

Master Thesis Progress

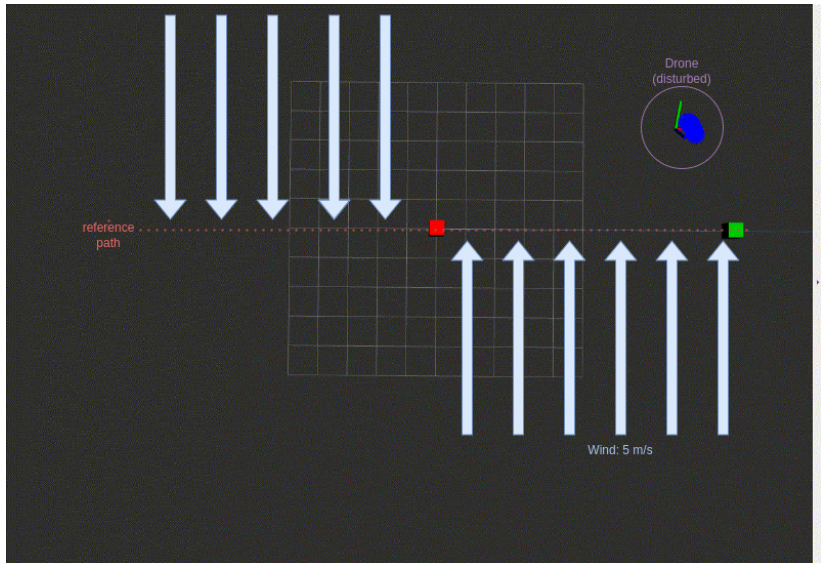
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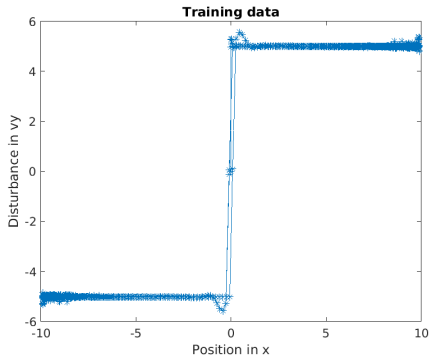
July 7, 2022

- Hand in draft literature report, waiting on feedback.
- Use simple MPC controller to fly drone back and forth.
- In simple python simulation add wind depending on x-position: $+5$ m/s for positive x , -5 m/s for negative x .
- Record system state and prediction in ROS.
- Process data in MATLAB to create .csv.
- Use .csv in Python together with GPyTorch to train basic GP.

Simple Simulation with wind

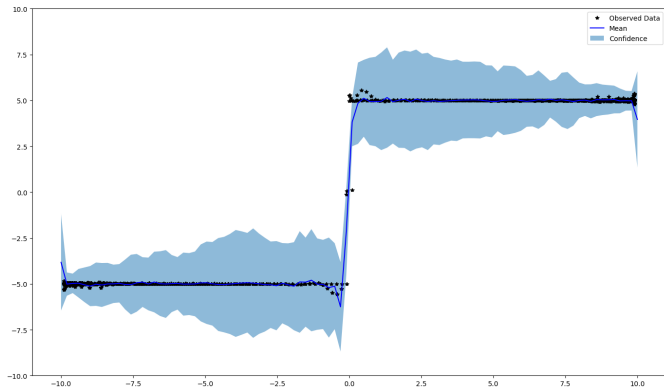


Process data



$$a_y = \frac{\hat{v}_y - v_y}{\Delta T} \quad (1)$$

Train GP



- Zero mean, squared exponential kernel
- Standard GP regression settings in GPyTorch

Discussion

- So far only simple MPC controller.
- Wind only in one direction, without any noise.
- But shows data flow and proofs that it is generally possible to reconstruct disturbance from available data .
- GP has high uncertainty: Perhaps because of sudden change of direction, or standard training parameters.
- General demonstration of concept and workflow.

- Extend wind model in simplesim to be more complex (e.g. multidirectional, add disturbance, create more realistic scenario).
- Extend basic MPC controller to LMPCC (mostly Dennis is working on this, but I will modify it for my needs).
- Improve training of GP model: Look at GPyTorch documentation, get help once there is more realistic data to train with.
- Extend simple simulation to Gazebo simulator, learn how to simulate wind in Gazebo.
- Process feedback literature report.