8th Semester

CSE-4201: Digital Image Processing [3.0 credits, 45 Hours Lecture]

Introduction; Digitization of images and its properties; Data structures for image analysis; Image processing; Segmentation: detection of discontinuities, edge linking and boundary detection, thresholding, region oriented segmentation, use of motion in segmentation; Image transforms: Z-transform, 2D Fourier transform, discrete cosine transform, Hadamard transform, Walsh transform, Slant transform; Image compression: run-length coding, transform coding, standards.

CSE-4202: Project and Thesis [6.0 credits]

Study of problems in the field of Computer Science and Engineering.

Optional Courses:

CSE-4203: Distributed Systems [3.0 Credits, 45 Hours lectures]

Introduction to Parallel and Distributed Systems: Architecture, Challenges, principle and paradigm, Middleware: Introduction to Erlang, Communication: synchronous and asynchronous communication abstraction and model, message passing and shared memory. Replication & Consistency: Control replication, data replication, consistency model and protocols. Distributed Shared Memory: Design issue, Implementation issue, consistency issue, Shared Memory model, MPI, LINDA, ORCA, case study: TradMark, JACKAL. Distributed Objects: introduction, remote objects, CORBA, Distributed Shared object, Globe. Synchronization & Coordination: Distributed algorithms, time and clocks, Local state, Global State, consistency protocols, coordination elections, distributed transactions management. Fault Tolerance: Failure model, Faults, Process Resilience, reliable communication, Recovery, checkpoints and checkpoint algorithms, Rollback recovery algorithms, Security: Threats and attacks, policy and mechanism, Design issue, design of cryptographic algorithms, cryptographic protocols, key distribution, authentication, secure communication, auditing. Naming: Basic concept, Naming Services, DNS, Attribute based naming, X.500 and LDAP, Distributed File Systems: Client perspective, Server perspective, NFS, Coda, Google File System(GFS). Parallel Programming: parallel computing, parallel programming structure, PlanetLab, Grid: Grid model, Grid Middleware, Globus toolkit, PlanetLab Overview.

CSE-4204: Distributed Systems Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4203.

CSE-4205: Cryptography and Network Security [3.0 Credits, 45 Hours lectures]

Overview, Symmetric Ciphers, Block Ciphers and the Data Encryption Standard, Mathematical Tools for Cryptography: Substitutions and Permutations, Modular Arithmetic, Euclid's Algorithm, Finite Fields, Polynomial Arithmetic, Discrete Logarithms. Classical Encryption Techniques, Conventional Symmetric Encryption Algorithms, Modem Symmetric Encryption Algorithms, Advanced Encryption Standard, Contemporary Symmetric Ciphers Confidentiality Using Symmetric Encryption Public, Key- Encryption, Hash Functions and Message Digests. Introduction to Number Theory, Public-Key Cryptography and RSA, Key Management; Other Pubic-Key Cryptosystems, Message Authentication and Hash Functions, Hash Algorithms, Digital Signatures, Certificates, User authentication: Digital Signature Standard (DSS and DSA), Security Handshake Pitfalls Protocols, Network. Security Practice, Authentication Application Electronic Mail Security, IP Security, Web Security, Electronic Commerce Security, System Security, Intruders, Malicious Software, Firewalls.

CSE-4206: Cryptography and Network Security Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4205.

CSE-4207: Basic Multimedia Theory [3.0 credits, 45 Hours Lecture]

Multimedia systems - introduction; Coding and compression standards; Architecture issues in multimedia; Operating systems issues in multimedia - real-time OS issues, synchronization, interrupt handling; Database issues in multimedia - indexing and storing multimedia data, disk placement, disk scheduling, searching for a multimedia document; Networking issues in multimedia - Quality-of-service guarantees, resource reservation, traffic specification, shaping, and monitoring, admission control; Multicasting issues; Session directories; Protocols for controlling sessions; Security issues in multimedia digital water-marking, partial encryption schemes for video streams; Multimedia applications - audio and video conferencing, video on demand, voice over IP.

CSE-4208: Multimedia Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4207.

CSE-4209: Algorithm Engineering [3.0 credits, 45 Hours Lecture]

Computational complexity, Parameterized complexity, Algorithms for combinatorial optimization, practical computing and heuristics, Approximation algorithms, LP based approximation algorithms, randomized algorithms, Experimental algorithmic, Algorithms in state-of-the-art fields like Bioinformatics, Grid Computing, VLSI design etc.

