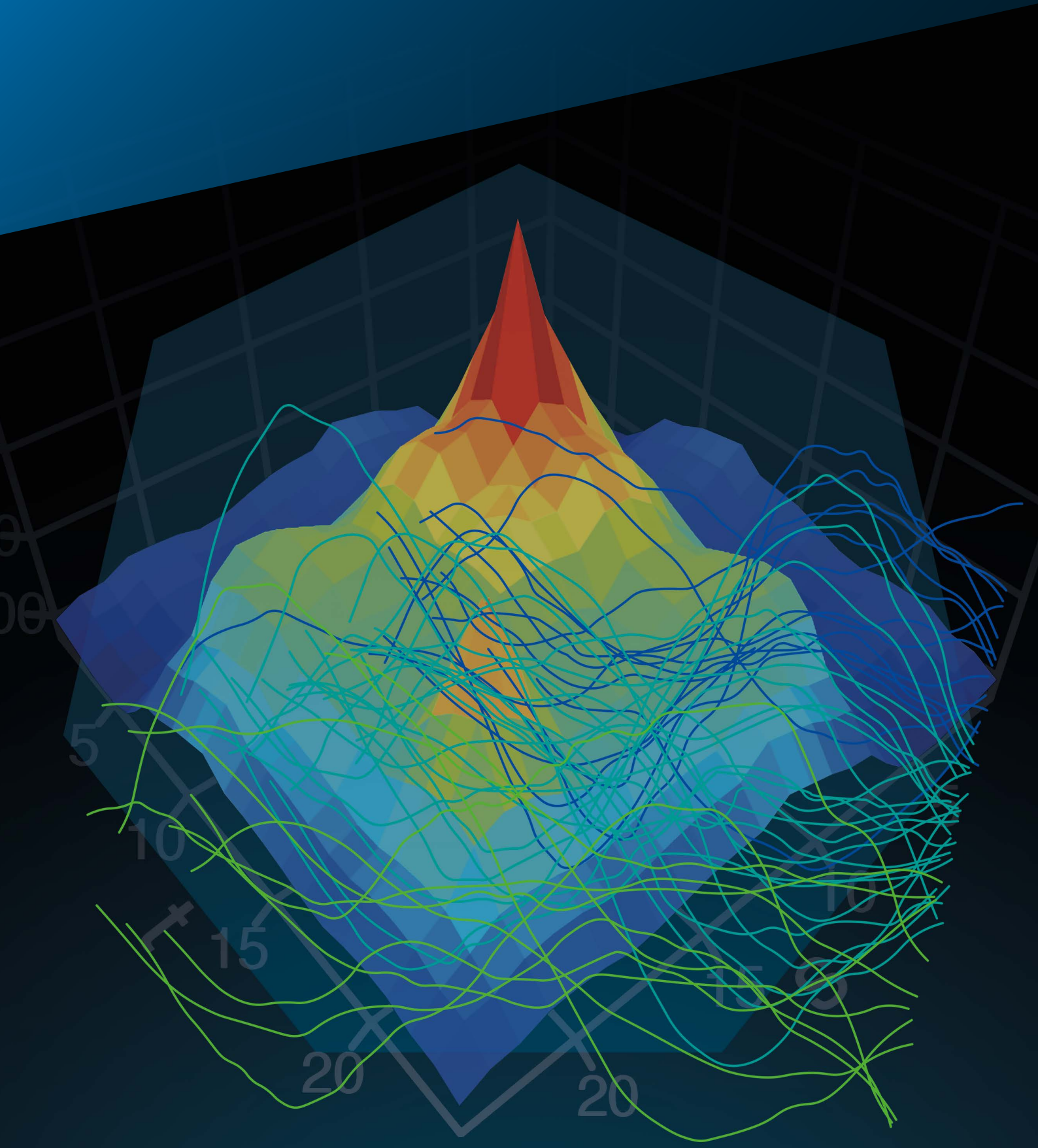
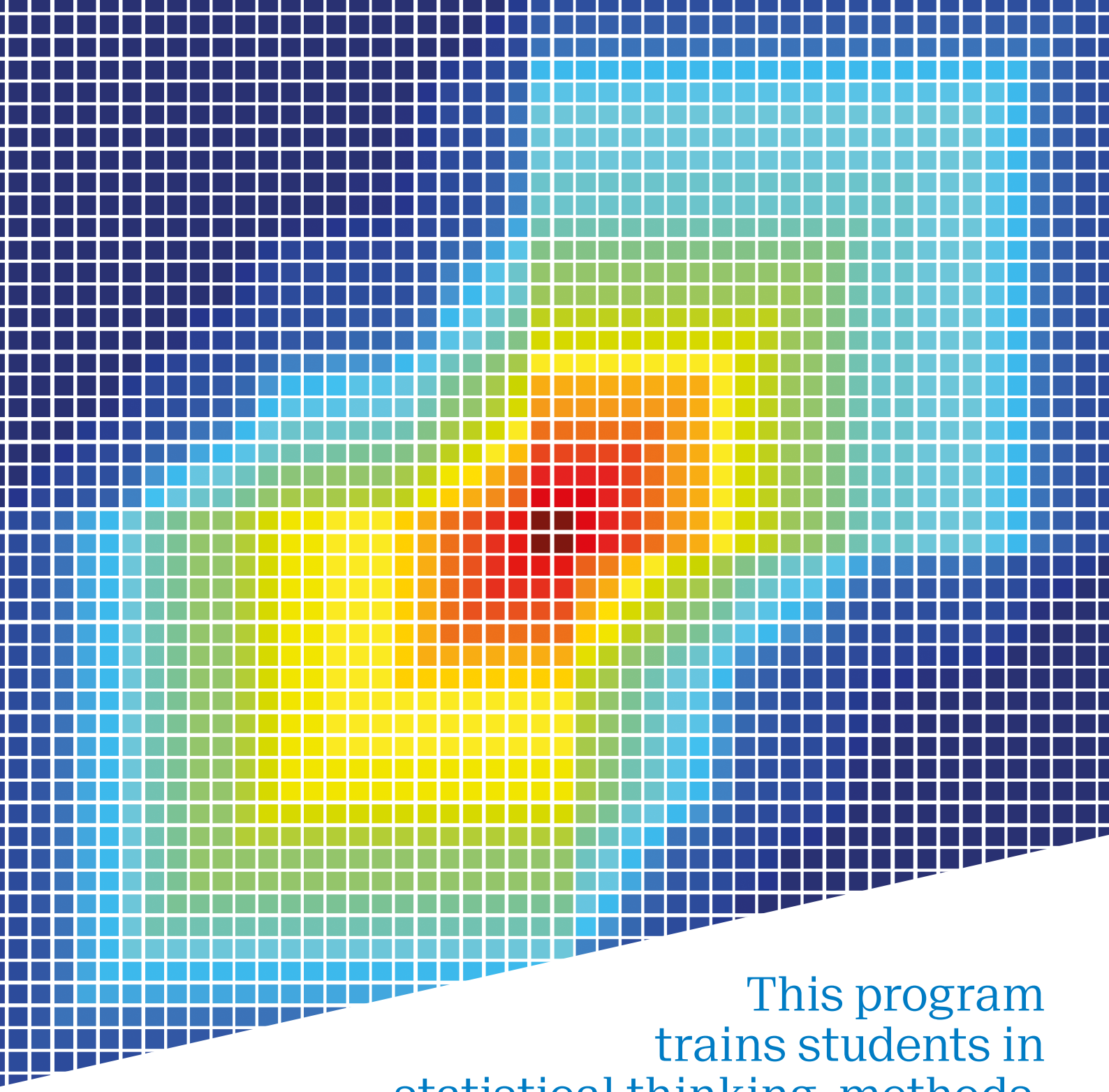
STATISTICS

