RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based on AICTE Flexible Curricula

CSE-Data Science/Data Science, V semester

CD504 (A) Computer Graphics & Visualization

Unit-I Introduction to Raster Scan displays, Pixels, Frame buffer, Vector & Character generation, Random Scan systems, Display devices, Scan Conversion techniques, Line Drawing algorithms: simple DDA, Bresenham's Algorithm, Circle Drawing Algorithms: Midpoint Circle drawing and Bresenham's Algorithm, Polygon fill algorithm: Boundary-fill and Flood-fill algorithms.

Unit-II 2-D Transformation: Translation, Rotation, Scaling, Shearing, Reflection. Inverse Transformation, Homogeneous coordinate system, Matrices Transformation, Composite Transformation. Windowing & Clipping: World Coordinate System, Screen Coordinate System, Viewing Transformation, Line Clipping & Polygon Clipping Algorithms

Unit-III 3-D Transformations: Translation, Rotation and Scaling. Parallel & Perspective Projection: Types of Parallel & Perspective Projection, Hidden Surface elimination: Depth comparison, Back face detection algorithm, Painter's Algorithm, Z-Buffer Algorithm. Curve generation, Bezier and B-spline methods. Basic Illumination Model: Diffuse reflection, Specular reflection, Phong Shading, Gouraud shading, Ray Tracing, Color models like RGB, YIQ, CMY, HSV.

Unit-IV Visualization: Visualization of 2D/3D scalar fields: color mapping, ISO surfaces. Direct volume data rendering: ray-casting, transfer functions, segmentation. Visualization of Vector fields and flow data, Time-varying data, High-dimensional data: dimension reduction, parallel coordinates, Non-spatial data: multi-variate, tree/graph structured, text Perceptual and cognitive foundations, Evaluation of visualization methods, Applications of visualization, Basic Animation Techniques like traditional, key framing

Unit –V Multimedia :Basic of multimedia, application of Multimedia, Text-Types, Unicode Standard ,text Compression, Text file formats, Audio Components, Digital Audio, Digital Audio processing, Sound cards, Audio file formats ,Audio Processing software ,Video-Video color spaces, Digital Video, Digital Video processing, Video file formats. Animation: Uses of Animation, Principles of Animation, Computer based animation, 3D Animation, Animation file formats, Animation software,Special Effects in animation, Storyboarding for Animation, Compression: Lossless/Lossy Compression techniques, Image, Audio & Video Compression, MPEG Standards ,Multimedia Architecture, Multimedia databases.

Recommended Text:

1. Donald Hearn and M.P. Becker "Computer Graphics" Pearson Pub.
2. Foley, Van Dam, Feiner, Hughes, "Computer Graphics: Principles and Practice" Addison- Wesley

3. Rogers, "Procedural Elements of Computer Graphics", Tata McGraw Hill
4. Parekh “Principles of Multimedia” Tata McGraw Hill
5. Maurya, “Computer Graphics with Virtual Reality System “ , Wiley India
6. Pakhira,”Computer Graphics ,Multimedia &Animation”,PHI learning
7. Andleigh, Thakral , “Multimedia System Design “ PHI Learning
8. Khalid Sayood , “Introduction to Data Compression”, Morgan Kaufmann

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CD504 (B) Data Compression

COURSE DESCRIPTION:

The course covers the theory of quantization and basic concepts in source coding and applications of the theory and concepts to systems that convert analog or high-rate digital signals into lowrate digital representations with or without loss of fidelity. The concept of source coding is extended to general descriptions of a statistical information source where various data modeling techniques find useful applications.

COURSE OBJECTIVES

The objective of this course is to

1. Gain a fundamental understanding of data compression methods for text, images, and video, and related issues in the storage, access, and use of large data sets
2. Select, giving reasons that are sensitive to the specific application and particular circumstance, most appropriate compression techniques for text, audio, image and video information
3. Illustrate the concept of various algorithms for compressing text, audio, image and video information.

COURSE OUTCOMES

On completion of this course, the students will be able to:

1. program, analyze Hoffman coding: Lossless image compression, Text compression, Audio Compression
2. program and analyze various Image compression and dictionary based techniques like static Dictionary, Diagram Coding, Adaptive Dictionary
3. understand the statistical basis and performance metrics for lossless compression
4. understand the conceptual basis for commonly used lossless compression techniques, and understand how to use and evaluate several readily available implementations of those techniques
5. understand the structural basis for and performance metrics for commonly used lossy compression techniques and conceptual basis for commonly used lossy compression techniques.

