MATH 7019 MATHEMATICS OF SIGNAL PROCESSING

Credit Points 10

Legacy Code 301440

Coordinator Paul Hurley (https://directory.westernsydney.edu.au/search/name/Paul Hurley/)

Description This subject teaches students to abstract and develop algorithms, in Python, for analysing and processing deterministic and stochastic data/signals. Students are taught strategies in developing solutions that are optimal and efficient to implement. They learn how to analyse signals under the Fourier transform and under different bases, allowing for an appreciation of how lossy compression works, and how to formulate and solve some convex optimisation algorithms. This subject will be undertaken at Parramatta City - Hassall St campus.

School Computer, Data & Math Sciences

Discipline Mathematics

Student Contribution Band HECS Band 1 10cp

Level Postgraduate Coursework Level 7 subject

Restrictions

Students must be enrolled in a postgraduate program

Assumed Knowledge

Students should know and understand basic linear algebra. Basic programming skills are necessary. Familiarity with Python notebooks is helpful but not mandatory.

Learning Outcomes

On successful completion of this subject, students should be able to:

1. Explain mathematical formulations of signal processing algorithms
2. Demonstrate mastery of tools for tackling advanced signal and data processing problems
3. Analyse advanced signal and data processing algorithms using numerical python programming
4. Design applications as advanced signal and data processing algorithms
5. Appraise applications of mathematical signal processing

Subject Content

1.Motivation - what is mathematics of signal processing, etc.
2.Linear algebra and Hilbert spaces
Examples ? neural networks
Basis and frames
3.Fourier Transforms
Continuous Fourier series, Fast Fourier transforms
Convolution
4.Sampling and interpolation
1D, 2D (sphere/manifold)
5.Filtering
Finite Impulse Response (FIR) filters, Infinite Impulse Response (IIR) filters
6.Approximation and compression
Wavelets
Time-frequency analysis
7.Inverse problems and optimisation
Compressed sensing
LASSO
8.Random signals
Probabilistic modelling
Wiener filter, etc.
Max likelihood / EM
9.Event-driven sampling/filtering
Sampling in time vs sampling in amplitude
Filtering in asynchronous time
10.Array signal processing
Beamforming

Assessment

The following table summarises the standard assessment tasks for this subject. Please note this is a guide only. Assessment tasks are regularly updated, where there is a difference your Learning Guide takes precedence.

Type	Length	Percent	Threshold	Individual/ Group Task
Quiz	30 minutes (per Quiz)	20	N	Individual
Applied Project	16 hours	30	N	Individual
Practical Exam	1.5 hours	20	Y	Individual
Practical Exam	2 hours	30	Y	Individual

Teaching Periods

Autumn (2022)

Parramatta City - Macquarie St

Day

Subject Contact Paul Hurley (https://directory.westernsydney.edu.au/search/name/Paul Hurley/)

View timetable (https://classregistration.westernsydney.edu.au/even/timetable/?subject_code=MATH7019_22-AUT_PC_D#subjects)

Autumn (2023)

Parramatta City - Macquarie St

On-site

Subject Contact Paul Hurley (https://directory.westernsydney.edu.au/search/name/Paul Hurley/)

View timetable (https://classregistration.westernsydney.edu.au/odd/timetable/?subject_code=MATH7019_23-AUT_PC_1#subjects)