

Course content for MT3410/MT4410, Channels

Prerequisites:

MT2320 and MT2800 are both recommended

Aims:

To investigate the problems of data compression and information transmission in both noiseless and noisy environments.

Learning outcomes:

1. state and derive a range of information-theoretic equalities and inequalities;
2. explain data-compression techniques for ergodic as well as memoryless sources;
3. explain the asymptotic equipartition property of ergodic sources;
4. understand the proof of the noiseless coding theorem; define and use the concept of channel capacity of a noisy channel; explain the noisy channel coding theorem;
5. understand a range of further applications of the theory;
6. MT4410: demonstrate a breadth of understanding appropriate for an M-level course.

Course content:

Entropy: Definition and mathematical properties of entropy, information and mutual information.

Noiseless coding: Memoryless sources: proof of the Kraft inequality for uniquely decipherable codes, proof of the optimality of Huffman codes, typical sequences of a memoryless source, the fixed-length coding theorem.

Ergodic sources: entropy rate, the asymptotic equipartition property, the noiseless coding theorem for ergodic sources. Lempel-Ziv coding.

Noisy coding: Noisy channels, the noisy channel coding theory, channel capacity.

Further topics, such as hash codes, or the information-theoretic approach to cryptography and authentication.