CSE4210: Algorithm Engineering Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4209.

CSE-4211: Computational Geometry [3.0 credits, 45 Hours Lecture]

Algorithm and complexity of fundamental geometric objects: polygon triangulations and art gallery theorem, polygon partitioning, convex hulls in 2-dimension.
Proximity: Voronoi diagrams and Delaunary triangulations. Graph Drawing: drawing styles and applications, drawing of rooted trees, straight line drawing of planar graphs.

CSE-4212: Computational Geometry Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4211.

CSE-4213: Machine Learning [3.0 credits, 45 Hours Lecture]

Introduction to machine learning; Learning algorithms: supervised, unsupervised, reinforcement, attribute based, neural network based, relational supervised and negative correlation; Genetic algorithm, genetic programming and evolutionary programming; Practical application of machine learning.

CSE-4214: Machine Learning Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4214.

CSE-4215: Pattern Recognition [3.0 credits, 45 Hours Lecture]

Pattern Recognition: introduction, importance; Statistical and Neural Pattern Recognition: Bayesian classifier, Bayes decision theory, discriminant functions and decision surfaces; Bayesian classifier for normal distributions; Linear classifiers: discriminant functions and decision hyperplanes, Perceptron algorithm and its variants, Kesslerâ€™s construction; Nonlinear classifiers: two and three layer perceptrons, backpropagation algorithm and its variants; Template matching: optimal path searching techniques, dynamic programming methods, correlation based matching and 2D log search algorithm for image matching; Context dependent classification: Viterbi algorithm, channel equalization, observable and hidden Markov models, three problems of HMM and their application in speech recognition; Syntactic Pattern Recognition: introduction to Syntactic Pattern Recognition, grammar-based approach, parsing, graph-based approach; Unsupervised classification: basic concepts of clustering, proximity measures, categories of clustering algorithms, sequential clustering algorithms.

CSE-4216 Pattern Recognition Lab. [1.5 credits, 45 Hours Lecture]

Introduction to MATLAB; Laboratory works based on CSE-4215and using MATLAB: Bayesian classifier, linear classifier, nonlinear classifier, image matching, speech recognition, context dependent classification.

CSE-4217: VLSI Design [3.0 credits, 45 Hours Lecture]

VLSI design methodology: top-down design approach, technology trends and design automation algorithms; Introduction to CMOS inverters and basic gates; Brief overview of CMOS fabrication process: layout and design rules; Basic CMOS circuit characteristics and performance estimation; Buffer circuit design; Complex CMOS gates, CMOS building blocks: adder, multiplier; data path and memory structures.
Hardware modeling: hardware modeling languages, logic networks, state diagrams, data-flow and sequencing graphs, behavioral optimization.
Architectural Synthesis: circuit specification, strategies for architectural optimization, data-path synthesis, control unit synthesis and synthesis of pipelined circuits.
ASIC design using FPGA and PLDs.

CSE-4218: VLSI Design Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE-4217.

CSE-4219: Wireless Networks [3.0 credits, 45 Hours Lecture]

Cellular concepts: frequency reuse, handoff strategies, interference and system capacity, grade of service, improving capacity and coverage, call blocking probability; Propagation effects: outdoor propagation models, indoor propagation models, power control, Doppler's effect, small and large scale fades; Wireless LAN Technology; IEEE 802.11: standard, protocol architecture, physical layer and media access control; Mobile IP; Wireless Application Protocol; IEEE 802.16 Broadband Wireless Access; Brief review of 2nd and 3rd generation wireless: GSM, GPRS, CDMA; Cordless system; Wireless local loop;
Bluetooth: overview and baseband specifications.

CSE-4220: Wireless Networks Lab. [1.5 credits, 45 Hours Lecture]
Laboratory works based on CSE 4219.

