionals**	
Total Contact Hrs/Week	**4**	**(Internal) External (Semester Exam)**	**100**

Learning approach:

In today's complex, geographically mobile, increasingly electronically wired information society, the problem of verifying an individual's identity continues to pose a great challenge. Conventional technology using Personal Identification Numbers (PIN) or passwords, often in conjunction with plastic cards, is neither convenient nor particularly secure. In the quest for a superior solution, it is necessary to develop information security. It covers many related technologies and systems, such as software and hardware security. Biometrics verification techniques are fast emerging as the most reliable and practical method of individual identity verification.

This is a guided reading course that requires covering research material and working on a specific problem in biometrics: technologies and systems. The primary requirement for the completion of this course will be a project which will include the survey and analysis of the problem domain, reporting the progress on a regular basis and presenting the methods and techniques for the possible solutions proposed. Meetings will be held with the instructor in order to discuss the direction of the project, the survey material, identify potential problems, solution, analysis and results. Students will give periodic oral presentations for the three stages of the course progress (1) background, problem identification and proposed direction of research, (2) midterm progress report and (3) final analysis and results. Students are expected to search and survey research papers, conduct analysis, and give oral presentations. Upon the completion of the course students will submit a written report on the project conducted and give an oral presentation.

Objectives:

- Provide a basis for research work on multibiometrics.
- Guidance and training for critical analysis of research papers.
- Enhance technical writing and oral presentation skills.

Keyword syllabus:

Current research topics include the following:

- Biometrics
- Personal Identification
- Information Fusion
- Combined classifiers
- Neural network

Course Contents

UNIT I. Basic Concept: Biometrics

Why biometrics? What is biometrics? Which support is biometrics based on? How is biometrics applied? Where will be biometrics used? Biometrics in living body, including human head & face, the mechanism of human eye, hand & skin characteristics, personal voice & sound, and habitual behaviors.

UNIT II. Common Biometrics Techniques

Biometrics data acquisition and biometrics database, The related image processing and pattern recognition technologies, including digital image and signal representation, pattern extraction and classification, Basic approaches of automated biometric identification and verification.

UNIT III. Typical Physical Biometrics

Basic physical characteristics of biometrics, and some basic introduction of physical biometrics systems (such as fingerprint, palm-print, finger, hand, face, iris, and face, as well as dental, DNA, and retina recognition). Fingerprint system is given in detail.

UNIT IV. Typical Behavioral Biometrics

Behavioral biometrics characteristics and basic introduction of basic behavioral biometrics systems (including voice, signature, gesture recognition, knowledge-based recognition, and keyboard-input-based recognition), Voice Recognition System is explained in detail.

UNIT V. Multibiometrics

Introduction to information fusion in biometrics, levels of fusion in biometrics, Evaluation of multibiometric systems, Multimodal biometric databases: framing and evaluation (particularly in the Multimodal Biometric Research Laboratory of the department).

Indicative reading list and references:

- Handbook of Biometrics, Jain, Anil K.; Flynn, Patrick; Ross, Arun A. (Eds.), 2008, Springer, ISBN 978-0-387-71040-2
- Handbook of multibiometrics. A. A. Ross, K. Nandakumar, and A. K. Jain. Springer, 2006.
- D. Zhang (ed.), 2002, *Biometrics Solutions for Authentication in an e-World*, Kluwer Academic Publishers, USA, 449pp, 2002, ISBN 1-4020-7142-6.
- D. Zhang, 2000, *Automated Biometrics: Technologies & Systems*, Kluwer Academic Publishers, USA, 331pp, 2000, ISBN 0-7923-7856-3.
- IEEE Transactions on Pattern Analysis and Machine Intelligence
- IEEE Transactions on Image Processing
- IEEE Transactions on System Man and Cybernetic
- IEEE Transactions on Neural Networks
- IEEE Transactions on Signal Processing
- IEEE Vision, Image and Signal Processing, IEEE Proceedings
- Pattern Recognition and Pattern Recognition Letters
- Pattern Recognition and Artificial Intelligence
- Image and Vision Computing

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Department of Computer Science and Information Technology,