COURSE CONTENT

Unit I: Compression Techniques

Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, com-posite source model, Coding: uniquely decodable codes, Prefix codes.

Unit II: The Huffman coding algorithm

Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Lossless image compression, Text compression, Audio Compression.

Unit III: Coding

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression- The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, ImageCompression: The Graphics Interchange Format (GIF),

Compression over Modems: V.42 bits, Predictive Coding:

Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Move to- front coding, CALIC, JPEGLS, Multi-resolution Approaches, Facsimile Encoding, Dynamic Markoy Compression.

Unit IV: Scalar Quantization

Distortion criteria, Models, Scalar Quantization: The Quantization problem, Uniform Quantizer, Adaptive Quantization, Non uniform Quantization.

Unit V: Vector Quantization

Advantages of Vector Quantization over Scalar Quantization, TheLinde-Buzo-Gray Algorithm.

TEXT BOOKS

1. The Data Compression Book – Mark Nelson.
2. Data Compression: The Complete Reference – David Salomon.

REFERENCE BOOKS

1. Introduction to Data Compression – Khalid Sayood, MorganKaufmann Publishers.

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CD504 (C) Computer Organization & Architecture

Unit I:

Review of Digital Logic Circuits, Digital Logic Components and Data representation.Computer Arithmetic**:** Integer and Floating Point Arithmetic operations.
Computer Organization v/s Architecture,Milestonesin Computer Architecture, Basic Structure of Computer System, Componentsof Computer System-CPU;Memory;System Bus- Bus width, Bus Operations;I/O subsystem. CPU Organization: General Register Organization-Memory Register, Instruction Register; Control Word, Stack Organization; ALU, Control Unit.

Unit II:

(A) Machine Language Level/Instruction Set Architecture (ISA) level: Instruction Set-Machine Instruction Characteristics, Types of operands, Types of operations**;** Instruction Types, Instruction Formats, Addressing Modes; Registers, Program Counter; Instruction Execution Cycle;Interrupts and Traps, Sources of interrupts, Interrupt identification and priorities, Interrupt servicing.Case Study of 8086 Microprocessor.
(B) Control Unit: Hardwired Control Unit;Micro-programmed Control Unit-Micro Instructions, Micro Instruction Formats, Micro Instruction Control, Micro program sequencer, Execution of Micro Instructions.

Unit III:

Memory Organization: Memory Hierarchy, Main memory-RAM, ROM; Memory Technologies; Memory Addresses, Memory Address Map; Flash Memory; Associative Memory, Cache Memory: Cache Structure and Design, Mapping Schemes, Replacement Algorithms, Improving Cache Performance; Concept of L1, L2, L3 Cache.
Secondary Memory –Magnetic Tape, Magnetic Disk, Optical Disks, Solid State Disk.

Unit IV:

I/O Organization: Data Transfer- Serial, Parallel, Synchronous, Asynchronous Modes of Data Transfer, I/O Techniques- Programmed I/O, Interrupt driven I/O,Direct Memory Access(DMA); External Interconnection Standards **(**I/O Interfaces): PCI Bus,PCI Express, SCSI Bus, USB; I/O Channels and I/O Processors; I/O Instructions**.**

Unit V:

Parallel Architectures:On-chip parallelism, Thread level parallelism, Instruction level parallelism; Multicore Processor Architecture;Processor level parallelism; Overview of Pipelining, Vector Processing and Array Processing. RISC vs CISC Architectures. Introduction to ARM processor and its architecture. Introduction to Assembly Language Programming.

Books Recommended:

1. William Stallings, “Computer Organization and architecture”, Pearson.
2. Tannenbaum and Austin, “Structured Computer Organization”, PHI.
3. V. Carl Hamacher, “Computer Organization”, McGraw Hill.
4. John P. Hayes, “Computer Architecture and Organization”, TMH.
5. Morris Mano, “Computer System Architecture”, PHI.
6. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software Interface”, Morgan Kauffman.
7. M. Usha, T.S. Shrikant: “Computer System Architecture and Organization”, Willey India.
8. Chaudhuri, P.Pal: “Computer Organization and Design”,PHI
9. Sarangi: “Computer Organization and Architecture”, McGraw Hill.