CS010 801 : HIGH PERFORMANCE COMPUTING

Teaching scheme **Credits:** 4
3 hours lecture and 2 hour tutorial per week

Objectives

- *To design a powerful and cost-effective computer system.*
- *To provide the basic concepts of parallel processing on high performance computers.*

Module I (15 hours)
Introduction to parallel processing - Trends towards parallel processing - Parallelism in uniprocessor - Parallel computer structures-Architecture classification schemes ,Amdahl's law,Indian contribution to parallel processing

Module II (15 hours)
Principles of pipelining and vector processing - Linear pipelining - Classification of pipeline processors - General pipelines - Instruction and Arithmetic pipelines –Design of Pipelined instruction unit-Principles of Designing Pipeline Processors- Instruction prefetch and branch handling- Data Buffering and Busing Structure-Internal forwarding and register tagging-Hazard detection and Resolution,Dynamic pipelines and Reconfigurability

Module III (15 hours)
Array processors - SIMD array processors - Interconnection networks - Static vs dynamic networks - mesh connected networks - Cube interconnection networks - Parallel algorithms for array processors - SIMD matrix multiplication-Parallel sorting on array processors - Associative array processing - Memory organization.

Module IV (15 hours)
Multiprocessor architectures and Programming - Loosely coupled and Tightly coupled multiprocessors - Interconnection networks - Language features to exploit parallelism -Inter process communication mechanism-Process synchronisation mechanisms,synchronization with semaphores.

Module V (15 hours)
Dataflow computers - Data driven computing and Languages, Data flow computers architectures - Static data flow computer , Dynamic data flow computer ,Data flow design alternatives.

References:

1.Computer Architecture & Parallel Processing - Kai Hwang & FayeA.Briggs,McGraw Hill

2. Computer architecture A quantitative approach - John L Hennessy and David A. Patterson-ELSEVIER,Fourth Edition

3. Elements of Parallel computing - V. Rajaraman - PHI

4. Super Computers - V. Rajaraman - Wiely arstern

5. Parellel Processing for Super Computers & AI Kai Hwange & Douglas Degneot Mc Graw Hill

6. Highly parallel computing - George S. Almasi,Allan Gottlieb. - Benjamin Cumings Publishers.

7. HIgh Performance Computer Architecture - Harold S. Stone, Addison Wesley.

8. Advanced Computing- Vijay P.Bhatkar, Asok V.Joshi, Arirban Basu, Asok K.Sharma.

CS010 802: ARTIFICIAL INTELLIGENCE

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To provide introduction to the basic knowledge representation, problem solving, and learning methods of Artificial Intelligence.*
- *To familiarize with Fuzzy Logic and knowledge processing in expert systems*
- *To give exposure to problem solving in AI using Python*

Module 1 (14 hours)

Problems- problem spaces and search, production systems, Problem characteristics, Searching strategies – Generate and Test, Heuristic Search Techniques- Hill climbing– issues in hill climbing, General Example Problems.
Python-Introduction to Python- Lists Dictionaries & Tuples in Python- Python implementation of Hill Climbing

Module 2 (12 hours)
Search Methods- Best First Search- Implementation in Python- OR Graphs, The A * Algorithm, Problem Reduction- AND-OR Graphs, The AO* algorithm, Constraint Satisfaction. Games as search problem, MINIMAX search procedure, Alpha–Beta pruning.

Module3 (12 hours)
Knowledge representation -Using Predicate logic- representing facts in logic, functions and predicates, Conversion to clause form, Resolution in propositional logic, Resolution in predicate logic, Unification, Question Answering, forward and backward chaining.

Module 4 (12 hours)
Learning- Rote Learning – Learning by Advice- Learning in Problem Solving - By Parameter Adjustment with Macro Operators, Chunking, Learning from Examples- Winston's Learning Program, Version Spaces- Positive & Negative Examples – Candidate Elimination- Decision Trees- ID3 Decision Tree Induction Algorithm.

Module 5 (10 hours)
Fuzzy Sets – Concept of a Fuzzy number- Operations on Fuzzy Sets – Typical Membership Functions – Discrete Fuzzy Sets.
Expert System –Representing and using Domain Knowledge – Reasoning with knowledge– Expert System Shells –Support for explanation- examples –Knowledge acquisition-examples.

References

1. Elaine Rich, Kevin Knight, Shivashankar B Nair
Tata McGraw Hill- Artificial Intelligence, 3rd Edn ,2004.
2. Stuart Russell – Peter Narang, Pearson Education Asia - Artificial Intelligence- A modern approach.
3. George F Luger - Artificial Intelligence, Pearson Education Asia
4. Allen B. Downey – (Think Python) Python for software design- How to think like a computer scientist, Cambridge University press, 2009 .