Subject Reference no	**CSC705**	**Subject Title**	**DATA MINING**
No of Credits	**4**	**Assignment/Sectionals**	
Total Contact Hrs/Week	**4**	**(Internal)**	**100**
		External (Semester Exam)	

Course Objective:

A Student Completing this course unit should:

1) Have an understanding of the foundations, the design, the maintenance, the evolution and the use of data warehouses, by looking at these topics in a rigorous way.
2) Have mastered the basic range of techniques for creating, controlling and navigating dimensional business databases, by being able to use a powerful tool for dimensional modelling and analysis.
3) To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining. Students will be able to actively manage and participate in data mining projects executed by consultants or specialists in data mining. A useful take away from the course will be the ability to perform powerful data analysis.

Detailed Syllabus:

Unit I

Data Warehousing Concepts: Data Warehousing Architectures.
Logical Design in Data Warehouses: Logical Versus Physical Design in Data Warehouses, Data Warehousing Schemas, Data Warehousing Objects.
Physical Design in Data Warehouses: Physical Design, Data Segment Compression, Integrity Constraints, Indexes and Partitioned Indexes, Materialized Views, Dimensions.

Unit II

Introduction to Data Mining:

Why Mine Data? Commercial Viewpoint, Scientific Viewpoint Motivation, Definitions, Origins of Data Mining, Data Mining Tasks, Classification, Clustering, Association Rule Discovery, Sequential Pattern Discovery, Regression, Challenges of Data Mining.

Data Mining: Data

What is Data? Attribute Values, Measurement of Length, Types and Properties of Attributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density.

Data Mining: Exploring Data:

Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Visualization, Representation, Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations

Unit III

Data Mining Classification: Basic Concepts, Decision Trees, and Model Evaluation

Classification: Definition, Classification Techniques, Tree Induction, Measures of Node Impurity, Practical Issues of Classification, ROC curve, Confidence Interval for Accuracy, Comparing Performance of Two Models, Comparing Performance of Two Algorithms.

Data Mining Association Analysis: Basic Concepts and Algorithms

Association Rule Mining, Frequent Itemset Generation, Association Rule Discovery : Hash tree, Factors Affecting Complexity, Maximal Frequent Horible Closed Item set, Alternative Methods for Frequent Item set Generation, FP-growth Algorithm, Tree Projection, Rule Generation, Pattern Evaluation, Statistical Independence, Properties of A Good Measure, Support-based Pruning, Subjective Interestingness Measure

Unit IV

Data Mining Cluster Analysis: Basic Concepts and Algorithms

Applications of Cluster Analysis, Types of Clusters, Clustering Algorithms:

K-means and its variants, Hierarchical clustering, Density-based clustering. Graph-Based Clustering, Limitations of Current Merging Schemes, Characteristics of Spatial Data Sets, Shared Near Neighbor Approach, ROCK (Robust Clustering using links), Jarvis-Patrick Clustering, SNN Clustering Algorithm.

Data Mining Anomaly Detection

Anomaly/Outlier Detection, Importance, Anomaly Detection Schemes, Density-based: LOF approach.

Unit V: Case Study

WEKA (Waikato Environment for Knowledge Analysis): is a well-known suite of machine learning software that supports several typical data mining tasks, particularly data preprocessing, clustering, classification, regression, visualization, and feature selection.

REFERENCES:

1. William Inmon, Building the Data Warehouse, John Wiley and Sons, 1996
2. Kimball, Margy Ross, The Data Warehouse Toolkit, John Wiley & Sons,
3. Oracle 9i Data Warehousing Guide Release 2 (9.2) by Oracle Press.
4. Matthias Jarke, Maurizio Lenzerini, Yannis Vassiliou, Panos Vassilidis, Fundamentals of Data Warehouses, Springer
5. Introduction to Data Mining by Tan, Steinbach, Kumar.
6. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers.
7. Data Mining: Practical Machine Learning Tools and Techniques by Ian H. Witten and Eibe Frank, Morgan Kaufmann, 2nd Edition (2005).
8. Principles of Data Mining: David Hand, Heikki Mannila & Padhraic Smyth, PHP Publication.
9. Hand, Mannila, and Smyth. *Principles of Data Mining*. Cambridge, MA: MIT Press, 2001. ISBN: 026208290X.
10. Berry and Linoff. *Mastering Data Mining.* New York, NY: Wiley, 2000. ISBN: 0471331236.
11. Delmater and Hancock. *Data Mining Explained.* New York, NY: Digital Press, 2001. ISBN: 1555582311.
12. http://www.cs.waikato.ac.nz/ml/weka/

