M.TECH - MULTIMEDIA SYSTEMS AND NETWORKING

Department of Computer Science and Engineering

Multimedia information has become pervasive in our environment, at both personal and professional domains. Mobile devices can easily record pictures and videos that are downloaded onto computers and shared across networks. The web provides a unified access to huge amounts of information. Companies integrate multimedia information in the development of their own products or in service to their customers. It is a challenge for multimedia engineers to understand the structure and characteristics of multimedia signals and know how to integrate them in new applications, new devices and new networks. This program addresses jointly all the aspects related to the creation processing and usage of multimedia information in standalone and networked applications. Industries involved in designing, producing and managing systems and infrastructure for information (data, voice, images, video, multimedia) acquisition are prospective organizations for recruitment of students of this course. The need to learn emerging trends in ubiquitous networks makes it necessary for students to equip themselves with this course and make possible a career in cutting edge technologies of multimedia.

Curriculum

First Semester

Course Code	Type	Course	LTP	Credits
MA607	FC	Linear Algebra	4-0-0	4
MN601	FC	Operating Systems	4-0-0	4
MN603	FC	Analysis of Algorithms	4-0-0	4
MN604	SC	Network Systems	3-0-1	4
MN605	SC	Signal Processing	3-0-1	4
HU601	HU	Cultural Education*		P/F
			Credits	**20**

*** Non – Credit Course**

Second Semester

Course Code	Type	Course	LTP	Credits
MN602	FC	Multimedia Information Systems	3-0-1	4
MN606	SC	Multimedia Compression	4-0-0	4
MN607	SC	Multimedia Streaming Techniques	3-0-1	4
	E	Elective I	3-0-0	3
	E	Elective II	3-0-0	3
EN600	HU	Technical Writing*		P/F
			Credits	**18**

*** Non – Credit Course**

Third Semester

Course Code	Type	Course	LTP	Credits
	E	Elective III	3-0-0	3
	E	Elective IV	3-0-0	3
MN799	P	Dissertation		10
			Credits	**16**

Fourth Semester

Course Code	Type	Course	LTP	Credits
MN799	P	Dissertation		12
			Credits	**12**

Total Credits: 66

List of Courses

Foundation Core

Course Code	Course	LTP	Credits
MA607	Linear Algebra	4-0-0	4
MN601	Operating Systems	4-0-0	4
MN602	Multimedia Information Systems	3-0-1	4
MN603	Analysis of Algorithms	4-0-0	4

Subject Core

Course Code	Course	LTP	Credits
MN604	Network Systems	3-0-1	4
MN605	Signal Processing	3-0-1	4
MN606	Multimedia Compression	4-0-0	4
MN607	Multimedia Streaming Techniques	3-0-1	4

Electives

Course Code	Course	LTP	Credits
MN701	Intelligent Multimedia Systems	3-0-0	3
MN702	Video Processing	3-0-0	3
MN703	Media Processing for E-Learning	3-0-0	3
MN704	Computer Vision	3-0-0	3
MN705	Multimedia Security	3-0-0	3
MN706	Interactive Multimedia	3-0-0	3
MN707	3D Graphics and Animation	3-0-0	3
MN708	Medical Imaging	3-0-0	3
MN709	3D Construction and Modeling	3-0-0	3
MN710	Wireless Networks for Multimedia	3-0-0	3
MN711	Digital Video Broadcast	3-0-0	3
MN712	Multimedia Processing for Smart Devices	3-0-0	3
MN713	Green Computing	3-0-0	3
MN714	Multimedia Information Retrieval	3-0-0	3
MN715	Machine Vision	3-0-0	3

Project Work

Course Code	Course	LTP	Credits
MN799	Dissertation		10
MN799	Dissertation		12

MA607 **LINEAR ALGEBRA** **4-0-0-4**

Matrices: System of Linear Equations, LUD Factorization, Rank of a matrix, Eigen Values and Eigen Vectors. Vector Spaces: Vector spaces - Sub spaces - Linear independence - Basis - Dimension - Inner products - Orthogonality - Orthogonal basis - Gram Schmidt Process - Change of basis - Orthogonal complements - Projection on subspace - Least Square Principle. Linear Transformations: Positive definite matrices - Matrix norm and condition number - QR-Decomposition - Linear transformation - Relation between matrices and linear transformations - Kernel and range of a linear transformation - Change of basis - Nilpotent transformations - Similarity of linear transformations - Diagonalization and its applications - Jordan form and rational canonical form. Introduction to Normed Linear space, Banach spaces and Hilbert space.

TEXTBOOKS/REFERENCES:

1. Howard Anton and Chris Rorres, *Elementary Linear Algebra*, 10th Edition, John Wiley & Sons, 2010.
2. Gilbert Strang, *Linear Algebra and Its Applications*, 4th Edition, Cengage, 2006.
3. Justin Solomon, *Mathematical Methods for Computer Vision, Robotics and Graphics*, Stanford University, 2013.
4. Serge Land, *Introduction to Linear Algebra*, 2nd Edition, Springer-Verlag, 1986.
5. Kenneth Hoffmann and Ray Kunze, *Linear Algebra*, 2nd Edition, Prentice Hall, 1971.

