

Probability and statistics

The main research interests of the Probability and Statistics team of the LMAP are stochastic and statistical modeling as well as the development and the optimization of deep learning models. Its areas of expertise, listed in the first column of the following table, lead to applications in biomedical sciences, environmental sciences, in the industry, and are more generally connected to the increasing use of artificial intelligence in society:

	Application areas			
	Biomedical applications (genomics, public health, ...)	Environmental applications (climate change, biodiversity, coastal hazards, water quality, ...)	Industrial applications (energy, intellectual property, aeronautics, ...)	AI-related applications
aging properties			x	
Bayesian modelling	x	x	x	x
big data / omics data	x			x
censoring	x	x	x	
change-point detection		x	x	
control charts		x	x	
copulas		x	x	
deep learning / neural networks / LLM	x	x	x	x
degradation modeling			x	
dimension reduction	x			x
empirical processes	x	x	x	
environmental monitoring		x		
experimental design			x	
Lévy processes			x	
lifetime/survival analysis	x	x	x	
machine learning	x	x	x	x
model selection	x	x	x	
multi-state models	x	x	x	
occupancy and abundance models		x		
Poisson point processes			x	
reliability			x	
resampling techniques		x	x	
sensitivity analysis			x	x
space-filling design			x	
spatially balanced sampling		x		
spatio-temporal data extraction				x
survey design		x		
thermal performance curves		x		

In the framework of our biomedical applications, we collaborate closely with researchers in epidemiology and genetics and develop statistical methods to identify genetic variants associated with various cancers, in the context of genomic studies. We are also interested in gene-environment interactions and the exposome. Finally, we also work on survival models applied to clinical data, including studies focused on melanoma.

Our environmental applications concern the development of spatially explicit biodiversity occupancy and abundance models, as well as implementing spatially balanced sampling strategies for long-term environmental monitoring. One of our priorities is the understanding of the impact of climate change on socio-ecosystems and biodiversity.

When developing stochastic and statistical models for industrial applications, the team carries out lifetime and degradation data analysis and uses its expertise in reliability, the design of experiments and statistical process control. Research activities range from theoretical investigations to applications through contracts with companies from the energy and aeronautics sectors.

Finally, the research team is interested in the development and the optimization of deep learning models, with an emphasis on their application in social and industrial contexts, particularly in the analysis of large text data or the processing of natural language ambiguity in specific corpora.