

CAP5015 (Fall 2005): Term Project

The goal of the term project is to expose you to research in data compression and to give you an opportunity to contribute your own ideas.

Procedure

1. Select a team of two students among your classmates. One member team is also acceptable.

2. (a) [For two member team] Select a topic of research. Pick 3 to 5 relevant papers from recent literature (after 2003). You will be required to critically review the papers and formulate a research problem that you think you will be able to handle within two months. The final product will be a complete report with implementation of the research idea and results. Depending on the scope of the problem, implementation of parts of the proposed idea will be acceptable.

OR

(b) [For one member team] select a topic that is not going to be covered in this course or a research topic of current interest. You will be required to write a critical review of the state of the art in a tutorial style. You will also be required to implement one interesting and a reasonably complex algorithm (your own code, not any code downloaded from the internet). The final product will be a tutorial report on the topic with experimental results of the algorithm. If the scope of the topic is too big for one person, two students may work on it provided they work on non-overlapping material.

3. The initial term project proposal may be just 2/3 pages. You are required to give a section on introduction and motivation emphasizing the importance of the topic and its applications. Cite relevant historical references. Give a detailed plan of papers that you will read, a detailed description of tasks and deadlines of completion of each task. For two person team, the proposal must indicate how the execution of the tasks is shared between the partners. The deadline for initial project proposal is due on **September 21(W), 2005**. Email the proposal to Mr. Wefeng Sun with a copy to Dr. Mukherjee.

4. You should have a thorough discussion with Mr. Sun during preparation of the initial proposal and get his approval before you submit to Dr. Mukherjee for further discussion and approval. Finalize your project proposal by taking into account comments from Dr. Mukherjee. The deadline for final proposal is **October 5(W), 2005**.

4. Complete writing the introduction, motivation, review of literature, critical review of selected papers, theoretical foundation and your method of approach in no less than **10** (reasonable) pages. The deadline for the review is **October 19(M), 2005**. Email this partial report to Mr. Sun with a copy to Dr. Mukherjee

5. Implement the algorithm (Only C/C++/Matlab are acceptable. No Java.).

6. Combine the review and your algorithm into a project report. The report should be in a format that is acceptable to journals and/or conference proceedings (Size limited to 25 typed pages, excluding references but including diagrams and tables). If there are too many tables, include only summary of results and put additional tables and diagrams in the Appendix).

7. Typical format of a report is as follows:

- Title, author(s), affiliation, email
- Abstract (150 words), key words
- Introduction and Motivation
- Review and critique of earlier work
- A summary of your approach and major contributions
- Background terminology and definitions
- Theory behind your method
- Technical approach and algorithms
- Analysis of algorithms Experimental results
- Theoretical justification/discussion of your results
- Conclusions
- References
- Appendices

8. Final Report should be submitted by **November 14(M), 2005**. Submit all your materials (the project report, the source code, the executable file, all the data file, and all related files) electronically to Mr. Sun (wsun@cs.ucf.edu) **with** a copy to Dr. Mukherjee (amar@cs.ucf.edu). You may wish to create your own website for the project and give us your link. You may want to submit rough draft of your final reports Mr. Sun to get additional input.

9. Final project presentation will be scheduled on the week of **November 14(M), 2005**.

10. Start as early as possible and meet all your deadlines for the tasks defined in the project proposal.

Following are the suggested topics:

1. 3D Geometry Compression (DCC 2004, DCC 2005, SIGGRAPH 2005)
2. Fast decoding of prefix encoded texts (DCC 2005)
3. Adaptive Block-based Image Coding with Pre-/post-filtering (DCC 2005)
4. Lossless Audio compression (DCC 2004)
5. Flicker reduction in intraframe codecs (DCC2004)
6. High Dynamic Range video compression (SIGGRAPH 2005)
7. Information hiding using compression (digital watermarking & steganography)

8. Search and Retrieval of Textual Information (compressed domain search and retrieval). [Chapters 3,4,5 of “Managing Gigabytes” Witten, Moffat and Bell; <http://vlsi.cs.ucf.edu>)
9. Mixed text and images (handwritten text, musical notes, pdf files),Chapters 7, 8 of “Managing Gigabytes” Witten, Moffat and Bell; Section 8.7 of “Data Compression” David Salomo. Chapter 17 of “Lossles Compression Handbook”, Sayood.
10. Internet Search engines.. how do they work? Can their performance be improved using data compression techniques? Find your own research sdources about google, yahoo and the Microsfot search engines.
11. Lossles Image Compression; JPEG-LS, CALIC (Chapter 9 of “Lossles Compression Handbook”, Sayood. Section 6.5, 6.6 Sayood’s text, Section 4.21, Salomon.
12. Compression of Geometric Objects, “Wavelets for Computer Graphics”, Stollnitz, DeRose and Salesin, Salomon Section 8.11
13. Lifting Schemes for Wavelets (Salomon, Section 5.11), SIGGRAPH Wavelet notes
14. Universal Codes (Chapter 3 (Peter Fenwick), in “Lossles Compression Handbook”, Sayood, Chapter 3 of “ Compression and Coding Algorithms”, Moffat and Turpin
15. Image Retrieval and Data Mining, CBIR (Content Based Image Retrieval), Chapter 11 of “ Image Processing” Acharya and Ray, Wiley Interscience, 2005
16. Audio Compression, Chapter 7 (Salomon)

For one person team, skim through the text books placed in the library and the proceedings of the Data Compression Conferences (E-version available from IEEE xplora). IEEE and ACM publications and select a topic of your interest for further study and research.

Last time this course was taught, the students did the following term projects:

Video compression
 Lossless microarray image compression
 Wireless extension to JPEG 2000
 Pattern matching on compressed XML documents
 Programming Lossless Audio Compression using the Discrete Wavelet Transform
 3D Geometry Compression
 Parallel LZ text compression
 XML-conscious text compression
 Progressive image compression (FELICS)
 Pattern matching with k-mismatches over BWT compressed text
 Finger print compression
 Geometry compression
 Demystifying MPEG/Audio compression

Data compression in fast query searching Inverted File Index Compression