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science and Information Technology,

Subject Reference no	**CSC706**	**Subject Title**	**ADVANCED IMAGE PROCESSING**
No of Credits	**4**	**Assignment/Sectionals (Internal) External (Semester Exam)**	**100**
Total Contact Hrs/Week	**4**		

Goal and Objectives:

- To discuss advanced topics in image processing and analysis that build on the introduction course.
- To teach participants about scientific methodology which includes reading of scientific publications and book chapters, summarizing the contents, developing strategies to implement the algorithms.
- To enable participants to implement solutions for complex image processing problems.
- To enable participants to better understand novel, advanced methodology that is discussed in the image processing and image analysis literature.

Short description:

In-depth study of advanced methods and research topics of current interest in image processing and analysis

Who should attend this course?

The course is particularly important for students involved in image processing research and will be a core course of the newly established imaging track.

Prerequisites:

You are highly recommended to refresh your knowledge on probability and statistics as of basic digital image processing prior to this class. Introduction to Digital Image Processing or equivalent, advanced programming skills related to imaging (MATLAB, ENVI, and VC++, imaging libraries or equivalent). Students with different background and curriculum need to discuss suitability and options with the teacher.

Overview of the Course

UNIT I. **Introduction:** What Is Digital Image Processing? The Origins of Digital Image Processing, Examples of Fields that Use Digital Image Processing, Fundamental Steps in Digital Image Processing, Components of an Image Processing System **Digital Image Fundamentals:** Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships Between Pixels, Linear and Nonlinear Operations, **Image Enhancement in the Spatial Domain:**Background, 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.

UNIT II. **Image Enhancement in the Frequency Domain:** Background, Introduction to the Fourier Transform and the Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency Domain Filters, Homomorphic Filtering, Implementation, **Image Restoration:** A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only-Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering, Geometric Mean Filter, Geometric Transformations, **Color Image Processing:** Color Fundamentals, Color Models, Pseudocolor Image Processing, Basics of Full-Color Image Processing, Color Transformations, Smoothing and Sharpening, Color Segmentation, Noise in Color Images, Color Image Compression,

UNIT III. **Wavelets and Multiresolution Processing:** Background, Multiresolution Expansions, Wavelet Transforms in One Dimension, The Fast Wavelet Transform, Wavelet Transforms in Two Dimensions, Wavelet Packets **Image Compression:** Fundamentals, Image Compression Models, Elements of Information Theory, Error-Free Compression, Lossy Compression, Image Compression Standards **Morphological Image Processing:** Preliminaries, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Some Basic Morphological Algorithms, Extensions to Gray-Scale Images, **Image Segmentation:** Detection of Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region-Based Segmentation, Segmentation by Morphological Watersheds, The Use of Motion in Segmentation.

UNIT IV. **Representation and Description:** Representation, Boundary Descriptors, Regional Descriptors, Use of Principal Components for Description, Relational Descriptors, **Object Recognition:** Patterns and Pattern Classes, Recognition Based on Decision-Theoretic Methods, Structural Methods **3D vision, geometry:** 3D vision tasks, Marr's theory, Other vision paradigms: Active and purposive vision, Basics of projective geometry, Points and hyperplanes in projective space, Homography, Estimating hornography from point correspondences, A single perspective camera, Camera model, Projection and back-projection in homogeneous coordinates, Camera calibration from a known scene, Scene reconstruction from multiple views, Triangulation, Projective reconstruction, Matching Constraints, Bundle adjustment, Upgrading the projective reconstruction, self-calibration, Two cameras, stereopsis, Epipolar geometry; fundamental matrix, Relative motion of the camera; essential matrix, Decomposing the fundamental matrix to camera matrices, Estimating the fundamental matrix from point correspondences, Rectified configuration of two cameras, Computing rectification, Three cameras and trifocal tensor, Stereo correspondence algorithms, Active acquisition of range images, 3D information from radiometric measurements, Shape from shading, Photometric stereo,