MN601 **OPERATING SYSTEMS** **4-0-0-4**

Introduction – Hardware review, Operating system Zoo, Operating system concepts, System call, Operating system structure, CPU Scheduling – Process, Scheduling, Case Study – Process in Linux, User and Kernel threads, Synchronization – threads, inter – process communication – Hardware support for locking, condition variables, Monitors, and semaphores, classical IPC problems.

Deadlock: Deadlock detection and recovery, avoidance, prevention, other issues.

Memory Management – memory abstraction, Virtual memory, Page replacement algorithms, Design issues for paging system, Implementation issues, Segmentation File System: Files, Directories, File System implementation, File System management and Optimization, Case study – Unix System V7 File system I/O System and Storage devices: Principles of I/O Hardware and I/O Software, I/O Software layers, Disks clocks, user interface, thin clients, Power management Multiple Processor System – Multiprocessors, Multicomputer, Visualization, Distribution System, Security – The security environment, Protection mechanisms, Authentication.

Case Study – Linux kernel, Android.

TEXTBOOKS /REFERENCES:

1. Andrew S Tanenbaum, *Modern Operating Systems*, 3rd Edition, Prentice Hall, 2007.
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, *Operating System Concepts with Java*, 8th Edition, Wiley, 2008.

3. *Charles Crowley, Operating Systems – a Design Oriented Approach*, Tata McGraw – Hill, 1998.
4. Wolfgang Mauerer, *Professional Linux Kernel Architecture*, Wiley, 2008
5. Daniel P. Bovet and Marco Cesati, *Understanding the Linux Kernel*, 3rd Edition, O'Reilly, 2006

MN602 MULTIMEDIA INFORMATION SYSTEMS 3-0-1-4

Multimedia Databases, Multimedia Storage Techniques, Information Theory & Systems, Video Information Systems, Query Processing, Storage system architectures - server architectures, input/output processors, Storage array, Disk performance, Disk array, Statistical placement on disks - Frequency based placement, Bandwidth based placement, Striping on disks - Simple striping, Staggered striping, Pseudorandom placement, Constraint allocation on disks - Phase based, Region based.

TEXTBOOKS/REFERENCES:

1. Ze Nian Li and Mark S Drew, *Fundamentals of Multimedia*, Prentice Hall, 2004.
2. Weisi L, Tao D, Kacprzyk J, Li Z, Izquierdo E and Wang H (Eds), *Multimedia Analysis Processing and Communications*, Springer, Vol. 346, 2011.
3. Mahbubur Rahman Syed, *Design and Management of Multimedia Information Systems: Opportunities and Challenges*, Minnesota State University, IGI Global Publishers, 2000.
4. Shu-Ching Chen and Mei-Ling Shyu, *Methods and Innovations for Multimedia Database Content Management*, IGI Global Publishers, June 2012.
5. Shu-Ching Chen and Mei-Ling Shyu, *Multimedia Data Engineering Applications and Processing*, IGI Global Publishers, Feb 2013.

MN603 ANALYSIS OF ALGORITHMS 4-0-0-4

Algorithm Analysis: Asymptotic Notation - Standard notations and common functions - Recurrences – Substitution and Master Method - Amortized Analysis – Aggregate Method - Algorithm Design Techniques: Greedy - Divide and Conquer - Dynamic Programming – Algorithms from Parallel and Distributed Systems- Advanced Topics: NP Completeness – Definitions – Reductions of known NP Hard problems - Approximation Algorithms - Multidimensional Data: Introduction – Need for Multidimensional Data Structures. Multidimensional Point Data Structures: Point Quadtrees – Trie-based Quadtrees – KD, Trees (Point and Tries).

TEXTBOOKS/REFERENCES

1. Michael T Goodrich and Roberto Tamassia, *Algorithm Design: Foundations, Analysis and Internet Examples*, John Wiley & Sons, 2001
2. H. Samet, *Foundations of Multidimensional and Metric Data Structures*, Morgan-Kaufmann, San Francisco, 2006.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, *Introduction to Algorithms*, 2nd Edition, The MIT Press, 2001.

4. Samet, H., *The Design and Analysis of Spatial Data Structures*, Addison-Wesley Publishing Company, San Francisco, 1990.

MN604 NETWORK SYSTEMS 3-0-1-4

Introduction to Computer Networks, Networking Principles, Constant Bit Rate, Variable Bit Rate Network Services, Network Elements, Multiplexing, Switching, Error Control, Flow Control Multimedia Networking, Multimedia Networking Applications, Streaming Stored Audio and Video, Making the Best of the Best-Effort Service, RTP, Beyond Best Effort Scheduling and Policing Mechanisms for Providing QoS Guarantees, Integrated Services RSVP, Differentiated Services- Network Layer Introduction, Network Aspects of Standardization Projects, , Transport, Network Technologies Radio and Satellite Systems, Network Functions, Network Management Transport Network Layered Architecture, Routing Procedure for Multimedia Communications, Security Issues, Multimedia Traffic Management- Introduction to High Speed Networks, Analysis of Network traffic using deterministic and stochastic Models, Simulation tools, Tele-traffic engineering, Queuing Models -High Speed TCP Variants, Congestion Control in TCP/IP, ATM High Speed LAN, Gigabit Ethernet, Distributed Queue Dual Bus (DQDB) Protocols for QoS Support: IntServ, DiffServ, RSVP, MPLS, Applications demanding high speed communication, Multimedia IP broadcasting, Error resilience in Multimedia Transmission.

