Abstract

Understanding the brain processes that underlie human behavior is an immensely challenging endeavor. Many techniques are currently used to record and analyze brain signals. Yet, because of the complexity of the human brain, both in terms of structure and dynamics, the signals that the various imaging modalities capture are inevitably highly complex; Depending on the distinct underlying physiological mechanisms that each method taps into, brain imaging tools capture different facets of brain activity (e.g. haemodynamic, metabolic or electrophysiological responses).

Research in my lab explores brain function and dysfunction by focusing on tools that allow for millisecond-range temporal resolution. Techniques such as magnetoencephalography (MEG) or electroencephalography (EEG) allow us to probe the spatio-temporal dynamics of the human brain both during active cognitive tasks and during rest (i.e. resting-state). While hypothesis-driven approaches continue to play an important role in neuroscience, recent years have seen a surge in data-driven approaches where machine-learning techniques are increasingly used to data-mine the human brain. The merits and limitations of such approaches will be discussed based on studies in my lab that use machine-learning to address various questions in basic and clinical neuroscience.