ELEC4622
Multimedia Signal Processing

Course Outline – Term 2, 2019

Australia's Global University | Faculty of Engineering | School of Electrical Engineering and Telecommunications

Course Staff

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Consultations: You are encouraged to ask questions on the course material, after the lecture class times in the first instance, rather than via email. Lecturer consultation times will be advised during lectures. ALL email enquiries should be made from your student email address with ELEC4622 in the subject line.

Keeping Informed: Announcements may be made during classes, via email (to your student email address) and/or via the subject web-site – this subject uses the School of EE&T's subjects repository at http://subjects.ee.unsw.edu.au/~elec4622 as a primary source of information, with links added to the subject's Moodle page as required. Please note that you will be deemed to have received the information on this web-site, so you should not rely solely upon materials uploaded to Moodle.

Course Summary

Contact Hours

The course consists of 3 hours of lectures, and a 3-hour laboratory session every week. The laboratory session will be divided flexibly between a tutorial and a computer laboratory, using a single venue for both. To help you get up to speed as quickly as possible in the new term model, there are four additional 1-hour lectures scheduled in the first 4 weeks. These also help offset the loss of the main lecture in Week 2 due to the Queen's Birthday public holiday.

	Day	Time	Location	Weeks
Lectures	Mondays	12-3pm	TETB LG07	W1, W2-W11
Extra Lecture	Wednesdays	12-1pm	Ainsworth 102	W1-W4
Labs and Tutorials	Slot 1: Tues Slot 2: Wed	12-3pm 9am-12	ElecEng 108 ElecEng 108	W1-W10 W1-W10

Context and Aims

This course provides a broad introduction to multimedia signal processing. The major emphases of the course are:

1. Extension and application of one dimensional signal processing concepts into multiple dimensions (2 dimensions for images and 3 dimensions for video);
2. Practical implementation of signal processing algorithms in software, using real programming environments (particularly C/C++) as opposed to Matlab;
3. Understanding, estimating and enhancing specific multimedia features of shape, orientation, texture, colour and motion.
4. Understanding multi-media formats and representation schemes.

Assumed Prior Knowledge

Students taking this course should have previously taken at least an introductory subject in one-dimensional signal processing, and have at least some computer programming skills.

Assessment for ELEC4622

- Final exam: 60%
- Midterm test (taken during the laboratory session of Week 6): 10%
- Three laboratory projects (assessed in Labs in Weeks 5, 8 and 10): 30% (+ possible bonus marks)

The final mark for the subject is $B + (1 - B/100) \cdot (E + Q + L)$, where B, E, Q and L are the bonus, exam, quiz and laboratory marks mentioned above.

Student learning outcomes

At the successful completion of the course the student should:

1. Be familiar with multimedia signal representations, acquisition, file formats and standards;
2. Be comfortable with Fourier transforms, power spectra, convolution and other signal processing concepts for multi-dimensional signals;
3. Be able to design filters and other algorithms to enhance and extract important features from multimedia signals;
4. Be confident in implementing multimedia signal processing algorithms in both Matlab and C/C++.

Rationale behind this course's approach to learning and teaching

- Signal processing is an important branch of Electrical Engineering, which is foundational to multimedia processing and telecommunications. The initial mathematical framework for signal processing is introduced in earlier courses in signals and systems and the third year signal processing course ELEC3104. However, many students find that they do not feel confident enough to implement real signal processing algorithms to solve practical problems. In view of this, the present professional elective has been deliberately designed to have a strong emphasis on practical implementation.
- Multimedia signal processing is highly intensive in terms of computational and memory resources. As a result, most practical work in this area involves programming in a native language (typically C or C++), sometimes in tandem with the development of dedicated hardware (FPGA's initially). In view of this, the practical aspects of this course emphasize native implementation and resource management methodologies.
- The course covers significant fundamental material of a theoretical nature. In order to provide an efficient and balanced learning experience, laboratory sessions are designed to closely follow the relevant developments in lectures. A portion of each laboratory session is used to provide practical demonstration of strategies for implementing concepts very recently taught in lectures.
- Independent thinking and problem solving are very important aspects of this course, since it is only by independently tackling a challenging problem that the student becomes confident in his/her understanding. A second portion of most laboratory sessions is devoted to the completion and interactive assessment of multimedia

processing solutions, which students must have designed in their own time, based on a thorough understanding of the lecture materials.