TEXTBOOKS/REFERENCES:

1. Kurose and Ross, *Computer Networking: A Top-Down Approach Featuring the Internet*, 3rd Edition, Pearson Education, 2012
2. Peterson and Davie, *Computer Networks: A Systems Approach*, 4th Edition, Morgan Kaufmann, April 2007.
3. Tarek N. Saadawi and Mostafa H. Ammar, *Fundamentals of Telecommunication Networks*, Wiley Interscience Publication, John Wiley & Sons, 1994
4. William Stallings, *High-speed networks and Internets – Performance and Quality of Service*, 2nd Edition, Prentice Hall, 2008
5. Fred Halsall, *Multimedia Communications: Applications, Networks, Protocols and Standards*, Addison-Wesley, 2001.
6. K. R. Rao, Zoran S. Bojkovic and Dragorad A. Milovanovic, *Introduction to Multimedia Communications Applications, Middleware, Networking*, John Wiley, 2006.

MN605 SIGNAL PROCESSING 3-0-1-4

Sequences and Discrete-Time - From Euclid to Hilbert **-** Vector spaces, Hilbert spaces, Approximations, Projections and decompositions, Bases and frames. Systems **-** Sequences, Systems, Discrete-time Fourier transform, z-transform, DFT, Multirate sequences and systems, Stochastic processes and systems. Functions and Continuous-Time Systems **-**Functions, Systems, 2-D Discrete-Space Transforms Fourier transform, Fourier series, Continuous stochastic processes and systems. Sampling and Interpolation **-** Sampling and interpolation with -finite-dimensional vectors, sequences, functions, periodic functions, stochastic processes. Approximation and Compression **-** Approximation by - polynomials, splines, series truncation,

Compression and transform coding. Localization and Uncertainty **-** Localization for - functions, sequences, bases, Local Fourier and wavelet bases, Time, frequency and resolution in the real world - Group theoretical methods for signal processing- Image Representation and Properties: Introduction – Image Representation – Image Digitization – Digital Image Properties- Color Images – Overview of Cameras - DCT – Eigen Analysis – SVD – PCA - Image as Stochastic Processes –Image Pre-Processing in Spatial and Frequency Domain: Pixel Brightness Transformation – Geometric Transformations – Local Preprocessing – Image Smoothing – Edge Detectors - Corner Detectors – Image Restoration -Image Segmentation: Thresholding – Edge-Based Segmentation – Region Based Segmentation – Matching – Evaluation Issues in Segmentation.

TEXTBOOKS/REFERENCES:

1. Tamlal Bose, *Digital Signal and Image Procesing*, Wiley, 2003
2. John G Proakis and Dimitris K Manolakis, *Digital Signal Processing, Principles Algorithms and Applications*, 4th Edition, Pearson Education, 2007
3. Jae S lim, *Two Dimensional Signal and Image Processing*, Prentice Hall, 1990
4. John W. Woods, *Multidimensional Signal, Image, and Video Processing and Coding*, 2nd Edition, Academic Press, Elsevier Inc., 2012.
5. Milan Sonka, Vaclav Hlavac and Roger Boyle, *Image Processing, Analysis and Machine Vision*, 3rd Edition, Cengage Learning, 2007.
6. Rafael C. Gonzalez and Richard E. Woods, *Digital Image Processing*, 3rd Edition, Pearson Education, 2009.
7. Ulrich Karrenberg, R. Hooton and U. Boltz, *An Interactive Multimedia Introduction to Signal Processing*, Springer 2007.

MN606 MULTIMEDIA COMPRESSION 4-0-0-4

Image and video compression. Entropy coding. Prediction. Quantization. Transform coding and 2-D discrete cosine transform. Color compression. Motion estimation and compensation. Digital video. Image coding standards such as JPEG. Video coding standards such as the MPEG series and the H.26x series. H.264/MPEG-4 AVC coding. Natural and synthetic visual coding. Rate-distortion theory and optimization. Video quality and coding efficiency – Inter Frame Coding Standards: H.261-H.263-H.265- MPEG-1- MPEG-2-MPEG-4-MPEG-7-MPEG-H - Audio and speech compression - Digital audio signal processing fundamentals - Non-perceptual coding - Perceptual coding - Psychoacoustic model - High-quality audio coding - Parametric and structured audio coding - Audio coding standards - Scalable audio coding - Speech coding - Speech coding standards.