Web Reference

1. http://code.google.com/p/aima-python/ - Website for search strategy implementation in python

CS010 803: Security in Computing

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart an essential study of computer security issues*
- *To develop basic knowledge on cryptography*
- To impart an essential study of various security mechanisms

Module 1 (12 hours)

Introduction: Security basics – Aspects of network security – Attacks Different types –Security attacks -Security services and mechanisms.
Cryptography: Basic Encryption & Decryption – Classical encryption techniques – symmetric encryption, substitution ciphers – Caesar cipher – Monoalphabetic Cipher, Playfair Cipher, Polyalphabetic cipher - Vigenère – Cipher, Transposition ciphers - Rail Fence cipher, Row Transposition Ciphers.

Module 2 (12 hours)

Modern Block Ciphers - Fiestel Networks , DES Algorithm – Avalanche Effect.
Introduction to Number Theory - Prime Factorisation, Fermat's Theorem, Euler's Theorem, Primitive Roots, Discrete Logarithms.
Public key Cryptography:- Principles of Public key Cryptography Systems, RSA algorithms-Key Management – Diffie-Hellman Key Exchange, Elliptic curve cryptography.

Module 3 (12 hours)

Message Authentication-Requirements- Authentication functions- Message authentication codes-Hash functions- Secure Hash Algorithm, MD5, Digital signatures- protocols- Digital signature standards, Digital Certificates.
Application Level Authentications- Kerberos, X.509 Authentication Service, X.509 certificates.

Module 4 (12 hours)

Network Security: Electronic Mail Security, Pretty Good Privacy, S/MIME, IP Security Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload.
Web Security: Web Security considerations- Secure Socket Layer -Transport layer Security-Secure electronic transaction. Firewalls-Packet filters- Application Level Gateway- Circuit Level Gateway.

Module 5 (12 hours)

Operating System Security: Memory and Address Protection, Control of Access to General Objects, File Protection Mechanisms, Models of Security – Bell-La Padula Confidentiality Model and Biba Integrity Model.
System Security: Intruders, Intrusion Detection, Password Management, Viruses and Related Threats, Virus Countermeasure.

Reference Books

1. William Stallings, “Cryptography and Network Security – Principles and Practices”, Pearson Education, Fourth Edition, 2006.
2. Charles P. Pfleeger, “Security in Computing”, Pearson Education, Third Edition, 2005.
3. Behrouz A. Forouzan, Dedeep Mukhopadhyay “Cryptography & Network Security”, Second Edition,Tata McGraw Hill, New Delhi, 2010.
4. Andrew S. Tanenbaum, “Modern Operating Systems”, Pearson Education, Second Edition, 2002.
5. Atul Kahate, “Cryptography and Network Security”, Second Edition, Tata McGraw Hill
6. Wenbo Mao, “ Modern Cryptography- Theory & Practice”, Pearson Education, 2006.
7. Bruce Schneier, “Applied Cryptography”, John Wiley and Sons Inc, 2001.

CS010 804L01: E-COMMERCE

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart an introduction to Elecronic Commerce.*
- *To develop basic knowledge of Business in Internet and Electronic Payment.*

Module I (12 hours)
Introduction to Electronic Commerce:- E-Commerce Framework, Anatomy of E-Commerce Applications, E-Commerce Consumer & Organization Applications. **E-Commerce and World Wide Web** – Internet Service Providers, Architectural Framework for Electronic Commerce, WWW as the Architecture, Hypertext publishing.

Module II (14 hours)
Network Security:- Client-Server Network Security, CS Security Threats, Firewalls, Data & Message Security, Encrypted Documents, Security on the Web.
Consumer Oriented Electronic Commerce:- Consumer Oriented Applications, Mercantile Process Models, Mercantile Models from the Consumer's Perspective, Mercantile Models from the Merchant's Perspective

Module III (10 hours)
Electronic Payment Systems :- Types of Electronic Payment Systems, Digital Token Based Electronic Payment System, Smart Cards, Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems.

Module IV (12 hours)
Electronic Data Interchange:- EDI Application in Business, EDI-Legal, Security and Privacy Issues, EDI standardization, EDI Envelope for Message Transport, Internet based EDI, Internal Information System, Work-flow Automation and Coordination, Supply Chain Management, Document Library, Types of Digital Documents, Corporate Data Warehouses.

Module V (12 hours)
Recent Trends in E-Commerce:- Multimedia in E-Commerce, Video Conferencing with Digital Videos, Broad Band Telecommunication, Frame & Cell Relays, Switched Multimegabit Data Service (SMDS), Asynchronous Transfer Mode, Mobile Computing and Wireless Computing.

Reference Books

1) Ravi Kalakota, Andrew B Whinston, Frontiers of Electronic Commerce, Pearson Education Inc., New Delhi, 2009
2) Ravi Kalakota, Andrew B. Whinston, Electronic Commerce A Manager's Guide, Pearson Education Inc., New Delhi, 2007
3) P. T. Joseph, E-Commerce An Indian Perspective, PHI Learning Private Limited, New Delhi, 2009

CS010 804L02: GRID COMPUTING
(Common to IT010 804L06:Grid Computing)

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To impart an introduction to Grid Computing.*
- *To develop basic knowledge about the Open Grid Service Architecture.*

Module I (12 hours)

Grid Computing – Introduction- Grid Activities- Overview of Grid Business Areas- Grid Applications- Grid Infrastructure.

