The Field Robotics Center

Seminar Series

Tuesday 21st April **NSH 1507 10am – 11am**

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RI, CMU

Enabling High Speed Autonomous Flights

Abstract: Autonomous mobile robots are required to operate in partially known, unstructured environments. It is imperative to guarantee safety of such systems for their successful deployment. Current state of the art for guaranteeing safety does not fully exploit the sensory and dynamic capabilities of a robot. For a non-holonomic system with non-linear dynamic constraints, operating in an unknown environment it becomes computationally infeasible to find an optimal solution online. I will present an online algorithm to guarantee the safety of the robot through the use of an emergency maneuver library (EML) and active sensor control. The EML is optimized to maximize survivability in known obstacle free space. We leverage the fact that the related set generation function is monotonic, sub-modular allowing for efficient generation of the EML offline. The sensor bandwidth is used to detect obstacles in the volume bounded by EML. We develop a policy to actively control a nodding LIDAR to keep the vehicle safe at high speeds. The policy focuses the sensor bandwidth on gaining information relevant for the mission once safety is ensured. We test and validate the algorithm on a full-size autonomous helicopter flying up to speeds of 56 m/s in partially-known environments. I will present results from 4 months of flight testing where the helicopter has been avoiding trees, performing autonomous landing, avoiding mountains while being guaranteed safe.

Speaker Bio: Sankalp Arora is a Ph.D. student in the Robotics Institute advised by Sebastian Scherer. He received his B.E. in Electronics and Communication Engineering from the University of Delhi in India in 2010. His current research focuses on exploration senor and path planning for aerial vehicles. He was research staff at FRC from 2010-2012 and a master's student 2012-2014. During which besides developing algorithms to ensure safety for autonomous systems, he worked on state estimation methods to enable autonomous landing of a helicopter on a shipdeck, autonomous lawn mowers, SLAM using ranging radios and river detection algorithm to allow autonomous river mapping through aerial robots.

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