Towards distributionally robust autonomy: A control perspective

Various decision-making and control problems associated with autonomous systems are subject to uncertainties such as other cars' behaviors and intentions. Distributional information about these uncertainties can be used to improve system performance if appropriate stochastic controllers are adopted, thereby reducing the conservativeness of classical techniques such as robust control. However, in practice, obtaining accurate distributional information is a challenging task. In this talk, I will introduce an emerging technique, called "distributionally robust control," for designing control policies that are robust against errors in the estimated distribution. The proposed framework using the Wasserstein metric has several salient features, including an out-of-sample performance guarantee, and an SDP-based solution in the partially observable LQ setting. I will further discuss its MPC variant and application to motion planning and control in learning-enabled environments.