Module II (12 hours)

Grid Computing Organizations and their roles- Grid Computing Anatomy- Grid Problem- Concept of Virtual Organizations- Grid Architecture- Autonomic Computing- Business on Demand and Infrastructure Virtualization- Semantic Grids.

Module III (12 hours)

Merging the Grid Services Architecture- Service Oriented Architecture- Web Service Architecture- XML relevance to Web Services- Service Message Description Mechanisms- Relationship between Web Service and Grid Service.

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Module IV (12 hours)

Open Grid Services Architecture- OGSA Platform Components- Open Grid Services Infrastructure- Introduction to Service Data Concepts- Grid Service- OGSA Basic Services- Common Management Model- Policy Architecture- Security Architecture.

Module V (12 hours)

Grid Computing Toolkits- GLOBAS GT3 Toolkit Architecture- GLOBAS GT3 Toolkit Programming Model- GLOBAS GT3 Toolkit High Level Services.

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Reference Books

1) Joshy Joseph, Craig Fellenstein, Grid Computing, Pearson Education Inc, New Delhi 2004.
2) D Janakiram, Grid Computing A research Monograph, Tata McGraw-Hill Publishing Company Limited New Delhi, 2005.

CS010 804L03: Bioinformatics

Teaching scheme Credits: 4

2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the science of storing, extracting, organizing, analysing and interpreting biological data.*

Module 1 (12 hours)

Basic Concepts of Molecular Biology: Cells - Chromosomes, DNA, RNA, Proteins,
Central dogma of molecular biology, RNA classification – coding and non coding RNA-mRNA, tRNA, miRNAand sRNA , Genomes and Genes - Genetic code, ORFs,Slice varients,Transcription ,Translation and Protein synthesis.

Module 2 (12 hours)

Sequence alignments – - local/global, pairwise/multiple Sequence alignment- Smith-Waterman algorithm, NeedlemanWunch algorithm, Multiple sequence alignment –Sum-of-Pairs measure - Star and tree alignments ,Scoring matrices: basic concept of a scoring matrix, Matrices for nucleic acid and proteins sequences, PAM and BLOSUM ,Phylogenetic Trees

Module 3 (12 hours)

Informational view of Genomic data, Gene expression, Microarrays-cDNA arrays,Oligo Arrays, Data analysis methodologies-Normalization,Principal Componenet Analysis,Clustering-Hierarchical,K-meana,FCM,Application of Microarrays.
Gene regulation, Gene Ontology, metabolic pathways, and gene set enrichment analysis.

Module 4 (12 hours)

Evolution of Protein Structures, Classification of Protein Structures- primary,secondary,ternary and quatenary,Protein Structure prediction and modeling, Assignment of protein structures to genomes, Prediction of protein function, Protein folding problem, Protein Threading, Drug discovery and development

Module 5 (12 hours)

Biological data bases: Pubmed,Swissport,EMBL,DDBJ,Genbank,
Software Tools: Use of Tools for basic and specialized sequence processing such as: BLAST, FASTA, RasMol, Phylip, ClustalW

References

1. Setubal & Meidanis, “Introduction to Computational Molecular Biology”, Brooks/Cole Cengage Learning 2009.
2. Arthur M Lesk, “Introduction to Bioinformatics”, Oxford University Press, India, 2004
3.Vittal R. Srinivas “Bioinformatics a mordern Approach”,PHI Learning 2009 .
4.Shuba Gopal,Rhys Price Jones,Paul Thymann,Anne Haake,”Bioinformatics with fundamentals of Genomics and proteomics, Tata McGraw Hill
3.Zoe Lacroix,Terence Critchlow “Bioinformtics managing scientific Data”,Morgan Koufmann Publishers
4.B.G Curran,R J walker,SC Bhattia”Bioinformatics”,CBS Publishers,2010
5.Harshawardhana P. Bal “Bioinformatics Principles and Applications”,Tata MacGraw Hill

CS010 804L04 :Optimization Techniques

Teaching Schemes **Credits: 4**

2 hours lecture and 2 hour tutorial per week.

Objectives:

- *To understand the need and origin of the optimization methods.*
- *To get a broad picture of various applications of optimization methods used in engineering.*
- *To define an optimization problem and its various components.*

Module I (12 Hrs)

One Dimensional Unconstrained Minimization techniques, single variable minimization, unimodality, bracketing the minimum, necessary and sufficient conditions for optimality, convexity, steepest descent method.

Module II (12Hrs)

Linear programming, introduction, linear programming problem, linear programming problems involving LE (?) constraints, simplex method, optimality conditions, artificial starting solutions, the M method.

Module III (12hrs)

Transportation models, definition, non traditional models, transportation algorithm, East West corner method, Vogel approximation method. Assignment model, Introduction, Hungarian method.