Course schedule (tentative)

Week	Tut / Test / Lab	Lecture Topic(s)
W1 *3h Mon + 1h Wed*	Lab	Continuous and discrete LSI systems + review of native programming in C + memory organization and management + multi-dimensional filtering
W2 *1h Wed*	Tut + Lab	Imaging systems and aliasing
W3 *3h Mon + 1h Wed*	Lab	Aliasing in 3 dimensions + resampling and multi-dimensional filter design
W4 *3h Mon + 1h Wed*	Tut + Lab	Correlation and Discrete Fourier transforms in multiple dimensions
W5 *3h Mon*	Lab (Proj-1 due)	Multi-resolution processing and transforms
W6 *3h Mon*	Test + Lab	Shape and morphological processing
W7 *3h Mon*	Tut + Lab	Segmentation and feature analysis
W8 *3h Mon*	Lab (Proj-2 due)	Colour processing, conversion and analysis
W9 *3h Mon*	Tut + Lab	Motion and optical flow
W10 *3h Mon*	Lab (Proj-3 due)	Introduction to media compression
W11 *3h Mon*		Catchup on any unfinished topics + revision of key ideas

Course Resources

Textbooks

Prescribed:

- A complete set of typeset lecture notes for the course, written by Prof. Taubman, are available via the course web-site. These might be ammended from time to time over the running of the course, but are nonetheless very stable. They should be treated like a textbook and read carefully as essential prescribed material for the course.

On-line resources

Course Web-site:

For all course materials, project descriptions, problem sets and so forth, the official web-site for this course is at http://subjects.ee.unsw.edu.au/~elec4622.

Announcements:

Announcements concerning course information will be given in the lectures and/or via the course web-site. You might also be sent email with important announcements, which will be sent to your student email address via Moodle.

Other Matters

Academic Honesty and Plagiarism

Plagiarism is the unacknowledged use of other people's work, including the copying of assignment works and laboratory results from other students. Plagiarism is considered a form of academic misconduct, and the University has very strict rules that include some severe penalties. For UNSW policies, penalties and information to help you avoid plagiarism, see https://student.unsw.edu.au/plagiarism. To find out if you understand plagiarism correctly, try this short quiz: https://student.unsw.edu.au/plagiarism-quiz.

In this subject, a particularly concerning form of plagiarism is the use of code written by third parties (including other students from current or previous years) for any of the course projects. If you are not very familiar with native programming, you may find yourself tempted to resort to this, but giving into this temptation would be a very serious mistake.

You will be interrogated concerning your understanding of your work, during the lab, and students who cannot explain how individual parts of their solution work or why they were adopted will receive zero marks for the entire project. You are welcome and encouraged to exchange ideas with other students, but not solutions. You will also be required to submit electronic copies of your project solutions to allow for machine inspection, which may be run at any time, including after you have received your initial mark.

The laboratory demonstrators are highly experienced and able to help you to build your understanding and confidence, especially in the early laboratories, so you should take full advantage of this resource to get the most out of the course and prepare for the projects that have a diversity of solutions.

Student Responsibilities and Conduct

Students are expected to be familiar with and adhere to all UNSW policies and particular attention is drawn to the following:

Workload

It is expected that you will spend approximately **twelve to thirteen hours per week** studying a 6 UoC course, averaged over the 10 week term, including both face-to-face classes and *independent, self-directed study*. In periods where you need to complete assignments or prepare for examinations, the workload may be greater. Over-commitment has been a common source of failure for many students. You should take the required workload into account when planning how to balance study with employment and other activities.

Attendance

Based on past experience, the students who struggle most with the material in this subject are those who fail to attend all lectures. While video recordings may be made available, the regularity and environment of the lecture itself are much more conducive to learning, asking questions and keeping in touch with the material and your peers.

General Conduct and Behaviour

Consideration and respect for the needs of your fellow students and teaching staff is an expectation. Conduct which unduly disrupts or interferes with a class is not acceptable and students may be asked to leave the class.

Work Health and Safety

UNSW policy requires each person to work safely and responsibly, in order to avoid personal injury and to protect the safety of others.

Special Consideration and Supplementary Examinations

You must attend all examinations scheduled for your course, including in-class tests. You must also submit all assessable laboratory projects for assessment in the designated laboratory session and week, allowing adequate time for laboratory demonstrators to mark your work. You should seek assistance early if you suffer illness or misadventure which affects your course progress. All applications for special consideration must be lodged **within 3 working days of the relevant assessment**, in accordance with the policy at: https://student.unsw.edu.au/special-consideration.

Continual Course Improvement

This course is under constant revision in order to improve the learning outcomes for all students. Please forward any feedback (positive or negative) on the course to the course convener or via the Course and Teaching Evaluation and Improvement Process. You can also provide feedback to ELSOC who can raise your concerns or positive feedback at student focus group meetings. As a result of previous feedback obtained for this course and in our efforts to provide a rich and meaningful learning experience, we have continued to evaluate and modify our delivery and assessment methods.

We are expecially interested in your feedback concerning this first instantiation of the course within the UNSW 3+ term model.

Administrative Matters

On issues and procedures regarding such matters as special needs, equity and diversity, occupational health and safety, enrolment, rights, and general expectations of students, please refer to: https://student.unsw.edu.au/policy