Speaker: Purvasha Chakravarti (University College London)

Date: 13:15-14:05 on 14/02/2023 in 8 West 2.20

Title: Signal Detection in Particle Physics using a Classifier Decorrelated through Optimal Transport

Abstract:
This talk will focus on the search for new physics signals that appear as deviations from known Standard Model physics (also called background) in high-dimensional experimental particle physics data. These new physics searches are usually performed in two steps - first finding signal-rich regions using ancillary variables and then performing signal detection using protected variables. The signal-rich regions are found by training a supervised classifier to separate a signal model from a background model. However, even when the signal model is correct, systematic errors in the background model can influence supervised classifiers and might adversely affect the signal detection procedure. To tackle this problem, one approach is to find a classifier constrained to be decorrelated with/independent of one or more protected variables, e.g., the invariant mass. We do this by considering an optimal transport map of the classifier output that makes it independent of the invariant mass for the background. We then fit a mixture model to the invariant mass for different cuts on the transformed classifier to detect the presence of signal. We compare and contrast this decorrelation method with previous approaches, show that the decorrelation procedure is robust to background misspecification, and analyze the power of the test. The talk will also briefly mention how our decorrelation algorithm can be used to address fairness in classification.