Project 1: Numerical algorithms in image processing

Image processing is an important topic on image quality enhancement or image information extraction. It covers many popular tasks, such as image denoising, image segmentation, image deblurring, etc. As one way to describe the magnificence of the world is through images, fast and robust algorithms in image processing to enhance image quality or extract useful information is in high demand. This project focuses on popular image processing models and algorithms. We will study the intuition and rationality of these models, and test the performance of various numerical algorithms.

Project 2: Learning Partial Differential Equations

Many scientific phenomena can be described by partial differential equations (PDEs), like the heat diffusion process can be modeled by the heat equation. To discover the governing equation of a phenomenon, people usually need some knowledge of the phenomenon, some physical laws and a lot of empirical observations. It is a very time-consuming task. In the past decade, many methods have been proposed to learn the underlying governing equation directly from a set of given data. This project surveys these PDE learning methods and compare their efficiency and performance on learning various types of PDEs.

Prerequisites: Basic knowledge on partial differential equations