Module IV (12Hrs)

Forecasting Models, moving average technique, regression method, exponential smoothing. Game Theory, two persons zero sum games, mixed strategy games-graphical method.

Module V (12Hrs)

Queuing models, elements of queuing model, pure birth and death model, specialized Poisson queues, single server models. Multiple server models, self service model.

References:

1. Ashok D Belegundu, Tirupathi R Chandrupatla, optimization concepts and Application in Engineering, pearson Education.
2 Kalynamoy Deb, “Optimization for Engineering Design, Alogorithms and Examples”, Prentice Hall,
3. Hamdy A Taha, “Operations Research – An introduction”, Pearson Education,
4. Hillier / Lieberman, “Introduction to Operations Research”, Tata McGraw Hill Publishing company Ltd,
5. Singiresu S Rao, “Engineering optimization Theory and Practice”, New Age International,
6. Mik Misniewski, “Quantitative Methods for Decision makers”, MacMillian Press Ltd.

CS010 804L05: MOBILE COMPUTING

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the relevance and underlining infrastructure of multimedia system.*
- *To enable the students to apply contemporary theories of multimedia learning to the development of multimedia products.*

Module I (10 hours)
Introduction to wireless communication system:- 2G cellular network,2G TDMA Standards,3G wireless networks,wireless local loop and LMDS, Broadcast Systems-Broadcast transmission, Digital Audio Broadcasting-Multimedia Object Transfer Protocol. Digital Video Broadcasting.
Cellular concepts-channel assignment strategy-hand off strategy-interface and system capacity-trunking –improving coverage and capacity in cellular system.

Module II (12 hours)
Wireless Communication Systems:-Telecommunication Systems-GSM-GSM services & features,architecture,channel type,frame structure,signal processing in GSM & DECT-features & characteristics,architecture,functional concepts & radio link,personal access communication system(PACS)-system architecture-radio interface,
Protocols.Satellite Systems-GEO, LEO, MEO.

Module III (11 hours)
Wireless LAN and ATM:- Infra red and Radio Transmission, Infrastructure and ad hoc networks ,802.11- Bluetooth- Architecture, Applications and Protocol, Layers, Frame structure. comparison between 802.11 and 802.16.

Wireless ATM- Services, Reference Model, Functions, Radio Access Layer. Handover-Reference Model, Requirements, Types, handover scenarios.
Location Management, Addressing, Access Point Control Protocol (APCP).

Module IV (14 hours)
Mobile Network and Transport Layers:- Mobile IP- Goals, Requirements, IP packet delivery, Advertisement and discovery. Registration, Tunneling and Encapsulation, Optimization, Reverse Tunneling, IPv6, Dynamic Host configuring protocol, Ad hoc networks – Routing, DSDV, Dynamic source routing. Hierarchical Algorithms.
Traditional TCP, Indirect TCP, Snooping TCP, Mobile TCP, Transmission.

Module V (13 hours)
Wireless Application Protocol & World Wide Web
WAP- Architecture, Protocols-Datagram, Transaction, Session.-Wireless Application Environment-WML- Features, Script- Wireless Telephony Application.
WWW- HTTP, Usage of HTML, WWW system architecture.

References

1. Jochen Schiller “Mobile Communications “ , Preason Education Asia
2.Wireless communications Principles and practice-second edition-Theodore S.Rappaport,PHI,Second Edition ,New Delhi, 2004

3. Computer Networks – Andrew S. Tanenbaum , PHI

4.. Communication Networks -Fundamental Concepts and Key Architectures Leon-Garcia & Indra Widjaja, Tata McGraw Hill

CS010 804L06 : Advanced Networking Trends

Teaching scheme **Credits:** 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To acquaint the students with the application of networking.*
- *To understand the variousTCP/IP protocols and the working of ATM and its performance, Network security and authentication, and variousalgorithms related to it has been dealt, to get a practical approach ,advanced topics in the design of computer networks and network protocols*

Module 1 (12 hours)

Ethernet Technology – Frame format – Interface Gap – CSMA/CD – 10 mbps Ethernet, Fast Ethernet, Gigabit Ethernet, Wire
less Ethernet.

ISDN - Definition - Protocol architecture - System architecture - Transmission channels - ISDN interface, B-ISDN.