TEXTBOOKS/REFERENCES:

1. Ze Nian Li and Mark S Drew, *Fundamentals of Multimedia*, Prentice Hall, 2004.
2. Krishna Kumar D N, *Multimedia Communications, Components, Techniques, Standards*, Sanguine Technology Publications, 2008.
3. Frederick Jeliek, *Statistical Methods for Speech Recognition*, MIT Press, 1998.
4. B. Furht, S. W. Smoliar and H-J. Zang, *Video and Image Processing in Multimedia Systems*, Kluwer Academic Pub, 1996.

5. Manjunath Ramachandra, *Information Compression*, IGI Global Publishers, 2010.

MN607 MULTIMEDIA STREAMING TECHNIQUES 3-0-1-4

Multimedia over Internet - RSVP, RTP, RTCP, RTSP; Real-time Characteristics (Limits on Delay and Jitter), Need for Higher Bandwidth, Error Requirements Multicasting Support, Session Management, Security, Mobility Support; Best-effort Internet Support for Distributed Multimedia Traffic Requirements; Proposed Service Models for the Internet; H.323, Session Initiation Protocol; Quality of Service Architecture for 3rd Generation Cellular Systems, Multimedia Streaming, Internet protocols for VoIP: IP, TCP, UDP, ARP, DNS, RTP, SCTP; VoIP signalling in public networks - H.323, SIP; VoIP signalling in corporative networks.

TEXTBOOKS/REFERENCES

1. Steve Mack, *Streaming Media Bible*, Wiley Publishers, 2002.
2. Damien, *Mastering Internet Video: A Guide to Streaming and On-Demand*, Addison-Wesley, 2004.
3. K R Rao, Zoran S Bojkovic and Dragorad A. Milovanovic, *Multimedia Communication Systems Techniques, Standards and Networks*, Prentice Hall, ISBN 8120321456, 2002
4. Ce Zhu, Yuenan Li and Xiamu Niu, *Streaming Media Architectures, Techniques and Applications: Recent Advances*, IGI Global, 2010
5. Gregory C. Demetriades, *Streaming Media: Building and Implementing a Complete Streaming System*, IGI Global, 2003

EN600 TECHNICAL WRITING P/F

Mechanics of writing: Grammar rules – punctuation - spelling rules - tone and style- prewriting techniques - document editing – proof reading – visual elements- formatting documentation style - technical definitions & descriptions- Different kinds of written documents: user and instruction manuals - reports - proposals - content for World Wide Web- creation of web pages, lay out, design etc.

TEXT BOOKS / REFERENCES:

1. Hirish, Herbert. L, *Essential Communication Strategies for Scientists, Engineers and Technology Professionals*, 2nd Edition, New York: IEEE press, 2002
2. Anderson, Paul. V, *Technical Communication: A Reader-Centred Approach*, 6th Edition. Cengage Leraning India Pvt. Ltd., New Delhi, Reprint 2010.
3. Strunk,William Jr. and White. EB. *The Elements of Style*, New York. Alliyan & Bacon, 1999.

MN701 INTELLIGENT MULTIMEDIA SYSTEMS 3-0-0-3

Multimodal Interaction and Presentation, Intelligent Environments, Embodied Conversational Agents, Virtual Humans, Intelligent Graphics, Augmented Reality, Multimodal Dialogue,

Natural Language Interfaces, User Modeling, Recommender Systems, Intelligent Workspaces (Tool-Based Computing, Assistive Animation), Multimedia Information Retrieval, Humanoid Robotics, Intelligent Tutoring Systems, Affective Interfaces.

TEXTBOOKS/REFERENCES

1. Randy M. Kaplan, *Intelligent Multimedia Systems: A Handbook for Creating Applications*, Wiley, 1997.
2. Chabane Djeraba, *Multimedia Mining: A Highway to Intelligent Multimedia Documents*, Springer, 2002.
3. George A. Tsihrintzis, Maria Virvou, Lakhmi C. Jain and Robert J. Howlett, *Intelligent Interactive Multimedia Systems and Services*, Springer 2011.
4. Zdzislaw S. Hippe, Juliusz L. Kulikowski, Jerzy Wtorek and Teresa Mroczek, *Human-Computer Systems Interaction: Backgrounds and Applications 3 (Advances in Intelligent Systems and Computing)*, Springer, 2014.
5. Pradeep K. Atrey, Mohan Kankanhalli and Andrea Cavallaro, *Intelligent Multimedia Surveillance: Current Trends and Research*, Springer, 2013.

MN702 VIDEO PROCESSING 3-0-0-3

Video formation and representation: Color perception and specification - Video capture and display- Analog video raster- Analog color television systems - Digital video - Fourier analysis of video signals and frequency response of the human visual system-Mixing of Signals and colour perception-Chromaticity Diagram-Color Television Camera-Color TV Signals-Video sampling: Basics of the lattice theory - Sampling over lattices - Sampling of video signals - Filtering operations in cameras and display devices. Video sampling rate conversion: Conversion of signals sampled on different lattices - Sampling rate conversion of video signals. Video Modeling: Camera Lenses, Auto Focus Systems, Camera model - Illumination model - Object model - Scene model - Two dimensional motion models - Motion estimation and Compensation-Block Matching Method, Hierarchical Block. 3D Video: Challenges in 3D video processing - disparity estimation, view synthesis, quality metric, Analog video, Digital Video, Time varying Image Formation models : 3D motion models, Geometric Image formation , Photometric Image formation, sampling of video signals, filtering operations.