CSE-4221: Optical Fiber Communication [3.0 Credits, 45 Hours lectures]

History of optical communication, advantages and limitations of fiber communication. Theory of light: reflection, refraction, critical incident angle, total internal reflection. Electromagnetic waves, Maxwell's equation, damping waves, wavefront, propagation constant, phase velocity, group velocity. Basics of optical fiber: acceptance angle, numerical aperture, fiber structure, comparison with copper, meridional rays, skew rays, v number of a fiber, modes in a planar guide, Evanescent field, single mode fiber, multimode fibers. Fabrication of optical fibers: Vapor phase deposition techniques: OVD, MCVD, PCVD, VAD, coating. Optical sources: requirements , energy band diagram, LED: (principle of action, internal quantum efficiency, homostructure and heterostructure of LEDs), Laser: (principle of action, properties of stimulated radiation, positive feedback, population inversion, lasing effect, properties of laser beam, types of lasers: QW, Fabry-Perot, DFB, VCSEL), Superluminescent diodes (SLD), blocks of optical transmitter. Photo detectors: principle of action, responsivity, quantum efficiency, modes of operation, advantages of reverse biasing, sensitivity, efficiency of light-current conversion, p-i-n photodiodes: (features, types, advantages), avalanche photodiode: working principle, noise sources in photodiode, blocks of receiver. Losses in fiber: Material absorption loss, Linear scattering loss, Nonlinear scattering loss, Fiber bend loss, Coupling loss, Dispersion, Polarization loss. Fiber optic cables, optical connectors: (basic structure, preparation, types, characteristics), fiber splices: (splicing procedure, mechanical splice, fusion splice, PAS, PAT). Optical

network: OTDM, WDM and DWDM: (lasers, transmitter requirements, receiver requirements, add/drop problem, repeaters), Tunable lasers: (characteristics, external cavity, DBR, integrated cavity lasers). Optical amplifiers: advantages, types, SOA: (types: FPA and TWA, principle of operation, advantages, and disadvantages). EDFA: (principle of operation, characteristics, structure, advantages, noise, DBFA, EBFA). Optical switches, Wavelength converters, Couplers / splitters, WDM mux and demux, filters, Isolators, Circulators, Attenuators. Optical layer: sections, sublayers, services. Protection and restoration techniques.

CSE-4222: Optical Fiber Communication Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE 4221.

CSE-4223: Human Computer Interaction [3.0 Credits, 45 Hours lectures]

Foundations of Human Computer Interaction: Humans and Machines, Interaction, Collaboration. Models in HCI: Cognitive Models, Socio-organizational Issues and Stakeholder Requirements. Importance of cognitive abilities. Design Process: Interaction Design Basics, HCI in Software Process, Design Rules, Universal Design, User Center Design. Design. Prototyping, Task Analysis, GOMS and other key HCI methods. Lifecycle Models. User Interfaces: Interfaces Basics, Interaction Techniques, System Control of Interfaces, Human Factors and Strategies in Designing Interfaces. Evaluation and User Support: Evaluation, Evaluation of Interfaces, User Support. Tasks Models and Dialogs: Analysing the Task, Dialog Notations and Design. Groupware, Ubiquitous Computing, Virtual and Augmented Reality. Social-Cultural Contexts of HCI.

CSE-4224: Human Computer Interaction Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE 4223.

CSE-4225: Mobile Computing [3.0 Credits, 45 Hours lectures]

Overview: Mobile Technologies, Anatomy of a Mobile Device, Survey of Mobile Devices, Applications of Mobile Computing; Application Design: Context, Information Architecture, Design Elements, Mobile Web vs Native Applications; Development Environments: Introduction to Objective-C, The Model-View-Controller Model, The Delegate Pattern, The iPhone, Android,

& Blackberry SDKs; The Application Environment: Limited Resource Computing, Memory Management, Low Power Computing, Fault Tolerance and Persistence, Security Issues; Wireless Communication Technologies: Celluar networks, Wireless (802.11), TCP/IP in the mobile setting, Geolocation and Global Positioning System (GPS); The User Experience: The Small Screen Problem, The Uni_ed Look and Feel Paradigm, The iPhone Human Interface Guidelines, The Blackberry User Interface Guidelines, Common User Interface Guidelines; Distributed Computing: Consistency and Reliability, Security Issues, Ad hoc Networks, Sensor Networks; The Future of Mobile Computing: Upcoming Technologies, Convergence of Media and Communication Devices.

CSE-4226: Mobile Computing Lab. [1.5 credits, 45 Hours Lecture]

Laboratory works based on CSE 4225.