Module 2 (12 hours)

ATM – ATM Principles – BISDN reference model – ATM layers – ATM adaption Layer – AAL1, AAL2, AAL3/4, AAL5 – ATM addressing – UNI Signaling – PNNI Signaling

Module 3 (12 hours)

Wireless LAN – Infrared Vs Radio transmission – Infrastructure & ad hoc n/w – IEEE 802.11 – Physical Layer – MAC layer.
Bluetooth – Physical Layer – MAC layer – Networking - Security

Module 4 (12 hours)

Mesh Networks- Necessity for Mesh Networks – MAC enhancements – IEEE 802.11s Architecture –Opportunistic Routing – Self Configuration and Auto Configuration - Capacity Models –Fairness – Heterogeneous Mesh Networks – Vehicular Mesh Networks

Module 5 (12 hours)

Sensor Networks- Introduction – Sensor Network architecture – Data Dissemination – Data Gathering –MAC Protocols for sensor Networks – Location discovery – Quality of Sensor Networks– Evolving Standards – Other Issues – Recent trends in Infrastructure less Networks

References

1. An introduction to Computer Networking - Kenneth C Mansfield, Jr., James L. Antonakos, PHI
2. Communication Networks Fundamental Concepts & Key Architecture - Leon-Garcia – Widjaja, Tata McGraw Hill
3. Mobile Communication - Jochen Schiller, Pearson Education Asia
4. C. Siva Ram Murthy and B.S.Manoj, “Ad hoc Wireless Networks – Architectures and Protocols’, Pearson Education, 2004
5. C.K.Toh, “Adhoc Mobile Wireless Networks”, Pearson Education, 2002.

CS010 805G01: MULTIMEDIA TECHNIQUES

Teaching scheme **Credits:** 4
2 hours lecture and 2 hours tutorial per week

Objectives

- *To study the relevance and underlining infrastructure of multimedia system.*
- *To enable the students to apply contemporary theories of multimedia learning to the development of multimedia products.*

Module I (10 hours)
Multimedia Basics: Multimedia and Hypermedia, Multimedia Software, Editing and Authoring Tools, VRML.
Graphics and Image Data Representation— Graphics/Image Data Types, Popular File Formats.
Concepts in Video and Digital Audio— Color Science, Color Models in Images, Color Models in Video. Types of Video Signals, Digitization of Sound, MIDI - Musical Instrument Digital Interface, Quantization and Transmission of Audio.

Module II (12 hours)
Lossless & Lossy Compression Algorithms— Introduction, Basics of Information Theory, Run-Length Coding, Variable-Length Coding, Dictionary-Based Coding, Arithmetic Coding, Lossless Image Compression. Distortion Measures, The Rate-Distortion Theory, Quantization, Transform Coding, Wavelet-Based Coding, Wavelet Packets, Embedded Zerotree of Wavelet Coefficients, Set Partitioning in Hierarchical Trees (SPIHT).

Module III (11 hours)
Image, Video and Audio Compression — Image Compression -JPEG , JPEG-LS.
Basic Video Compression Techniques - Introduction to Video Compression, Video Compression Based on Motion Compensation, MPEG
Video Coding— Audio Compression Techniques-—MPEG, ADPCM in Speech Coding, Vocoders, Psychoacoustics, Audio Codecs.

Module IV (14 hours)
Storage and Retrieval of Images — Content-Based Retrieval in Digital Libraries: Image retrieval, CBIRD. A Case Study, Image Search Systems, Quantifying Results, Querying on Videos, Querying on Other Formats, Outlook for Content-Based Retrieval.
Image Databases— Raw Images, Compress Image Presentations, Image Processing Segmentation, Similarity- Based Retrieval, Alternating Image DB Paradigms, Representing Image DBs with Relations and R Trees, Retrieving Images by Special Layout, Implementations, Selected Commercial Systems.

Module V (13 hours)
Multimedia Databases
Text/Document Databases— Precision and Recall, Stop Lists, Word Stems and Frequency tables, Latent Semantic Indexing, TV-Trees, Other Retrieval Techniques.
Multimedia Databases—Design and Architecture of a Multimedia Database, Organizing Multimedia Data based on the Principle of Uniformity, Media Abstractions, Query Languages for Retrieving Multimedia Data , Indexing SMDSs with Enhanced Inverted Indices, Query Relaxation/ Expansion.

References

1. .Ze-Nian Li and M. S. Drew, .*Fundamental of Multimedia*., Pearson Education,2004
2. V. S. Subrahmanian, .*Principles of Multimedia Database Systems*., Morgan Kaufmann Publication.
3. K. R. Rao, Zoran S. Bojkovic, D. A. Milovanovic, .*Introduction to Multimedia Communications.*, Wiley.
4. R. Steinmetz and K. Nahrstedt .*Multimedia: Computing, Communication & Applications*, Pearson Education.
5. Buford, .*Multimedia Systems*., Pearson Education.
6. C. T. Bhunia, .*Multimedia and multimedia Communications*., New Age International Publishers.
7. Prabhat K. Andheigh, Kiran Thakrar, *Multimedia Systems design*., PHI.
8. Koegel Buford, *Multimedia Systems*., Pearson Eduaction.
9. J. D. Gibson, .*Multimedia Communications: Directions and Innovations.*, Academic
10. Press, Hard-court India.