TEXTBOOKS/REFERENCES

1. Yao Wang, Jorn Ostermann and Ya-Quin Zhang, *Video Processing and Communications*, Prentice Hall, 2001.
2. John W Woods, *Multidimensional Signal, Image and Video Processing and Coding*, Academic Press, 2006.
3. Marcus Weise and Diana Weynand, *How Video Works from Analog to High Definition*, 2nd Edition, Focal Press, 2007.
4. Allen C. Bovik, *The Essential Guide to Video Processing*, 1st Edition, Academic Press, 2009
5. Michael Parker and Suhel Dhanani, *Digital Video Processing for Engineers: A Foundation for Embedded Systems Design*, Newnes, 2013.

MN703 MEDIA PROCESSING FOR E-LEARNING 3-0-0-3

Space, time and frequency division multiple access in satellite communication systems. Modulation and multiplexing techniques in satellite communications, Inter-satellite links, IP protocol for satellite networks, Control Server, Agent Server, AV (Audio/Video) Streaming Server, Presentation Capture Server apart from other servers like Media Control Recording Server, Whiteboard Server, Text interaction Server, Live Voice Room Server, Private Voice Call server; VSAT networks that are capable of supporting a wide variety of circuit connectivity's and protocol requirements, such as: point-to-point, point-to-multipoint, broadcasting, unicasting, and multi-casting services over dedicated circuits, switched circuits, IP, E-learning via Internet - Bandwidth, Streaming Server.

TEXTBOOKS/REFERENCES

1. Pierre, Samuel , *E-Learning Networked Environments and Architectures*, Springer 2007.
2. Allison Littlejohn and Chris Pegler, *Preparing for Blended e-learning (Connecting with E-learning)*, New Ed Edition, Routledge, June 16 2007.
3. Ruth C. Clark and Richard E. Mayer, *e-Learning and the Science of Instruction: Proven Guidelines for Consumers and Designers of Multimedia Learning*, 1st Edition, Pfeiffer, October 28 2002.
4. William Horton, *e-Learning by Design*, 2nd Edition, Pfeiffer, October 11 2011.

MN704 COMPUTER VISION 3-0-0-3

Image Formation Models **-** Monocular imaging system, Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems. Shape from X – Shape from Stereo, Shape from Shading, Shape from Silhouette, Shape from Texture and Shape from Focus - Shape Representation: Statistical Shape Models, Active Shape Models, Combined Appearance Models, Active Appearance Models, View-based Appearance Models, Tracking with View-based Appearance Models - Object Recognition: Shape Correspondence and Shape Matching, PCA, Shape Priors for Recognition, Finding Templates and Recognition, Recognition by Relations between Templates, Robotic vision, Computer Vision on the GPU - Tracking & Video Analysis: Tracking and Motion Understanding – Kalman filters, condensation, particle, Bayesian filters, hidden Markov models, change detection and model based tracking.

TEXTBOOKS/REFERENCES:

1. Forsyth and Ponce, *Computer Vision – A Modern Approach*, Prentice Hall, 2003.
2. Emmanuele Trucco and Alessandro Verri, *Introductory Techniques for 3-D Computer Vision*, Prentice Hall, 1998.
3. Richard Szeliski, *Computer Vision: Algorithms and Applications*, Springer 2011.
4. Milan Sonka, V. Hlavac and R. Boyle, *Image Processing, Analysis and Machine Vision*, Brooks Cole Publishing Company, 1999.

MN705 MULTIMEDIA SECURITY 3-0-0-3

Security Techniques: Steganography - Image, Audio and Video, Digital watermarking. Content Security: Encryption and compression methods for securing multimedia content delivery, Cross-layer multimedia security technology, Physical layer security for multimedia, Secrecy capacity of various channel models for multimedia, Emerging and needed standards in mobile security, Mobile device authentications for "Bring-Your-Own-Device" in enterprises, Lightweight multimedia encryption for mobile services, Information privacy in multimedia content. Secure transmission of multimedia data in resource-constrained environments such as wireless video surveillance networks, telemedicine frameworks for distant health care support in rural areas, and Internet video streaming.

TEXTBOOKS/REFERENCES

1. Chun-Shien Lu, *Multimedia Security*, IGI Publishing, 2004.
2. Amit Pande, and Joseph Zambreno, *Embedded Multimedia Security Systems: Algorithms and Architectures*, Springer, 2013.
3. Frank Y. Shih, *Multimedia Security: Watermarking, Steganography, and Forensics*, CRC Press, Taylor & Francis Group, 2013.
4. Sokratis Katsikas, *Communications and Multimedia Security*, Chapman and Hall, 1997.
5. Ralf Steinmetz, Jana Dittmann and Martin Steinebach, *Communications and Multimedia Security Issues of the New Century*, Kluwer Academic Publishers, 2001.
6. Wenjun Zeng, Heather Yu and Ching-Yung Lin, *Multimedia Security Technologies for Digital Rights Management*, Volume 18, Academic Press, 2006

MN706 INTERACTIVE MULTIMEDIA 3-0-0-3

Multimedia Transcoding: Adaptation and personalization of multimedia content, video annotation techniques, Quality of Service, Semantic architectures. Interaction by other methods: interaction design, new media, interactivity, human computer interaction, cyber culture, digital culture, and augmented reality.

