BSc Computer Science

Module Specification

Key Information

Module title	Intelligent Signal Processing		
Level	6	Credit value	15
Member Institution	Goldsmiths	Notional study hours and duration of course	150
Module lead author/ Subject matter expert	Mick Grierson		
Module co-author			

Rationale for the module

Intelligent signal processing involves capturing, storing, playing, processing and crucially, extracting meaningful information from various signals found in the real world, using a computer system. You interact with intelligent signal processing systems every day, for example, voice-controlled digital assistants. This module builds on other topics in the computer science programme such as computer graphics, data representation and artificial intelligence. It provides you with an advanced skill set for writing computer programs that can work with a range of digital signals.

Aims of the module

This module aims to provide you with a broad experience of digital signal processing techniques and applications. You will study how audio and video signals can be captured and processed by a computer program. You will learn about time domain and frequency domain representations and processing. You will learn how you can extract information from audio signals. You will implement movement and face detection systems that work with live camera input.

Topics covered in this module:

The topics listed here are an approximation of what will be covered. The topics presented may be slightly revised to ensure currency and relevance. Students will be advised of any changes in advance of their study.

1. Capturing representing and processing audio signals
2. LTI systems and impulse responses
3. Frequency domain representations
4. Extracting features from signals
5. Speech recognition
6. Capturing, representing and processing camera input
7. Computer vision: movement detection
8. Computer vision: face detection
9. Compressing signals: audio
10. Compressing signals: image and video

Approximately 10-12 hours of study will be required per topic. The remaining study time is intended for coursework.

Learning outcomes for the module

Students who successfully complete this module will be able to:

1. Explain how audio and video signals can be represented digitally and what the key properties of these signals are.
2. Write computer programs that can capture, process and play back audio and video signals.
3. Understand and use discrete Fourier transforms to process audio signals in the frequency domain and explain the process of feature extraction.
4. Implement simple movement and face detection systems that work with live camera input.
5. Describe the key components of a speech recognition system and analyse the design decisions involved.
6. Select and describe appropriate techniques for compressing audio and video signals.

Assessment strategy, assessment methods

Summative and Formative Assessments
The module will contain a range of summative and formative assessments. Summative assessments are assessments which contribute directly towards your final grade. Formative assessments do not count directly towards your final grade. Instead, they provide you with opportunities for low stakes practice, and will often provide some sort of feedback about your progress. For example, a practice quiz might provide you with feedback about why a particular answer was wrong.

Assessment Activities
The table below lists the assessment activity types you might encounter taking the module. It also states if that type of assessment can be automatically graded. For example, multiple choice quizzes can be automatically graded, and so can some programming assignments. It also states if that type of assessment will be found in the summative courseworks (CW1, CW2). More details about the summative assessments are provided below.

Assessment activity type	Can it be automatically graded with feedback in some cases?	CW1	CW2
Quiz	X	X	X
Writing task		X	X
Programming task	X	X	X
Video task		X	X

Pass Mark

In order to pass this module, you must achieve at least 35% in each element of summative assessment and an overall weighted average of 40%, subject to the application of rules for compensation. Please refer to the programme regulations for more information.

Summative Assessment Elements

This is a module that is best assessed largely through continuous assessment by way of programming exercises worked on throughout the term.

Summative Assessment Component	Components	Percentage of final credit	Deadline
Coursework 1	4 programming exercise submissions	50%	Mid session
Coursework 2	4 programming exercise submissions	50%	End of session

Each of the two courseworks will take up to 25 hours of study time to complete and comprise a variety of practical exercises and quizzes.

Learning resources

The module will draw on a number of different, largely web-based, public resources as well as the resources produced as bespoke material for this module. The standard text book(s) for the module will be:

Joshua Noble. *Programming Interactivity*, O'Reilly 2012

Nick Collins. *Introduction to Computer Music*, Wiley. 2009

ccrma.stanford.edu/~jos/pasp/pasp.html