CS010 805G02 :Neural networks
(Common to IT010 805G05 Neural Networks)

Teaching scheme Credits: 4

2 hours lecture and 2 hours tutorial per week

Objectives

To understand the fundamental building blocks of Neural networks

Module 1 (14 hours)

Biological Neurons and Neural Networks, Basic Structures and Properties of Artificial Neural Networks, Basic Neuron Models-McCulloch-Pitts -Nearest Neighbour- Radial Basis Function, Activation Functions ,Singe Layer Perceptrons-Linear Seperability, Learning and Generalization in Single Layer Perceptron-Hebbian Learning-Gradient Descent Learning-Widrow-Hoff Learning-The Generalized Delta rule, Practical Considerations

Module 2 (12 hours)

Multi Layer Perceptron Learning,Back Propogation Algorithim -Applications – Limitations– Network Paralysis – Local Minima – Temporal Instability, Pattern Analysis Tasks- Classification- Regression- Clustering, Pattern Classification and Regression using Multilayer Perceptron.

Module 3 (10 hours)

Radial Basis Function Networks: Fundamentals, Algorithms and Applications, Learning with Momentum, Conjugate Gradient Learning, Bias and Variance. Under-Fitting and Over-Fitting, Stochastic neural networks, Boltzmann machine.

Module 4 (12 hours)

Network based on competition:- Fixed weight competitive Network-Maxnet, Mexican Hat and Hamming Net, Counter Propagation Networks- Kohonen's self-organizing map – Training the Kohonen layer – Training the Grossberg layer – Full counter propagation network – Application, Adaptive resonance theory – classification- Architecture – Learning and generalization.

Module 5 (12 hours)

Pattern Association: - training algorithm for pattern association - Hetro Associative Network, Auto Associative Network, Architecture of Hopfield nets – stability analysis ,General Concepts of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM training algorithms.

References

1. B. Yegnanarayana, "Artificial Neural Networks", PHI.
2. Simon Haykin, Neural Networks, 2/e, Prentice Hall
3. Neural Computing & Practice – Philip D. Wasserman
4. Neural Networks in Computer Intelligence-Limin Fu,Tata Mc.Hill Edition

CS010 805G03 : Advanced Mathematics

(common to IT010 805G02 Advanced Mathematics)

Teaching Schedule: **Credits: 4**

2 hour Lecturer and 2 hour Tutorial per week

Objectives

- *To provide an understanding of Green's Function, Integral Equations, Gamma, Beta functions, Power Series solution of differential equation, Numerical solution of partial differential equations*

Module 1 (12 Hours)
Green's Function
Heavisides, unit step function – Derivative of unit step function – Dirac delta function – properties of delta function – Derivatives of delta function – testing functions – symbolic function – symbolic derivatives – inverse of differential operator – Green's function – initial value problems – boundary value problems – simple cases only

Module 2 (12 Hours)
Integral Equations
Definition of Volterra and Fredholm Integral equations – conversion of a linear differential equation into an integral equation – conversion of boundary value problem into an integral equation using Green's function – solution of Fredhlom integral equation with separable Kernels – Integral equations of convolution type – Neumann series solution.

Module 3 (12 Hours)
Gamma, Beta functions
Gamma function, Beta function – Relation between them – their transformations – use of them in the evaluation certain integrals – Dirichlet's integral – Liouville's extension of Dirichlet's theorem – Elliptic integral – Error function.

Module 4 (12 Hours)
Power Series solution of differential equation
The power series method – Legendre's Equation – Legendre's polynomial – Rodrigues formula – generating function – Bessel's equation – Bessel's function of the first kind – Orthogonality of Legendre's Polynomials and Bessel's functions.

Module 5 (12 Hours)
Numerical solution of partial differential equations
Classification of second order equations- Finite difference approximations to partial derivatives – solution of Laplace and Poisson's equations by finite difference method – solution of one dimensional heat equation by Crank – Nicolson method – solution one dimensional wave equation.

References

1. S.S Sasthri, “Introductory methods of Numerical Analysis”,Prentice Hall of India.
2. Ram P.Kanwal, Linear Integral Equation, Academic Press, New York.
3. Allen C.Pipkin, Springer, A Course on Integral Equations, Verlag.
4. H.K.Dass, Advanced Engg. Mathematics, S.Chand.
5. Michael D.Greenberge, Advanced Engg. Mathematics, Pearson Edn. Asia.
6. B.S.Grewal, Numrical methods in Engg.&science, Khanna Publishers.
7. R.F. Hoskins, Generalized functions, John Wiley and Sons.
8. Bernard Friedman, Principles and Techniques of Applied Mathematics, John Wiley and sons
9. James P.Keener, Principles of Applied Mathematics, Addison Wesley.
10. P.Kandasamy, K.Thilagavathy, K.Gunavathy Numerical methods, S.Chand & co

CS010 805G04: Software Architecture
(Common to IT010 805G01 Software Architecture)

Teaching scheme **Credits:** 4
2 hours lecture and 2 hour tutorial per week

Objectives

- *To understand the role of a software architecture in the development of an enterprise application system.*
- *To develop the ability to understand the models that are used to document a software architecture.*

Module I (13 hours)

Software Architecture—Software Architecture, Software Design Levels, The status of Software Engineering and Architecture.