UNIT V. **Use of 3D vision:** Shape from X, Shape from motion, Shape from texture, Other shape from X techniques, Full 3D objects, 3D objects, models, and related issues, Line labeling, Volumetric representation, direct measurements, Volumetric modeling strategies, Surface modeling strategies, Registering surface patches and their fusion to get a full 3D model, 3D model-based vision, General considerations, Goad's algorithm, Model-based recognition of curved objects from intensity images, Model-based recognition based on range images, 2D view-based representations of a 3D scene, Viewing space, Multi-view representations and aspect graphs, Geons as a 2D view-based structural representation, Visualizing 3D real-world scenes using stored collections of 2D views, 3D reconstruction from an unorganized set of 2D views—a case study, **Motion analysis:** Differential motion analysis methods, Optical flow, Optical flow computation, Global and local optical flow estimation, Combined local-global optical flow estimation, Optical flow in motion analysis, Analysis based on correspondence of interest points, Detection of interest points, Correspondence of interest points, Detection of specific motion patterns, Video tracking, Background modeling, Kernel-based tracking, Object path analysis, Motion models to aid tracking , Kalman filters , Particle filters

Books:

1. Rafael Gonzalez, Richard Woods Digital Image Processing:2/e, Pearson Prentice Hall,2004 ISBN-10: 0201180758 | ISBN-13: 9780201180756
2. Image Processing: Analysis and Machine Vision, Milan Sonka, Thomson Learning
3. A. K. Jain , Fundamentals of Digital Image Processing, Prentice-Hall, 1989.
4. A. Bovik, Handbook of Image & Video Processing, Academic Press, 2000.
5. H. Stark and J. W. Woods, Probability, Random Processes, and Estimation Theory for Engineers, Prentice-Hall, 1994.
6. H. V. Poor, An Introduction to Signal Detection and Estimation, 2nd Ed., Springer-Verlag, 1994.
7. M. Vetterli and J. Kovacevic, Wavelets and Subband Coding, Prentice-Hall, 1995.

References:

1. Machine Vision, Jain R C Kasturi R, McGrawHill
2. Three Dimensional Computer Vision, Y Shirai, Springer Verlag
3. Computer and Robot Vision Vo I and II, Haralick R M And Shapiro L G, Addison Wesley
4. Computational Vision, Wechsler, Academic Press
5. Robot Vision, Horn B K P, Cambridge MIT press
6. Digital Image Processing & Computer Vision, Robert J Schalkoff, John Willey Publication
7. Computer Vision: A Modern Approach, Forsyth Ponce, Pearson Education

Learning approach

- Students will read the relevant publications or chapters of books and/or reading assignments BEFORE the class lectures.
- In the course, the material will then be discussed in detail and motivated with real world examples and applications.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science and Information Technology,

Subject Reference no	**CSC707**	**Subject Title**	**ADVANCE DIGITAL SPEECH SIGNAL PROCESSING**
No of Credits	**4**	**Assignment/Sectionals**	
Total Contact Hrs/Week	**4**	**(Internal) External (Semester Exam)**	**100**

AIM

To introduce the PhD student to advanced digital speech signal processing techniques.

OBJECTIVE

- To study the parametric methods for power spectrum estimation.
- To study adaptive filtering techniques using LMS algorithm and to study the applications of adaptive filtering.
- To study multirate signal processing fundamentals.
- To study the analysis of speech signals.
- To introduce the student to wavelet transforms.

UNIT - 1 : PARAMETRIC METHODS FOR POWER SPECTRUM ESTIMATION

Relationship between the auto correlation and the model parameters – The Yule – Walker method for the AR Model Parameters – The Burg Method for the AR Model parameters – unconstrained least-squares method for the AR Model parameters – sequential estimation methods for the AR Model parameters – selection of AR Model order.

UNIT - 2 : ADAPTIVE SIGNAL PROCESSING

FIR adaptive filters – steepest descent adaptive filter – LMS algorithm – convergence of LMS algorithms – Application: noise cancellation – channel equalization – adaptive recursive filters – recursive least squares.

