Today, we have access to so much data generated by a variety of sensors, but we are facing difficulties in using these data in a sensible way.

Machine Learning and Statistics offer the main tools to help making sense of data, and novel techniques in this domain will be used and developed throughout this project.

Quantification of risk and decision-making require accurate quantification of uncertainty, which is a major challenge in many areas of sciences involving complex phenomena like in finance, environmental and life sciences.

In order to accurately quantify uncertainty, we employ flexible and accurate tools offered by modern statistical models. However, today's diversity and abundance of data make it difficult to use these models in practice. The goal of this project is to propose new ways to better manage the interface between computational and statistical models - which in turn will help get accurate quantification of the confidence in the predictions based on observed data.

The specific objectives of this project are as follows:

Objective 1: Proposing and implementing novel methodological advancements to scale and distribute computations for modern probabilistic models, with emphasis on Bayesian Deep Models;

Objective 2: Explore the capabilities of Bayesian Deep Models to accurately quantify uncertainty in the analysis of data in life or environmental sciences.

In order to tackle the objectives above, the Ph.D. project will make contributions in the areas of variational Inference for Bayesian Deep Nets and Conv Nets, as well as the characterization of priors for such deep models.