

Lecture plan

TIF150, Information theory for complex systems 2017

Week 1

Monday 16 January 15.15–17.00

Introductory meeting. Course overview. Basic information-theoretic concepts.

Wednesday 18 January 10.00–11.45

1. We discuss the introductory puzzle in an information theoretic perspective.
2. Information theory: Relative information or Kullback-Leibler divergence, the maximum entropy formalism, Gibbs distributions. (Continuous state space.)

Friday 20 January 13.15–15.00

Examples and exercises — basic concepts. (Rasmus)

Week 2

Monday 23 January 15.15–17.00

Information theory: lattice systems, entropies of symbol sequences. Decomposition of information in entropy and redundancy. Decomposition of redundancy into contributions from density information and correlation of different lengths.

Wednesday 25 January 10.00–11.45

Lattice systems, continued. Symbol sequences generated by finite automata. Complexity measures.

Friday 27 January 13.15–15.00

Examples and exercises — symbol sequences. (Rasmus)

Week 3

Monday 30 January 15.15–17.00

Introduction to Cellular automata; entropy law.

Wednesday 1 February 10.00–11.45

Cellular Automata.

Friday 3 February 13.15–15.00

Examples and exercises — Cellular Automata. (Rasmus)

Week 4

Monday 6 February 15.15–17.00

Examples and exercises — Cellular Automata. (Rasmus)

Friday 10 February 13.15–15.00

Information theory and Physics; statistical mechanics.

Week 5

Monday 13 February 15.15–17.00

Information theory and Physics — spin systems.

Wednesday 15 February 10.00–11.45

Geometric information theory, fractals.

Week 6

Monday 20 February 15.15–17.00

Self-organizing systems — flows of information.

Wednesday 22 February 10.00–11.45

Examples and exercises — Spin systems. (Rasmus)

Friday 24 February 13.15–15.00

Self-organizing systems, continued. Chaotic systems.

Week 7

Wednesday 1 March 10.00–11.45

Chaotic systems, continued.

Friday 3 March 13.15–15.00

Examples and exercises — Chaotic systems. (Rasmus)

Week 8

Monday 6 March 15.15–17.00

Example of recent research on information theory for complex systems.

Information theory: 2-dimensional systems. The Baker's map and spin systems.

Wednesday 8 March 10.00–11.45

Examples from previous exams. (Rasmus)