TEXTBOOKS/REFERENCES

1. Dix, Alan; Finlay, Janet; Abowd, Gregory D.; Beale, Russell., *Human-Computer Interactio*n, 3rd Edition, Pearson Education, p. xvi. ISBN 9780130461094, 2004.
2. Manovich, Lev, *The Language of New Media*, Cambridge: MIT Press. p. 55, 2001.
3. Syed Mahbubur Rahman, *Interactive Multimedia Systems*, Idea Group Inc (IGI), 2002.
4. Ioannis Deliyannis, *Interactive Multimedia*, InTech, ISBN: 978-953-51-0224-3, 2007.
5. Sanjaya Mishra and Ramesh C. Sharma, *Interactive Multimedia in Education and Training*, Idea Group Inc (IGI), 2004.
6. Dick C.A. Bulterman and Lloyd Rutledge, *Interactive Multimedia for the Web, Mobile Devices and Daisy Talking Books*, X. Media Publishing, 2008.

MN707 3D GRAPHICS AND ANIMATION 3-0-0-3

Modeling, Layout and animation, rendering 2D images, vector graphics, raster graphics, wireframe model, algorithms, lighting, rendering techniques, photorealistic rendering, 3D projection.

TEXTBOOKS/REFERENCES

1. Andy Beane, *3D Animation Essentials*, Sybex, 2012.
2. Fore June*, An Introduction to 3D Computer Graphics, Stereoscopic Image, and Animation in OpenGL and C/C++*, 2nd Edition, Create Space Independent Publishing Platform, November 2, 2011.
3. Isaac Kerlow, *The Art of 3D Computer Animation and Effects*, 4th Revised & Enlarged Edition, Wiley, April 13 2009.
4. John M. Blain, *The Complete Guide to Blender Graphics: Computer Modeling and Animation*, 1st Edition, A K Peters/CRC Press, April 16 2012.
5. Mark Giambruno, *3D Graphics & Animation*, 2nd Edition, New Riders Press, June 21 2002.

MN708 MEDICAL IMAGING 3-0-0-3

Medical imaging modalities: Planar X-Ray imaging- X-Ray Computed Tomography – Magnetic Resonance Imaging – Nuclear Imaging – Ultrasonography – other modalities. Image file formats: DICOM. Image Enhancement: Fundamental enhancement techniques-Adaptive image filtering – Enhancements by multiscale non linear operators – Case Study. Image segmentation: Overview and fundamentals of medical image segmentation –Segmentation using fuzzy clustering – Neural networks – Deformable models - Case study. Medical image registration: Rigid body transformation – Non rigid body transformation –Pixel based registration – Surface based registration – Intensity based registration. Medical image fusion: Linear and non linear methods – Wavelet based fusion – Pyramidal fusion schemes. Validation of medical image analysis techniques. Case Study: Tissue characterization and classification – Brain image analysis and atlas construction – Tumor image analysis and treatment planning – Microscopic Image analysis- Tongue and abdominal imaging.

TEXT BOOKS / REFERENCES:

1. Geoff Dougherty, *Medical Image Processing Techniques and Applications*, Springer New York Dordrecht Heidelberg London, 2011.
2. Thomas M Deserno, *Biomedical Image Processing* ,Springer-Verlag Berlin Hiedelberg 2011.
3. A Ardheshir Goshtasby, *2-D and 3-D Image Registration for Medical, Remote Sensing and Industrial Applications*, John Wiley & Sons, 2005.
4. Tania Sthathaki, *Image Fusion: Algorithms and Applications*, Academic Press, 2008.
5. James T. Dobbins III, Sean M. Hames, Bruce H Hasegawa, Timothy R. DeGrado, James A. Zagzebski and Richard Frane, *Measurement, Instrumentation, and Sensors Handbook*, 2nd Edition, Electromagnetic, Optical, Radiation, Chemical and Biomedical Measurement CRC Press, pp 67-1 - 67-23, 2014.

MN709 3D CONSTRUCTION AND MODELING 3-0-0-3

Modeling: Representation of 3D Objects: Raw 3D data, Surface Representation, Solid Representation, High-Level Representation. Reconstruction of 3D Meshes from Polygon Soup: Cell complex, Solidity Determination, Meshes reconstruction. Advanced Rendering Techniques: Photorealistic Rendering, Global Illumination, Participating Media Rendering, Ray tracing, Monte Carlo algorithm, Photon Mapping. Volume Rendering: Volume graphics Overview, Marching cubes, Direct volume rendering.

Surfaces and Meshes Subdivision: Distance fields and level sets, Physically-based Modeling Stable fluid solver, Lattice Boltzmann method. Visualization: Meshes for Visualization, Volume Visualization and Medical Visualization. Case study: Selected Topics in Vector and Tensor visualization in medical Applications, Visualization Systems, Surface extraction methods from medical imaging data, Geometry processing in medical Applications, Visualization of multi-channel medical imaging data.