MASTER

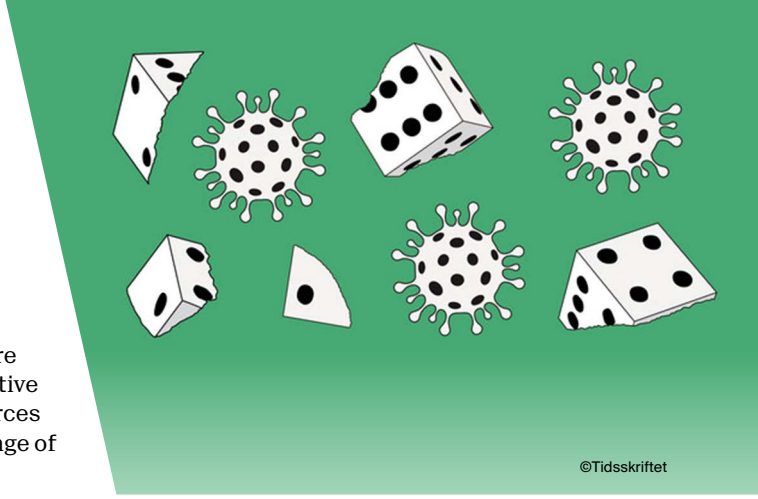


EPFL



This program trains students in statistical thinking, methods, visualization and computation and in their application in data analysis. It is intended for students with strong mathematical and computational skills and a scientific or engineering background who want to give themselves crucial skills for sound reasoning in a data-flooded world.

