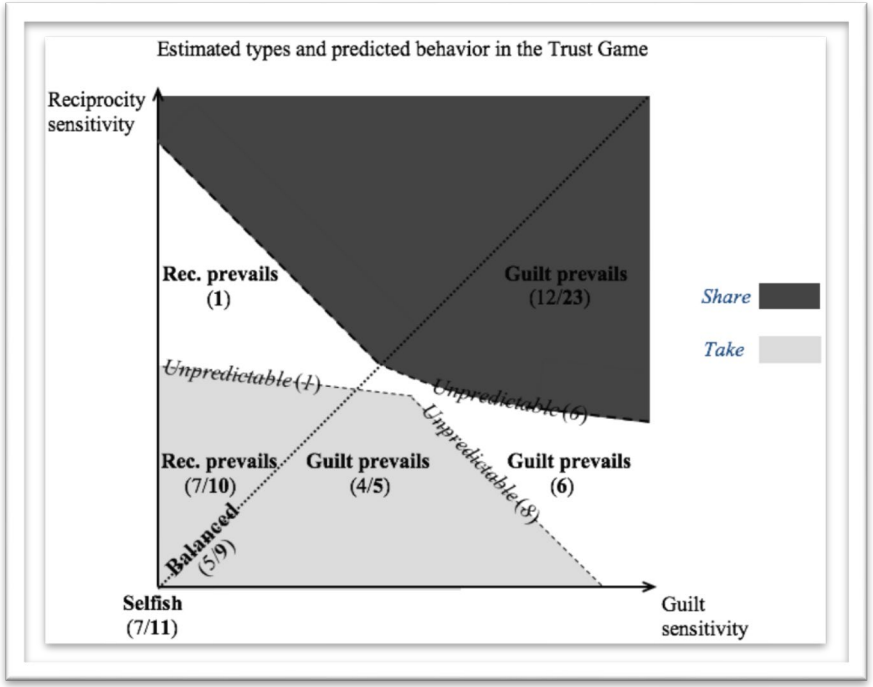
PIERPAOLO BATTIGALLI

How Do Emotions Affect Strategic Interaction?

Psychologically founded models of strategic interaction and reasoning



THREATS, PROMISES, AND EMOTIONS

In social interactions, psychological aspects affect strategic reasoning: e.g., ANGER gives credibility to threats, and the anticipation of GUILT supports promises, even if their execution goes against selfish material incentives

- Develop models of psychological motivations in interactive situations
- Embed them into (psychological) game theory
- Test them in the lab (or in the field)

SIMONE CERREIA VIOGLIO

Decision Making and Stochastic Choice

- We aim to show how different approaches and concepts in Decision Theory are connected to each other: incompleteness of preferences, violations of independence / transitivity, preference for diversification, certainty effect, and random choice
- These behavioral phenomena are becoming increasingly accounted for in applications, for example in Macroeconomics and Finance. We aim at getting a deeper understanding of these phenomena and of their relationships. It would naturally help in developing comprehensive models in which these biases are linked to each other
- The emphasis of the project on applications and on developing an encompassing framework for dynamic decision making, we hope, will provide a strong impetus and discipline to the dynamic decision-theoretic models that researchers will develop

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MASSIMO MARINACCI

1. Social Concerns in Decision Processes
2. Individual Decisions and Macroeconomic Robustness

- Making **choices under uncertainty** lies at the heart of human behavior in myriad economic, environmental, medical, social, and political contexts
- Both grants deal with models of rational choice under uncertainty
- The first grant (2009-2013) elaborated models of rational choice sensitive to the **social concerns** that arise because decision makers do not act in isolation but within a group of peers and, more generally, a society
- The second grant (2015-2020) is deriving models of rational choice under uncertainty that prescribe policies. Relative to the current modelling, these **policies** are **more robust** to the uncertainty that confronts policy makers (e.g., in designing macroeconomic or environmental policies)

