

Information Theory & Coding

Fall 2018

PAF-KIET

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Introduction

Information Theory is the branch of knowledge which tries to determine answers to questions like: What is the information carrying capacity of a communication channel? How many bits are required at a minimum to represent a certain type of information? How secure is an encryption algorithm? How can data be compressed before sent over channel? How redundancy could be added to data before transmission over the noisy channel to detect and correct errors?

We shall understand the principles behind theoretical limits on compression, error control and encryption coding techniques. The list of topics to be covered is given below:

- Introduction to Information Theory
- Mathematical Background (Computation of theoretical expression of Bit Error Rates)
- Entropy and Shannon's Measure of Information
- Source Coding Algorithms:
 - Shannon Fano Coding, Huffman Coding, Lempel-Ziv Coding, , Run Length Encoding, JPEG Image Compression
- Channel Coding Algorithms
 - Block Codes: Hamming Codes, Space Time block codes, Cyclic Codes, BCH codes, Reed Solomon Codes
 - Convolutional codes, Viterbi Algorithm, Trellis Coded Modulation (TCM)
- Introduction to Cryptography

In addition to this, Matlab activities will be scheduled to test out the principles of source coding and channel coding practically. It is highly recommended for students to do Matlab primers on their own, before the activities are assigned possibly from week 3.

Textbooks

John Proakis & Masoud Salehi, “*Digital Communications*”, 5th Edition, McGraw Hill
Ranjan Bose, “*Information Theory Coding & Cryptography*”, Tata McGraw-Hill Publishing Company
Bruce Carlson, “*Communication Systems*”, 4th Edition, McGraw Hill (Helpful undergrad level book)