

10. Information theory and Molecular biology

Pre-requisite: Students, who successfully completed Pre. PhD. Program in Computational B. and Bioinformatics are eligible.

Objective: This course aims to introduce information contents in biological molecules, sequence and surveys technical and biological aspects of information theory.

Detailed syllabus:

- Concepts of uncertainty/ information – entropy definition – Shannon entropy Joint entropy and conditional entropy (6 hrs)
- Relative entropy and mutual information (2 hrs)
- Overview of the applications of entropy concepts to communication networks (2 hrs)
- Overview of Markov chain - Hidden Markov models (4 hrs)
- Jansen's inequality - Maximum entropy principles (2 hrs)
- Parametric entropy – Renyi , Tsallis and their relation to Shannon entropy (4hrs)
- Molecular biology – The Genetic code - Central dogma and information flow (2)
- Randomness – complexity – information content (4 hrs)
- Applications of Shannon's entropy to molecular data – Sequence, structure and gene expression ratios (8 hrs)
- Entropic divergence and its application (2)
- Information theory and evolution of living systems (4 hrs)

References:

1. Thomas Cover and Joy A Thomas. Elements of Information theory (2nd Edition) Wiley InterScience 2006
2. Hubert P Yockey Information theory and Molecular biology. Cambridge University Press . 1992
3. John Avery Information theory and evolution. World scientific 2003. 4. Applebaum. Probability and Information: An integrated approach. Cambridge 1996