GUJARAT TECHNOLOGICAL UNIVERSITY

Master in Computer Application (Integrated MCA)

Year IV – (Semester-VII) (W.E.F. June 2016)

Subject Name: Data Compression
Subject Code: 4470612

Prerequisite: Programming, Engineering Mathematic
Rationale: The course provides an overview of classical and modern techniques and algorithms of various types' data compression. It covers statistical and dictionary methods, lossless and lossy compression algorithms for various type of data.

Content:

Unit No	Course Content	No. of Lectures
1	Introduction, Data Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Lossless compression: Derivation of average information, data models, uniquely decodable codes with tests, prefix codes, Kraft-McMillan inequality	05
2	The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression	08
3	Lossy coding- Mathematical preliminaries: Distortion criteria, conditional entropy, average mutual information, differential entropy, rate distortion theory, probability and linear system models.	07
4	Scalar quantization: The quantization problem, uniform quantizer, Forward adaptive quantization, non-uniform quantization-Formal adopting quantization, companded Quantization Vector quantization: Introduction, advantages, The Linde-Ruzo-Grey algorithm, lattice vector quantization	06
5	Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bit-level image compression-The JBIG standard, JBIG2, Image compression.	06
6	Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. The LZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress.	08

7	Image Compression: The Graphics Interchange Format (GIF), Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPE SYMBOL, length of context, The Exclusion Principle	08

References Books:

1. Mark Nelson and Jean-loup Gailly "The Data Compression Book , M&T Books, New York, United States of America, 2nd edition, 1995.
2. David Salomon , Data Compression: The Complete Reference, Springer, New York, Berlin, Heidelberg, United States of America, Germany, 2nd edition, 2000.
3. Khalid Sayood, Introduction to Data Compression, Morgan Kaufmann Publishers.

List of Experiments:

Use any language of your choice.

1. Write a program which inputs a string of 1s and 0s and compresses the 0s using the run-length compression technique.
2. Write a program to find the format of file? Is this a compressed format? What is the size of the file in bytes?
3. Develop a program to implement Arithmetic coding.
4. Develop a program to compress file using Huffman coding.
5. Implement the run-length encoding to compress file data and uncompress.
6. Write program to find difference between compression file and non-compress file size.
7. Write a program me to find entropy and self-information for a given set of symbol with the probabilities
8. Write a program to compress and uncompressed file using adaptive Huffman coding.
9. Develop a program using vector quantization technique.
10. Write a program to implement Huffman data compression algorithm to generate Prefix codes and encoded text.
    a. Count of character frequencies.
    b. Construction of prefix code.
    c. Encoding the text.
11. Develop a program to compress image using Lossy DPCM Algorithm and evaluate performance of DPCM Algorithm
12. Develop a program for compress the video file using the video compression technique.
13. Develop program to implement transform coding.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU