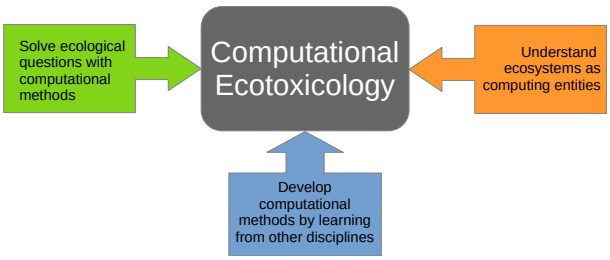
Computational Ecotoxicology (COPE)

Institute for Environmental Research, RWTH Aachen University

The working group Computational Ecotoxicology at the Institute for Environmental Research focuses on complexity in structures and processes of hierarchical dynamical bio-systems. Our research concentrates on three main objectives: (1) Solving ecological and biological questions and problems with computational methods, (2) Understanding the nature of ecological and biological systems as computing entities and (3) Developing computational methods by learning from other disciplines in an interdisciplinary way. The working group is lead by Dr. Richard Ottermanns.



We develop hybrid mathematical and machine learning algorithms and methods for multivariate modelling, pattern recognition, causal analysis and prediction in life-science disciplines like ecology, ecotoxicology and risk assessment as well as biomedical sciences. To link different lines of evidence (i.e. theory, simulation and observation) techniques from statistical pattern recognition, machine learning, data mining and bioinformatics as well as approaches from complex systems theory and chaos theory are used in a wide field of applications. More detailed attention is paid to non-linear dynamics, self-organization processes, the role of information and entropy, the integration of expert knowledge into modelling processes as well as epistemological consequences.

In our most recent research we apply the developed methods in questions about **Chemo-behavioral profiling** using *Danio rerio* video tracking data, modelling **Network dynamics** to assess ecosystem integrity, and **Expert-augmented statistics** in ecotoxicological bio-testing.

Special long-term research topics we are interested in are **Non-linear dynamics** (Bifurcation and chaotic dynamics and their implications for the stability and resilience of natural agent-based systems), **Entropy** (Negentropic information flow and its relation to self-organization in dissipative living systems), **Complexity** (Emerging phenomena and their relevance to ecological structures and dynamics), and **Limitations** (Gödel's incompleteness theorems and their implications for modelling in the life sciences).

For further information please see the working group's web page (https://cope.rwth-aachen.de) or contact**:**

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