Architecture Styles—Use of Patterns and Styles in Software Design, Common Architectural Styles -Pipes and Filters, Data Abstraction and Object Orientation, Event Based Implicit Invocation, Layered Systems, Repositories, Interpreters, **Process Control Paradigms**—Case Studies to Illustrate the use of Architectural Principles.

Module II (11 hours)

Architectural Design—Guidelines for User Interface Architectures, Design Space and Rules, Applying Design Space with an Example, A Validation Experiment.
The Quantified Design Space—Background, Quantified Design Space.

Module III (11 hours)

Formal models and Specifications— Formalizing the Architecture of a Specific System-Architectural Formalism and its Applications, Formalizing Various Architectural Styles, Filters, Pipes, Pipe-and-Filter System, Formalizing Architectural Design Space.

Module IV (14 hours)

Architectural Description Languages—Requirements for Architectural Description Languages, The Linguistic Character of Architectural Description, Desiderata for Architecture Description Languages, Problems.

First-Class Connectors—Current practice, Software System Composition . Adding Implicit Invocation to Traditional Programming Languages

Module V (11 hours)

Architectural Design Tools— UniCon A Universal Connecting Language, Components, Abstraction and Encapsulation, Types and Type checking.

Architectural Design - Exploiting Styles , Architectural Interconnection

References

1. Mary Shaw & David Garlan," *Software Architecture"*, Prentice Hall India Private Limited, Third Edition, New Delhi, 2000.
2. Len Bass, Paul Clements, & Rick Kazman, "*Software Architecture in Practice"*, Pearson Education.

CS010 805G05: Natural Language Processing

Teaching scheme **Credits**: 4

2 hours lecture and 2 hours tutorial per week

Objectives

- *To acquire a general introduction including the use of state automata for language processing*
- *To understand the fundamentals of syntax including a basic parse*
- *To explain advanced feature like feature structures and realistic parsing methodologies*
- *To explain basic concepts of remotes processing*
- *To give details about a typical natural language processing applications*

Module I (12 hours)

INTRODUCTION: Introduction: Knowledge in speech and language processing – Ambiguity – Models and Algorithms – Language, Thought and Understanding. Regular Expressions and automata: Regular expressions – Finite-State automata. Morphology and Finite-State Transducers: Survey of English morphology – Finite-State Morphological parsing – Combining FST lexicon and rules – Lexicon-Free FSTs: The porter stammer – Human morphological processing

Module II (12 hours)

SYNTAX: Word classes and part-of-speech tagging: English word classes – Tagsets for English – Part-of-speech tagging – Rule-based part-of-speech tagging – Stochastic part-of-speech tagging – Transformation-based tagging – Other issues. Context-Free Grammars for English: Constituency – Context-Free rules and trees – Sentence-level constructions – The noun phrase – Coordination – Agreement – The verb phase and sub categorization – Auxiliaries – Spoken language syntax – Grammars equivalence and normal form – Finite-State and Context-Free grammars – Grammars and human processing. Parsing with Context-Free Grammars: Parsing as search – A Basic Top-Down parser – Problems with the basic Top-Down parser – The early algorithm – Finite-State parsing methods.

Module III (12 hours)

ADVANCED FEATURES AND SYNTAX : Features and Unification: Feature structures – Unification of feature structures – Features structures in the grammar – Implementing unification – Parsing with unification constraints – Types and Inheritance. Lexicalized and Probabilistic Parsing: Probabilistic context-free grammar – problems with PCFGs – Probabilistic lexicalized CFGs – Dependency Grammars – Human parsing.

Module IV (12 hours)

SEMANTIC: Representing Meaning: Computational desiderata for representations – Meaning structure of language – First order predicate calculus – Some linguistically relevant concepts – Related representational approaches – Alternative approaches to meaning. Semantic Analysis: Syntax-Driven semantic analysis – Attachments for a fragment of English – Integrating semantic analysis into the early parser – Idioms and compositionality – Robust semantic analysis. Lexical semantics: relational among lexemes and their senses – WordNet: A database of lexical relations – The Internal structure of words – Creativity and the lexicon.

Module V (12 hours)

APPLICATIONS: Word Sense Disambiguation and Information Retrieval: Selectional restriction-based disambiguation – Robust word sense disambiguation – Information retrieval – other information retrieval tasks. Natural Language Generation: Introduction to language generation – Architecture for generation – Surface realization – Discourse planning – Other issues. Machine Translation: Language similarities and differences – The transfer metaphor – The interlingua idea: Using meaning – Direct translation – Using statistical techniques – Usability and system development.

References:

1. Daniel Jurafsky & James H.Martin, " Speech and Language Processing", Pearson Education(Singapore)Pte.Ltd.,2002.
2. James Allen, "Natural Language Understanding", Pearson Education, 2003

CS010 805G06 :Pattern Recognition

Teaching Schemes **Credits:4**
2 hours lecture and 2 hours tutorial per week

Objectives:

- *To impart a basic knowledge on pattern recognition and to give a sound idea on the topics of parameter estimation and supervised learning, linear discriminant functions and syntactic approach to PR.*
- *To provide a strong foundation to students to understand and design pattern recognition systems.*

Module I (12 hours)
Introduction: introduction to statistical, syntactic and descriptive approaches, features and feature extraction, learning and adaptation. Bayes Decision theory, introduction, continuous case, 2-categoryclassification, minimum error rate classification, classifiers. Discriminant functions and decision surfaces.

