

CM613 Multimedia Storage & Retrieval Module Guide

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1 Module Contacts

Paul Vickers is the module tutor and the first port of call for any queries.

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2 Aims of module

To provide students with a critical appreciation of the techniques currently available for compressing, storing, indexing and retrieving multimedia data in general, and image data in particular.

3 Learning Outcomes

Specified in terms of performance capability to be shown on completion of the module

1. Analyse data compression techniques from the perspective of information theory.
2. Discuss the latest developments and the likely directions for future advancements, in compression technology,
3. Critically discuss the special problems in providing content-based retrieval of images and other kinds of multimedia data.
4. Explain the role database management systems can play in handling multimedia data.

4 Outline Syllabus

1. Revision of database principles. Limitations of the relational model of data and the way object-oriented and object-relational models attempt to overcome these.
2. The special nature of multimedia data and the demands this imposes on database management systems (DBMS) in areas such as storage, I/O, transaction handling and semantics. How an object-relational DBMS like Oracle attempts to meet these demands. Methods of accessing multimedia data. Design and implementation of multimedia databases using Oracle.
3. Content-based retrieval. Techniques for text storage, indexing and retrieval. Image retrieval examined in depth, including: the different levels of image query; techniques for colour, texture, and shape retrieval; strengths and limitations of primitive-level techniques; the problem of semantic image retrieval; techniques for query formulation and results display; methods of improving search efficiency; case studies of experimental and practical content-base image retrieval (CBIR) applications. Techniques for video retrieval, including shot boundary detection, keyframe extraction, and video skimming. Case studies of systems such as Informedia. Implementation of a demonstration CBIR system.
4. Information theory and Compression: entropy and source coding. A review of the basic measures required for the assessment of compression technique including definitions of the bit, bits per symbol and optimal bits per symbol coding.
5. Lossless coding technique A review of the symbol, stream and predictive coding, focusing on key compression techniques that are in mainstream use. These include Huffmann and Adaptive Huffman, the Lempel-ziv family of algorithms and Arithmetic Coding.
6. Lossy transform domains and quantisation: A study of the major transform domains for image and sound compression, and techniques for quantising these to perform lossy compression. These domains

investigated will be Fourier, DCT (for JPEG and ATRAC), Wavelets (for JPEG2000) and the perceptual coding domain of MP3.

5 Teaching Scheme

5.1 Multimedia Databases (EJP) – Weeks 1-4

EJP will be covering:

“Special requirements for multimedia data storage and the difference between relational–object/relational and object databases considerations for data storage and extraction methods from a multimedia database theoretical v practical implementation methods for multi- media databases.”

5.2 Storage & Retrieval (PV & DM) – Weeks 5-12

Week	Owner	Lecture	Seminar
5	DM	Colour	Colour
6	PV	Digital Audio	Hands-on
7	PV	Lossless compression	Hands-on
8	DM	Lossy compression	Hands-on
9	DM	MPEG	MPEG
10	PV	Audio Compression	Hands-on
11	PV	Multimedia Networks	Discussion
12	DM	CBIR	Discussion

6 Learning & Teaching Strategy

Lectures will concentrate on the basic theoretical grounding for this unit. Seminars and practical work will then provide students with the opportunity to develop appropriate skills based on this knowledge, and to learn how to apply these skills.

Formative feedback will be used to support the learning, this will typically consist of seminar and lab exercises with in-class feedback (both tutor and peer based).

7 Assessment Strategy

Summative assessment will be carried out via an examination (100% of total mark).

The exam will be used to assess learning outcomes 1-4.

8 Reading List

Indicative Reading List or other Learning Resources

8.1 Essential

1. Li, Ze-Nian and Drew, Mark S., “Fundamentals of Multimedia”, Prentice-Hall, 2004.
2. Dunckley, Lynne “Multimedia Databases” Addison Wesley, 2003

8.2 Supplementary Reading

1. Information Theory, Inference and Learning Algorithms David Mackay’s online textbook <http://www.inference.phy.cam.ac.uk/mackay/itprnn/book.html>
2. Elmasri, R and Navathe, S B “Fundamentals of Database Systems” 3rd ed. Addison-Wesley, 2000
3. Khoshafian, S and Baker, A B “Multimedia and Imaging Databases” Morgan Kaufmann, 1996
4. Lu, Gojun “Multimedia Database Management Systems” Artech House, 1999

5. Subrahmanian, V S "Principles of Multimedia Database Systems" Morgan Kaufmann, 1998
6. Oracle 9i Documentation, Oracle Corporation, Redwood City, CA (<http://www.oracle.com>)
7. Compressed Image File Formats: JPEG, PNG, GIF, XBM, BMP (ACM Press) John Miano Addison Wesley; ISBN: 0201604434
8. Specific reports and journal articles will also be recommended by module tutors.