TEXT BOOKS / REFERENCES:

1. Tomas Moller and Eric Haines, *Real-Time Rendering*, 2nd Edition, A K Peters Ltd, 2002.
2. Alan H. Watt and Mark Watt, *Advanced Animation and Rendering Techniques: Theory and Practice*, Addison-Wesley, 1992.
3. Matt Pharr and Greg Humphreys, *Physically Based Rendering: From Theory to Implementation*, Morgan Kaufmann, 2004.
4. Georges-Pierre Bonneau, Thomas Ertl and Gregory Nielson, *Scientific Visualization: The Visual Extraction of Knowledge from Data (Mathematics and Visualization),* Springer, 2010.
5. Bernhard Preim and Dirk Bartz, *Visualization in Medicine, Theory, Algorithms and Applications*, Morgan Kaufmann, 2007.
6. Lars Linsen, Hans Hagen and Bernd Hamann, *Visualization in Medicine and Life sciences*, Springer-Verlag Berlin Hiedelberg, 2008.

MN710 WIRELESS NETWORKS FOR MULTIMEDIA 3-0-0-3

Wireless Systems: Network infrastructure for mobility, Hand off between IP networks, Mobile IP(MIP) - Streaming multimedia over wireless networks: Quality of Service (QoS), High quality transmission during handoff, multimedia signal (images, text, audio and data) integrity for transmissions on wireless systems, QoS issues in real-time communication, IEEE 802.11 MAC protocol.

TEXTBOOKS/REFERENCES

1. Stallings William, *Wireless Communications and Networks*, 2nd Edition , Pearson Education Ltd, 2009.
2. K R Rao, Zoran S Bojkovic, Dragorad A Milovanovic, *Multimedia Communication Systems Techniques, Standards and Networks*, Prentice Hall, ISBN 8120321456, 2002.
3. Mihaela van der Schaar and Philip A Chou, *Multimedia over IP and Wireless Networks: Compression, Networking, and Systems,* 1st Edition, Academic Press, March 30 2007.

4. Aura Ganz, Zvi Ganz and Kitti Wongthavarawat, *Multimedia Wireless Networks: Technologies, Standards and QoS,* Prentice Hall PTR, September 28 2003.
5. Benny Bing, *Broadband Wireless Multimedia Networks,* 1st Edition, Wiley, December 17 2012.

MN711 DIGITAL VIDEO BROADCAST 3-0-0-3

HD television standards, HD signals multiplexing, Channel coding, Digital modulation (OFDM and COFDM), 3D television systems. Auto-stereoscopy. Tridimensional sense of space, HD and 3D video signal transmission using DVB-T2 standard., Standards for generating and storage of HD and 3D video material, HD and 3D television signal receivers (LCD, plasma, LED, 3D displays and glasses).

TEXTBOOKS/REFERENCES

1. K R Rao, Zoran S Bojkovic, Dragorad A Milovanovic, *Multimedia Communication Systems Techniques, Standards and Networks*, Prentice Hall, ISBN 8120321456, 2002.
2. Fa-Long Luo, *Mobile Multimedia Broadcasting Standards: Technology and Practice,* 2009 Edition, Springer, November 26 2008.
3. Walter Fischer, *Digital Video and Audio Broadcasting Technology: A Practical Engineering Guide (Signals and Communication Technology),* 3rd Edition, Springer, 2010.
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MN712 MULTIMEDIA PROCESSING FOR SMART DEVICES 3-0-0-3

Multimedia service and applications for smart device and equipments: context-aware ubiquitous computing, novel machine architectures, parallel/distributed/grid computing, protocols for ubiquitous services, semantic Web and knowledge grid, smart home and natural interfaces, ubiquitous database methodologies, ubiquitous security, U-healthcare, and other applications.

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1. Huang**,** Y. M., Chao**,** H. C., Deng**,** D. J., Park**,** *Advanced Technologies, Embedded and Multimedia for Human-centric Computing*, Series: Lecture Notes in Electrical Engineering, Vol. 260, Springer 2013.
2. Xiaoyi Jiang, Matthew Y. Ma and Chang Wen Chen**,** *Mobile Multimedia Processing: Fundamentals, Methods, and Applications*, Lecture Notes in Computer Science / Computer Communication Networks and Telecommunications, Springer, 2010.
3. Jun-Ho Kim, Hyun-Woo Kim, Eun-Ha Song and Young-Sik Jeong, *An Efficient Privacy Scheme Based on Smart Multimedia Devices*, Springer Berlin Heidelberg, Book Title: Future Information Technology, 2014.

4. Dan Saffer, *Designing for Interaction: Creating Smart Applications and Clever Devices*, New Riders, 2006.

MN713 GREEN COMPUTING 3-0-0-3

Green data centers, new challenges for volume-intensive power-demanding video traffic over today's network in processing, storage, extraction, delivery, and management. Real-time semantic processing, Content storage, preservation, and computation, Distributed multimedia, middleware, and context-aware, Collaborative extraction, modeling, data and decision fusion, Scalable video coding in large-scale hierarchical networks, Collaborative sensing and processing for smart cameras. Energy aware processing: Low-power multimedia rendering and display including content adaptive display adaptation, environment adaptive presentation, and multimedia display technologies, low-power multimedia system design including software and hardware architectures, scalable computations, and low-memory implementations.