Module 2(12 hours)
Introuction- Maximum likelihood estimation - General principle,Gaussian case ; bias. Bayesian estimation – class conditioned density, parameterdistribution, Bayesian Parameter estimation – General Theory,Gibb's Algorithm – Comparison of Bayes Method with Maximum likelihood.

Module 3(12 hours)
Introduction,Density Estimation. Parzen Windows – Convergence of mean, variance,Kn – Nearest Neighbourestimation,Nearest neighbor rule,Converge error rate, error bound , partial distance.

Module 4(12 hours)
Linear discriminate functions and decision surfaces:-Introduction, training error, Threshold weight, discriminate function – two category case, multicategory case. Generalized discriminant function, Quadratic discriminant functions, Polynomial discriminant, PHI functions. Augmented vector.Two category linearly separable case: weight space, solution region, margin, learning rate ,algorithm(Gradient descent – newton)Relaxation procedures.

Module 5(12 hours)
Syntactic approach to PR : Introduction to pattern grammars and languages ,higher dimensional grammars, tree, graph, web, plex, and shape grammars, stochastic grammars , attribute grammars, Parsing techniques, grammatical inference.

References

1. R.O Duda, Hart P.E, “Pattern Classification And Scene Analysis”, John Wiley
2. Gonzalez R.C. & Thomson M.G., “Syntactic Pattern Recognition - An Introduction”, Addison Wesley.
3. J. T. Tou and R. C. Gonzalez, “Pattern Recognition Principles”, Wiley, 1974
4. Fu K.S., “Syntactic Pattern Recognition And Applications”, Prentice Hall,
5. Rajjan Shinghal, “Pattern Recognition: Techniques and Applications”, Oxford University Press, 2008.

CS010 806: Computer Graphics Lab

Teaching scheme **Credits: 2**
3 hours practical per week

Objectives

- *To acquaint the students with the implementation of fundamental algorithms in Computer Graphics.*

I. Experiments to implement the following: (**first 3 weeks**)

1. DDA Algorithm
2. Bresenham's Line drawing Algorithm for any slope.
3. Mid-point Circle Algorithm.
4. 2D Transformations

II. Experiments to implement the following:

1. 3D Rotations on a cube (about any axis, any general line) controlled by keyboard navigation keys.
2. 3D Rotations on a cube with hidden surface elimination.(keyboard controlled)
3. Composite transformations
4. Bezier cubic splines like screen saver
5. Any Fractal Construction (Koch curve)
6. Animations using the above experiments.(eg.moving along curved path)

Any experiment according to the syllabus of CS010 702 Computer Graphics can be substituted subjected to permission from competent authority.

CS010 807 Project Work

Teaching scheme **credits: 4**

6 hours practical per week

The progress in the project work is to be presented by the middle of eighth semester before the evaluation committee. By this time, the students will be in a position to publish a paper in international/ national journals/conferences. The EC can accept, accept with modification, and request a resubmission.

The progress of project work is found unsatisfactory by the EC during the middle of the eighth semester presentation, such students has to present again to the EC at the end of the semester and if it is also found unsatisfactory an extension of the project work can be given to the students.

Project report: To be prepared in proper format decided by the concerned department. The report shall record all aspects of the work, highlighting all the problems faced and the approach/method employed to solve such problems. Members of a project group shall prepare and submit **separate** reports. Report of each member shall give details of the work carried out by him/her, and only summarise other members' work.

The student's sessional marks for project will be out of 100, in which 60 marks will be based on day to day performance assessed by the guide. Balance 40 marks will be awarded based on the presentation of the project by the students before an evaluation committee.

For Project, the minimum for a pass shall be 50% of the total marks assigned to the Project work.

CS010 808 Viva -Voce

Teaching scheme **credits: 2**

A comprehensive oral Viva-voce examination will be conducted to assess the student's intellectual achievement, depth of understanding in the specified field of engineering and papers published / accepted for publication etc. At the time of viva-voce, certified bound reports of seminar and project work are to be presented for evaluation. The certified bound report(s) of educational tour/industrial training/ industrial visit shall also be brought during the final Viva-Voce.

An internal and external examiner is appointed by the University for the Conduct of viva voce University examination.

For Viva-voce, the minimum for a pass shall be 50% of the total marks assigned to the Viva-voce.

Note: If a candidate has passed all examinations of B.Tech. course (at the time of publication of results of eighth semester) except Viva-Voce in the eighth semester, a re-examination for the Viva-Voce should be conducted within one month after the publication of results. Each candidate should apply for this 'Save a Semester examination' within one week after the publication of eighth semester results.