OVERTPOLY

An Algorithm for Forward Reachability Analysis of Neural Feedback Systems

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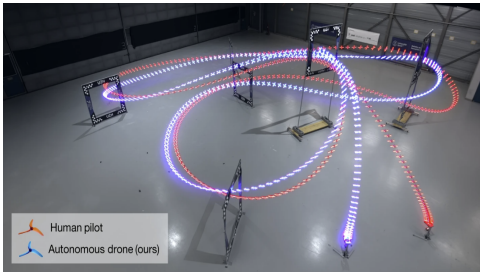
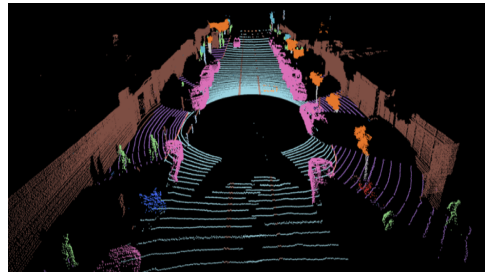
Introduction

Neural networks have found recent success as controllers for dynamical systems



(a) Drone Racing [1]



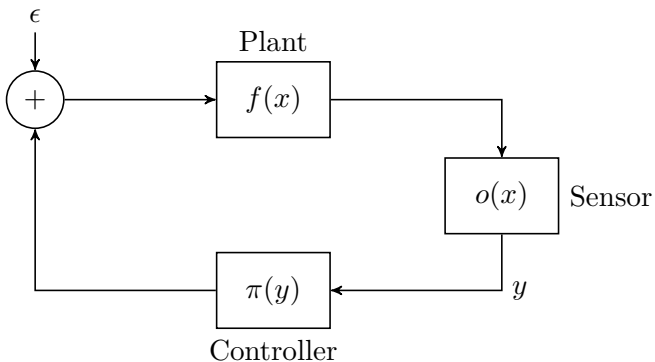
(b) Autonomous Driving [2]

[1] Credit: (Kaufmann et al. 2023)

[2] Credit: (Ettinger et al. 2021)

Neural Feedback Systems

The resulting systems are what we call *Neural Feedback Systems* (NFS)



Assume: $x \in \mathbb{R}^n, f(x) = [f_1(x), \ldots, f_n(x)]$, each $f_i : \mathbb{R}^n \to \mathbb{R}$, $\epsilon \in E$, π is a neural network with ReLU activations

Neural Feedback Systems

More formally

References

Ettinger, Scott et al. (2021). "Large scale interactive motion forecasting for autonomous driving: The waymo open motion dataset". In: *Proceedings of the IEEE/CVF International Conference on Computer Vision*, pp. 9710–9719.

Kaufmann, Elia et al. (2023). "Champion-level drone racing using deep reinforcement learning". In: *Nature* 620.7976, pp. 982–987.