The Field Robotics Center

Seminar Series

Wednesday, 25th Feb **GHC 2109 12:00pm – 1:00pm**

Food will be served

Debadeepta Dey
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Vision and Learning for Reactive and Deliberative Monocular Cluttered Flight

Abstract: Autonomous navigation for large Unmanned Aerial Vehicles (UAVs) is relatively well-studied, with many deployable expensive sensors and monitoring devices. In contrast, obstacle avoidance remains a challenging task for Micro Aerial Vehicles (MAVs) which operate at low altitude in cluttered environments. Unlike large vehicles, MAVs can only carry very light sensors, such as cameras, making autonomous navigation through obstacles much more challenging. In this talk, we describe both reactive and deliberative approaches for navigating a small UAV autonomously at low altitude through natural forest environments. Given a small set of human pilot demonstrations, we use recent state-of-the-art imitation learning techniques to train a controller that can avoid trees by adapting the MAV's heading, using monocular vision.

In the second part of the talk we describe, the first implementation of receding horizon control, which is widely used in ground vehicles, with monocular vision as the only sensing mode for autonomous UAV flight in dense clutter. Two key contributions make this possible: novel coupling of perception and control via relevant and diverse, multiple interpretations of the scene around the robot, leveraging recent advances in machine learning to showcase anytime budgeted cost-sensitive feature selection, and fast non-linear regression for monocular depth prediction. We empirically demonstrate the efficacy of our novel pipeline via real world experiments of more than 2 kms through dense trees with an off-the-shelf quadrotor. Moreover our pipeline is designed to combine information from other modalities like stereo and lidar.

Speaker Bio: Debadeepta Dey is a PhD candidate at the Robotics Institute, Carnegie Mellon University. He works with Prof J. Andrew Bagnell and Prof. Martial Hebert on bridging the gap between perception and control. He is especially interested in developing robust decision making approaches for agents that interact with dynamic environments under budgeted computational resources and incomplete information.

From 2007-2010 he was research staff in the Field Robotics Center of the Robotics Institute where he worked on vision-based sense-and-avoid for aerial vehicles, automated drilling for mining, robotics in agriculture, and vision-based localization for heterogeneous robot teams. He has also developed systems for automated grape yield estimation at Intel Research and route planning for aircraft under wind uncertainty at Microsoft Research.




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