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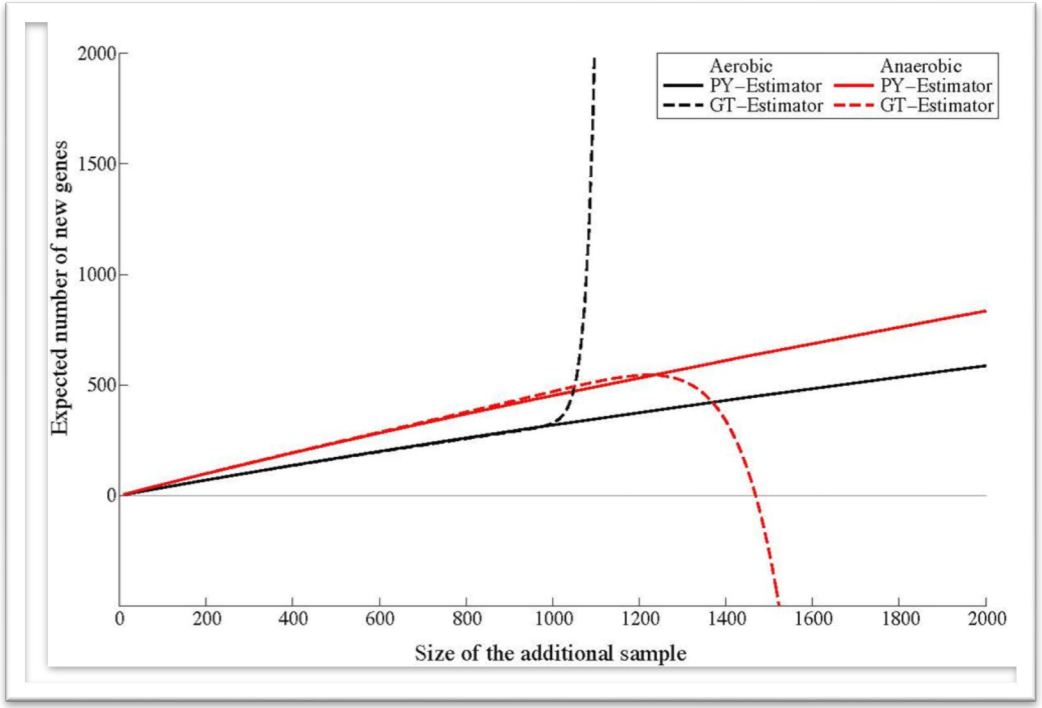
IGOR PRÜNSTER

Prediction of the Number of New Genes



GENERAL PREDICTION PROBLEM

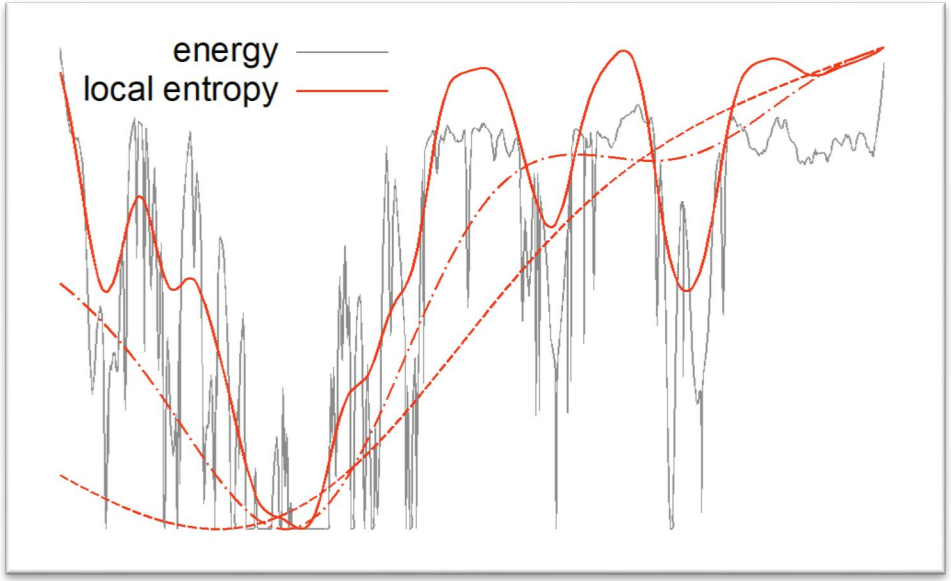
Given a sample, predict the number of new species (e.g. animals, genes, agent types) to be discovered in an additional sample

Application to gene discovery:

- Basic samples of size ≈ 1,000 from Naegleria Gruberi cDNA libraries under different culture conditions
- Comparison of Bayesian nonparametric (PY-estimator) and frequentist (GT-estimator) approaches
- Frequentist estimators become erratic for sizes of the additional samples larger than the basic sample
- Bayesian nonparametric estimators are stable and accurate for any sample size and also allow for uncertainty quantification

RICCARDO ZECCHINA

Optimization and Inference Algorithms from the Theory of Disordered Systems



The PI was awarded with the L. Onsager Prize of the American Physical Society in 2016, with motivations which included outcomes of OPTINF

In the last decade, new conceptual and computational challenges have emerged in deep machine learning and data science.