Allocation of scarce coronavirus treatments



Professor Mats Stensrud

The COVID-19 pandemic has placed tremendous strain on health care systems around the world. We have experienced shortages of protective equipment, intensive care units, doctors and vaccines. When resources are limited, decision makers are faced with the ethical challenge of determining allocation strategies.

The justification for an allocation strategy should ideally be supported by evidence from randomized experiments; that is, experiments designed to target the causal effects of the strategy on the outcome of interest, for example how different prioritization policies for COVID-19 vaccines would affect mortality in the population. However, such evidence is often lacking because experiments can be unethical, costly, time-consuming and infeasible in practice. Furthermore, even if experimental data exist, these data cannot be immediately used to answer practical questions in many limited-resource settings, due to the complex nature of the strategies and the dependence structure induced by the resource limitations.

Tatiana Ghasnavi: "Statistics is at the intersection of applied mathematics and data exploration and impacts everyday lives, so it appealed to my analytical mind. I really enjoyed my time at EPFL with high quality teachers and very stimulating lectures, ranging from theoretical to more practical ones!"

Theory has recently been developed to study the effects of allocation strategies, even if data from ideal experiments are lacking. This theory builds on a so-called counterfactual framework for causal inference, which considers what can be learned from allocations that did not actually happen, and can be used to improve studies that aim to guide future policies in medicine, public health and beyond.

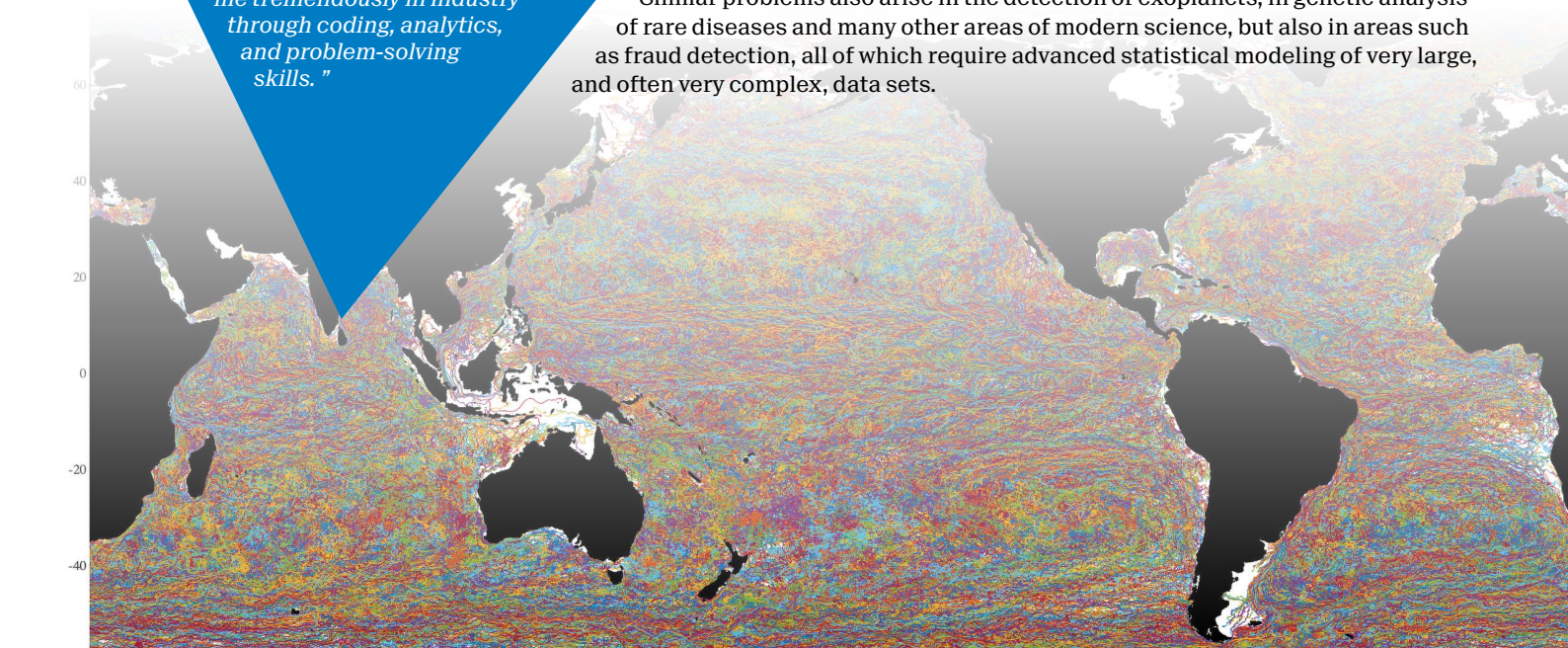
Surface drifters

Professor Sofia Olhede

Understanding changes in ocean currents is crucial to modeling the likely effects of global heating on our future climate, to forecasting the ecological effects of oil spills and other types of pollution, and to deepening our knowledge of ocean fluid dynamics. Ocean circulation is measured by buoys known as surface drifters, which send their positions, sea surface temperature and other information to passing satellites at irregular time intervals.