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1. Jason Harris, *Green Computing and Green IT Best Practices on Regulations and Industry Initiatives, Virtualization, Power Management, Materials Recycling and Telecommuting*, Emereo Publishing, 2008.
2. Wu-chun Feng, *Tackling Energy Efficiency at Large Scale*, Chapman & Hall/CRC Computational Science CRC Press, 2014.
3. John Lamb, *The Greening of IT*, Pearson Education, ISBN: 9780137150830, 2010.
4. Alvin Galea, Michael Schaefer and Mike Ebbers, *Green Data Center: Steps for the Journey*, Shroff/IBM Redbooks, ISBN: 9789350233672, 2011.

MN714 MULTIMEDIA INFORMATION RETRIEVAL 3-0-0-3

Information Retrieval, Web based IR, PageRank, HITS, Network Analysis & Social Networks, Multimedia Metadata, Image Analysis and Content Based Image Retrieval, Audio & Sound Analysis, Querying and Streaming, Feature extraction methods, Merging and Filtering methods, Categorization methods, Quality of systems, Open problems - Algorithms: Stereovision matching algorithms for real-time multimedia applications, scalable algorithms for multimedia signals, Block matching algorithms for multimedia service, Large scale multimedia indexing algorithms, such as MapReduce-based petabyte image/video; indexing algorithms, Locality-sensitive hashing for massive multimedia indexing, Scalable multimedia retrieval and mining algorithms, such as ultra-fast approximate nearest neighbor algorithm for massive image/video retrieval, online semantics-preserving algorithms for enhancing Bag-of-words (BoW) model, Distributed and parallel computing platform for massive multimedia process.

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2. Feng, David, Siu, W.C., Zhang, Hong Jiang (Eds.), *Multimedia Information Retrieval and Management*, *Series: Signals and Communication Technology,* Springer, 2003

3. Mark T. Maybury, *Intelligent Multimedia Information Retrieval*, AAAI Press, 1997.
4. David Feng, W.C. Siu and Hong Jiang Zhang, *Multimedia Information Retrieval and Management: Technological Fundamentals and Applications (Signals and Communication Technology),* Springer, 2003.
5. Stefan Rueger and Gary Marchionini, *Multimedia Information Retrieval (Synthesis Lectures on Information Concepts, Retrieval, and S)*, 1st Edition, Morgan and Claypool Publishers, Jan 13 2010.
6. Horst Eidenberger, *Handbook of Multimedia Information Retrieval*, Atpress, September 7 2012.

MN715 ` MACHINE VISION 3-0-0-3

Design and Fabrication of Soft Zoom Lens Applied in Robot Vision-Methods for Reliable Robot Vision with a Dioptric System-An Approach for Optimal Design of Robot Vision Systems-Visual Motion Analysis for 3D Robot Navigation in Dynamic Environments-A Visual Navigation Strategy Based on Inverse Perspective Transformation-Vision-based Navigation Using an Associative Memory-Vision Based Robotic Navigation: Application to Orthopedic Surgery-Navigation and Control of Mobile Robot Using Sensor Fusion-Visual Navigation for Mobile Robots-Interactive Object Learning and Recognition with Multiclass Support Vector Machines-Recognizing Human Gait Types-Environment Recognition System for Biped Robot Walking Using Vision Based Sensor Fusion-Non Contact 2D and 3D Shape Recognition by Vision System for Robotic Prehension-Image Stabilization in Active Robot Vision-Real-Time Stereo Vision Applications-Robot vision using 3D TOF systems- Calibration of Non-SVP Hyperbolic Catadioptric Robotic Vision Systems-Computational Modeling, Visualization, and Control of 2-D and 3-D Grasping under Rolling Contacts- Towards Real Time Data Reduction and Feature Abstraction for Robotics Vision-LSCIC Pre Coder for Image and Video Compression-The Robotic Visual Information Processing System Based on Wavelet Transformation and Photoelectric Hybrid-Direct Visual Serving of Planar Manipulators Using Moments of Planar Targets-Industrial Robot Manipulator Guarding Using Artificial Vision-Remote Robot Vision Control of a Flexible Manufacturing Cell- Robot Vision in Industrial Assembly and Quality Control Processes-Multi-Task Active-Vision in Robotics**.**

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1. Ales Ude, *Robot Vision*, InTech, March 01 2010.
2. Daiki Ito, *Robot Vision: Strategies, Algorithms and Motion Planning*, Nova Science Publishers, Incorporated, 2008.
3. Christian Wiedemann , Markus Ulrich and Carsten Steger, *Machine Vision Algorithms and Applications*, Wiley-VCH, 2008.
4. E. R. Davies, *Computer and Machine Vision, Theory, Algorithms, Practicalities*, 4th Edition, Elsevier, 2012.
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