UNIT - 3 : MULTIRATE SIGNAL PROCESSING

Decimation by a factor D – Interpolation by a factor I – Filter Design and implementation for sampling rate conversion: Direct form FIR filter structures – Polyphase filter structure.

UNIT - 4 : SPEECH SIGNAL PROCESSING

Digital models for speech signal : The Physiology of Speech Production– model for vocal tract, radiation and excitation – complete model – time domain processing of speech signal:- Pitch period estimation – using autocorrelation function – Linear predictive Coding: Basic Principles – autocorrelation method – Durbin recursive solution. The Acoustics and Acoustic Analysis of Speech , ,Sentence-level Phenomena ,The Perception of Speech ,Speech Disorders and Development ,Speech Synthesis and Speech Recognition

UNIT - 5 : WAVELET TRANSFORMS

Fourier Transform : Its power and Limitations – Short Time Fourier Transform – The Gabor Transform - Discrete Time Fourier Transform and filter banks – Continuous Wavelet Transform – Wavelet Transform Ideal Case – Perfect Reconstruction Filter Banks and wavelets – Recursive multi-resolution decomposition – Haar Wavelet – Daubechies Wavelet.

TEXT BOOK

1. John G.Proakis, Dimitris G.Manobakis, Digital Signal Processing, Principles, Algorithms and Applications, Third edition, (2000) PHI.
2. Monson H.Hayes – Statistical Digital Signal Processing and Modeling, Wiley, 2002.
3. L.R.Rabiner and R.W.Schaber, Digital Processing of Speech Signals, Pearson Education (1979).
4. Roberto Crist, Modern Digital Signal Processing, Thomson Brooks/Cole (2004)
5. Raghuveer. M. Rao, Ajit S.Bopardikar, Wavelet Transforms, Introduction to Theory and applications, Pearson Education, Asia, 2000.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science and Information Technology

Subject Reference no	**CSC708**	**Subject Title**	**Human Computer Interactions**
No of Credits	**4**	**Assignment/Sectionals (Internal)**	
Total Contact Hrs/Week	**4**	**External (Semester Exam)**	**100**

Objective:

Upon successful completion of this course, students should be able to:

- Design, implement and evaluate effective and usable graphical computer interfaces.
- Describe and apply core theories, models and methodologies from the field of HCI.
- Describe and discuss current research in the field of HCI.
- Implement simple graphical user interfaces using the Java Swing toolkit.
- Describe special considerations in designing user interfaces for older adults.

UNIT-I: Foundations

1. The Human
2. The Computer
3. The Interaction
4. Paradigms

UNIT-II: Design Process

5. Interaction design basics
6. HCI in the software process
7. Design rules
8. Implementation support
9. Evaluation techniques
10. Universal design
11. User support

UNIT-III: Models and Theories

12. Cognitive models
13. Socio-organizational issues and stakeholder requirements
14. Communication and collaboration models
15. Task analysis
16. Dialogue notations and design
17. Models of the system
18. Modelling rich interaction

UNIT-IV: Outside the Box

19. Groupware
20. Ubiquitous computing and augmented realities
21. Hypertext, multimedia, and the world wide web

Reference Books:

1. **Human Computer Interaction** by Dix, Finlay, Abowd, & Beale, 3rd edition, New York: Prentice-Hall.

2. Ben Shneiderman and Catherine Plaisant, **Designing the User Interface: Strategies for Effective Human-Computer Interaction** 5th ed., Pearson Addison-Wesley, 2009.

3. Donald A. Norman, **The Design of Everyday Things**, Basic Books, 2002.

4. Jeff Johnson, Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules

5. Jenny Preece, Yvonne Rogers, and Helen Sharp: **Interaction Design: Beyond Human-Computer Interaction**, 3nd ed., Wiley, 2011.

