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Eawag Seminar Invitation

Robust algorithmics: a foundation for science?!

Speaker **Prof. Joachim M. Buhmann** ETH Zürich, Switzerland

When November 2, 11.00 – 12.00 a.m.

Where Forum Chriesbach, room C20, Eawag Dübendorf

Abstract The ALGORITHM is the idiom of modern science, as Bernard Chazelle phrazed it. I like to go a step further in this talk by claiming that algorithmics lays the foundation of modern science. The scientific method of "systematic observation, measurements, and experiments, as well as the formulation, testing, and modification of hypotheses" requires algorithms for knowledge discovery in complex experimental situations. Algorithms in data science map data spaces to hypothesis classes. Beside running time and memory consumption, such algorithms should be characterized by their sensitivity to the signal in the input and their robustness to input fluctuations. The achievable precision of analgorithm, i.e., the attainable resolution in output space, is determined by its capability to extract predictive information. I will advocate an information theoretic framework for algorithm analysis where an algorithm is characterized as a computational evolution of a posterior distribution on the output space.

The method allows us to investigate complex data analysis pipelines as they occur in computational neuroscience and neurology as well as in molecular biology. I will demonstrate this design concept for algorithm validation with a statistical analysis of diffusion tensor imaging data. A theoretical result for sparse minimum bisection yields statistical hints why random combinatorial optimization problems are hard to solve.