OPINF was concerned with the study of the related optimization and inference algorithms based on advanced Statistical Physics methods, Probability Theory and Computer Science.

Progress has been made in the understanding of basic theoretical questions at the root of current machine learning technologies and in the design of distributed algorithms for computational neuroscience and computational biology .

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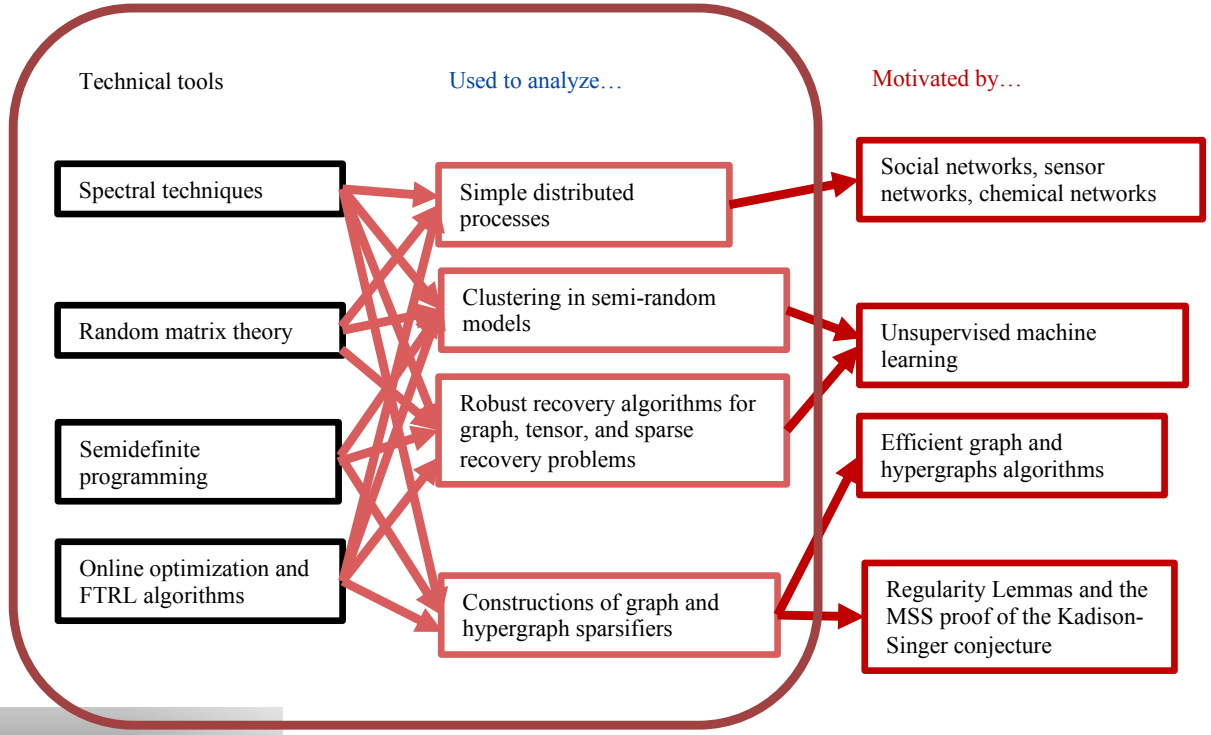
LUCA TREVISAN

Continuous methods for combinatorial problems



The ERC project on *Spectral and Optimization Techniques for Robust Recovery, Combinatorial Constructions, and Distributed Algorithms* applies techniques from linear algebra and from convex optimization to

- Design and analyze new algorithms for combinatorial «robust recovery» problems motivated by unsupervised learning;
- Devise new constructions of «sparse approximations» such as graph and hypergraph sparsifiers and regularity lemmas;
- Develop new approaches to the study of probabilistic processes in networks.

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