Charles Dufour: "This program was an inspiring experience. It provided me with both a solid theoretical basis and hands-on knowledge. I saw through internships how the material seen in the master helped me tremendously in industry through coding, analytics, and problem-solving skills."

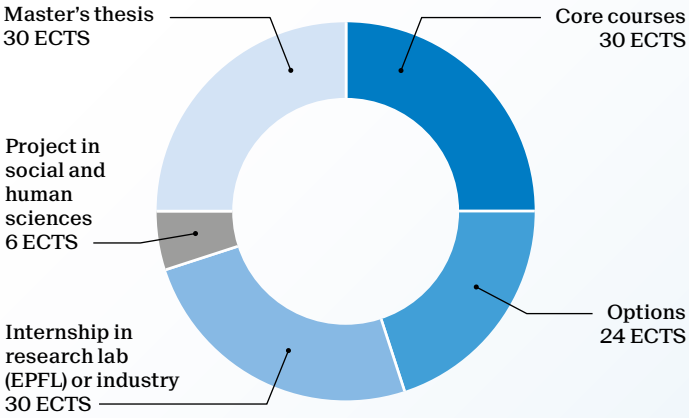
The quantity of such data is now massive, but extracting information from them depends on correct modeling of these space-time measurements, handling missing data and taking into account known physical constraints. Time series data are very common in all domains of science, social science, economics and finance, and many other areas, but drifter time series are very complex and require the development of new models and methods that can distinguish a small signal in a lot of noise, finding a needle in a haystack. Similar problems also arise in the detection of exoplanets, in genetic analysis of rare diseases and many other areas of modern science, but also in areas such as fraud detection, all of which require advanced statistical modeling of very large, and often very complex, data sets.



Master of Science in

STATISTICS

2-year program - 120 ECTS



	Credits
Core courses	**30**
Applied statistics	5
Multivariate statistics	5
Randomization and causation	5
Regression methods	5
Statistical computation and visualization	5
Statistical inference	5

Options	**24**
Biostatistics	
Applied biostatistics	5
Biostatistics	5
Genetics and genomics	4
Genomics and bioinformatics	4
Nutrition: from molecules to health	4
Statistical genetics	5
Statistics for genomic data analysis	5
Stochastic processes	5
Time series	5
Environmental statistics	
Exploratory data analysis in environmental health	4
Risk, rare events and extremes	5
Time series	5
Finance	
Derivatives	6
Financial big data	3
Martingales in financial mathematics	5
Probability and stochastic calculus	6
Stochastic processes	5
Stochastic simulation	5
Time series	5
Mathematical statistics	
Gaussian processes	5
Measure and integration	5
Probability theory	5
Statistical theory	5
Stochastic processes	5
Time series	5
Statistical data science	
Applied data analysis	8
Artificial neural networks/reinforcement learning	6
Computational linear algebra	5
Deep learning	4
Foundations of data science	8
Learning theory	6
Low-rank approximation techniques	5
Mathematical foundations of signal processing	6
Mathematics of data: from theory to computation	6
Optimization for machine learning	8
Statistical analysis of network data	5
Statistical machine learning	5

Students may choose a minor (30 ECTS) e.g.:

- Computational science and engineering
- Computer science
- Data science
- Environmental science and engineering
- Financial engineering

Career prospects

After graduation, students can enter the job market directly or continue their university studies by applying to a doctoral program. The realization that 'data is the new oil' means that statisticians and data analysts are highly sought-after and valued in many domains, including the pharmaceutical industry, the insurance sector, the financial sector, environmental science, and the health and social sciences. The internship portal, with offers from well-known companies such as Nestlé, Apple, AXA or Swissquote, gives a foothold in the professional world. The unique combination of theoretical and methodological foundations of statistics with skills in cutting-edge programming techniques, critical thinking team-working and communication, will make graduates valued collaborators in any data-rich environment.

Entry requirements

- A Bachelor's degree in Mathematics with an excellent academic record
- Holders of a Bachelor's degree in Physics, Engineering, Economics, or a field related to Mathematics with a strong quantitative background may also be admitted

School of Basic Sciences
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