AA203 Final Project Proposal

Ricardo Paschoeto[1] and Srikanth Vidapanakal[2]

[1]rp304154@stanford.edu
[2]vsrikant@stanford.edu

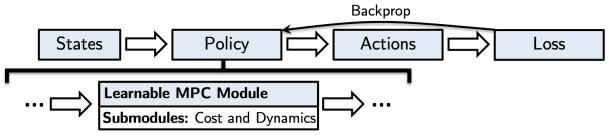
April 16, 2021

1 Proposal

This project is based on the paper "Differentiable MPC for End-to-end Planning and Control" and the proposal is to study in deep the theory presented and implement the Model Predictive Control (MPC) as a policy class for reinforcement learning in continuous state and action spaces and to apply it to planning and control of autonomous vehicles satisfying trajectory optimization and most efficient path.

The MPC is used to control a process while satisfying a set of constraints. MPC models predict the change in the dependent variables of modeled system that will be caused by changes in the independent variables, therefore provides one way of combining the advantages of model-free and model-based approaches.

MPC formulation[1] shows up that MPC is based on iterative, finite-horizon (at time **t** the current state is a sample[2]) of the optimization of a plant model (cost-minimizing control strategy is computed[2] for a short time horizon in the future). In this project, the MPC generate a policy class $u = \pi(x_{init}; C, f)$. Considering the cost C and dynamics model f. The approach involves learning by differentiating through MPC and using KKT conditions of the convex optimization at fixed point of the controller. The cost and dynamics of the controller are learnt by minimizing the Imitation learning loss in an end-to-end fashion. Our goal is to develop a robust end-to-end MPC controller in an Autonomous Driving setting. Below is presented the model proposed:



References

[1] https://arxiv.org/pdf/1810.13400.pdf
[2] https://en.wikipedia.org/wiki/Model_predictive_control#:~:text=Model%20predictive%20control%20(MPC)%20is,oil%20refineries%20since%20the%201980s.