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science and Information Technology

Subject Reference no	**CSC709**	**Subject Title**	**Advanced Computer Network**
No of Credits	**4**	**Assignment/Sectionals (Internal)**	
Total Contact Hrs/Week	**4**	**External (Semester Exam)**	**100**

AIM

To introduce the PhD student to **Advance Computer Networks**

Unit I Introduction

Requirements , Network architecture , Networking principles, Network services and Layered architecture , Network services and Layered architecture , Future networks (Internet , ATM , Cable TV, Wireless – Bluetooth, Wi-Fi, WiMax, Cell phone)

Unit II Advanced Technologies

Virtual circuits, Fixed size packets, Small size packets, Integrated service, History, Challenges, ATM Network protocols, IP over ATM, Wireless networks : Wireless communication basics, architecture, mobility management, wireless network protocols. Ad-hoc networks Basic concepts, routing; Bluetooth (802.15.1), Wi-Fi (802.11), WiMAX (802.16), Optical Network : links, WDM system, Optical LANs, Optical paths and networks.

Unit III Performance of Networks

Control of networks: objectives and methods of control, Circuit switched networks, Datagram and ATM networks. Mathematical background for control of networks like Circuit switched networks, Datagram and ATM networks

Unit IV Advanced Routing - I

Routing architecture , Routing between peers (BGP) , IP switching and Multi- Protocol Label Switching (MPLS), MPLS Architecture and related protocols , Traffic Engineering (TE) and TE with MPLS , NAT and Virtual Private Networks (L2, L3, and Hybrid), CIDR –Introduction , CIDR addressing, CIDR address blocks and Bit masks

Unit V Advanced Routing - II

Mobile IP- characteristics, Mobile IP operation, Security related issues. Mobility in networks. Voice and Video over IP (RTP, RSVP, QoS) IPv6: Why IPv6, basic protocol, extensions and options, support for QoS, security, etc., neighbor discovery, auto-configuration, routing. Changes to other protocols. Application Programming Interface for IPv6.

Unit VI Ad Hoc Networking

An Introduction, A DoD Perspective on Mobile Ad Hoc Networks, DSDV: Routing over a Multihop Wireless Network of Mobile Computers, Cluster-Based Networks, DSR: The Dynamic Source Routing Protocol for Multihop Wireless Ad Hoc Networks

Reference books:

1. Larry L. Peterson, Bruce S," Computer Networks: A Systems Approach
2. Douglas E. Comer, Internetworking with TCP/IP

Department of Computer Science and Information Technology,
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Subject Reference no	**CSC710**	**Subject Title**	**Foundation of Statistical NLP**
No of Credits	**4**	**Assignment/Sectionals (Internal)**	**100**
Total Contact Hrs/Week	**4**	**External (Semester Exam)**	

Goal and Objectives:

- To teach basic statistics in a scenario of NLP.
- Give profound Knowledge about Natural Language Processing.
- To make them participate by providing simulating advance models in NLP.

Short description:

In-depth study of Fundamental and research topics of current interest in NLP

Who should attend this course?

The course is particularly important for students involved in NLP related work.

Prerequisites:

You should of sound knowledge any one programming language. Students are recommended to refresh there knowledge about complier design and theory of computer science.

Overview of the Course

UNIT I. **: Introduction** :Rationalist and Empiricist Approaches to Language,ScientificContent,Questions that linguistics should answer,Non-categorical phenomena in language,Language and cognition as probabilisticphenomena,The Ambiguity of Language: Why NLP Is Difficult,DirtyHands,Lexicalresources,Wordcounts,Zipf'slaws,Collocations,Concordances
Mathematical Foundations :Elementary Probability Theory ,Probability spaces,Conditional probability and independence,Bayes' theorem,Randomvariables,Expectation and variance ,Notation ,Joint and conditional distributions,Determining ,Standard distributions,Bayesianstatistics,Essential Information Theory,Entropy,Joint entropy and conditional entropy ,Mutual information,The noisy channel model,Relative entropy or Kullback-Leiblerdivergence,The relation to language: Cross entropy,The entropy of English ,PerplexityLinguistic Essentials:Parts of Speech and Morphology,Nounspronoun,Words that accompany nouns: Determiners and adjectives, Verbs,Other parts of speech,PhraseStructure,Phrase structure ,Dependency: Arguments and adjuncts,X' theory,Phrase structure ambiguity ,Semantics and Pragmatics.**Corpus-Based Work** :Computers,Corpora,Software,Looking at Text,Low-level formatting issues,Tokenization: What is a word?,Morphology ,Sentences, Marked-up Data,Markupschemes,Grammatical tagging.

UNIT II. :**Collocations**:Frequency,Mean and Variance,HypothesisTesting,Thetest,Hypothesis testing of differences,Pearson's chi-square test,Likelihoodratios,Mutual Information **,Statistical Inference**: n - gram Models over Sparse Data, Bins: Forming Equivalence Classes ,Reliability vs. discrimination , n-grammodels**,Statistical Estimators**: Maximum Likelihood Estimation, Laplace's law, Lidstone's law and the Jeffreys-Perks law ,Held out estimation ,Cross-validation (deleted estimation),Good-Turing estimation,**Combining Estimators**: Simple linear interpolation,Katz's backing-off,General linear interpolation,Language models for Austen.

UNIT III. **:Word Sense Disambiguation :** Methodological Preliminaries ,Supervised and unsupervised learning,Pseudowords,Upper and lower bounds on performance,Supervised Disambiguation,Bayesian classification,An information-theoretic approach ,Dictionary-Based Disambiguation ,Disambiguation based on sense definitions,Thesaurus-based disambiguation,Disambiguation based on translations in a second-language corpus ,One sense per discourse, one sense per collocation , Unsupervised Disambiguation , What Is a Word Sense?**Lexical Acquisition :** Evaluation Measures,VerbSubcategorization,AttachmentAmbiguity,Hindle and Rooth (1993),General remarks on PP attachment,SelectionalPreferences,Semantic ,Vectosrpacemeasures,Probabilisticmeasures,The Role of Lexical Acquisition in Statistical NLP

UNIT IV. **Probabilistic Parsing**:SomeConcepts,Parsing for disambiguation,Treebanks,Parsing models vs. language models,Weakening the independence assumptions of PCFGs,Tree probabilities and derivational probabilities,Phrase structure grammars and dependency,Non-lexicalized grammars,**Grammar** :Markov Models:Markov Models, Hidden Markov Models, Why use HMMs?, General form of an HMM, The Three Fundamental Questions for HMMs,Finding the probability of an observation, Finding the best state sequence,The third problem: Parameter estimation,HMMs Implementation, Properties, and Variants,Implementation ,Variants, Multiple input observations ,Initialization of parameter values, Part-of-Speech Tagging :The Information Sources in Tagging ,Markov Model Taggers ,The probabilistic model, The Viterbi algorithm,Variations ,Hidden Markov Model Taggers ,Applying HMMs to POS tagging,The effect of initialization on HMM training,Transformation-Based Learning of Tags,Transformations,The learning algorithm ,Relation to other models ,Automata ,Tagging Accuracy and Uses of Taggers,**Probabilistic Context Free Grammars**:Some Features of PCFGs, Questions for PCFGs ,The Probability of a String,Using inside probabilities ,Using outside probabilities,Finding the most likely parse for a sentence,Training a PCFG.

UNIT V. **Statistical Alignment and Machine Translation:** Text Alignment ,Aligning sentences and paragraphs,Length-based methods,Offset alignment by signal processing techniques,Lexical methods of sentence alignment,Statistical Machine Translation**, Clustering :** Hierarchical Clustering,Single-link and complete-link clustering ,Group-average agglomerative clustering,An application: Improving a language model,Top-down clustering ,Non-Hierarchical Clustering**,**K-means,The EM algorithm.

Books:

1. Christopher D. Manning,"Foundations of Statistical Natural Language Processing ",MIT Press,ISBN 0-262-13360-l
2. Ray Jackendoff,Natural Language Processing with Python,Foundations of Language , Orilly Publication ,ISBN: 978-0-596-51649-9
3. Igor A. Bolshakov and Alexander Gelbukh,COMPUTATIONAL LINGUISTICS Models, Resources, Applications,ISBN 970-36-0147-2

References:

4. Vyvyan Evans and Melanie Green COGNITIVE LINGUISTICS AN INTRODUCTION ISBN 0 7486 1831 7

Learning approach

- Students will read the relevant publications or chapters of books and/or reading assignments BEFORE the class lectures.
- In the course, the material will then be discussed in detail and motivated with real world examples and applications.