Robot Motion Planning and Applications

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Overview

Motion Planning is a classic problem in robotics. Given a high-level description of a task, multiple motion planning problems are solved to perform certain actions or move the robot in a collision-free manner in an environment. This includes navigation of autonomous cars, flying trajectory of a drone, or a robot manipulator used in an industrial setting for part inspection or assembly. Similar problems are also addressed in computer games, computer-aided design and virtual environments.

This course deals with fundamental issues related to the representations of the motion as well as computing visibility and collision-free trajectories in an environment taking into account kinematic and dynamic constraints. Furthermore, we will address issue in terms of computing the motion of a high-DOF robot or a swarm of multiple robots. We will discuss various considerations and tradeoffs used in designing various methodologies (e.g. time, space, robustness, and generality). This will include data structures, algorithms, computational methods, their complexity and implementation. We will also give an overview of recently development open-source software systems (e.g. FCL, OMPL, MoveIt, RVO2, Menge) that can be used to efficiently implement such algorithms in various applications. Finally, we will cover some ideas in integrating these methods with real-time perception algorithms (i.e. computer vision) and natural language processing for human-robot interaction.

Some programming exercise will also be given. Jan 8 is an optional day, which will focus on completion and discussion of the exercise.

Dates	**Jan 3 - Jan 8, 2018** **Number of participants for the course will be limited to fifty.**
You Should Attend If…	▪ you are an engineer or scientist interested in designing and implementing autonomous motion planning algorithms. ▪ you are a student or faculty from academic institution interested in research in the Robotics area. ▪ you are a student interested in Robotics.
Fees	The participation fees for taking the course is as follows: **Non IITD Students: Rs 5,000** **Non IITD Faculty: Rs 10,000** **Industry/ Research Organizations: Rs 15,000** This course fee includes instructional material, computer use for tutorials/assignments, laboratory equipment usage charges, and internet facility. Accommodation will be available on nominal charges.

The Faculty

Prof. Dinesh Manocha is the Phi Delta Theta/ Mason Distinguished Professor of Computer Science at the University of North Carolina at Chapel Hill. He has co-authored more than 450 papers in the leading conferences/journals on computer graphics, robotics, and scientific computing. He has also served as the program chair and on editorial boards for many leading journals in robotics, computer graphics, virtual reality, and geometric modeling. Some of the software systems related to collision detection, GPU-based algorithms and geometric computing developed by his group have been downloaded by more than 150,000 users and are widely used in the industry. Manocha has received awards including Alfred P. Sloan Fellowship, NSF Career Award, Office of Naval Research Young Investigator Award, and 15 best paper and Test-of-Time awards at the leading conferences. He is a Fellow of ACM, AAAS, and IEEE, and received Distinguished Alumni Award from Indian Institute of Technology, Delhi. He was a co-founder of Impulsonic, which was recently acquired by Valve, a leading VR and gaming company.

Prof. Subodh Kumar is a Professor of Computer Science and Engineering at IIT Delhi. He has been on the faculty of Johns Hopkins University and also served as a senior Architect at nVIDIA. Prof. Kumar. His list of awards include NSF Career Award and a number of best paper awards. His primary areas of interest include interactive three dimensional computer graphics, geometry processing, virtual worlds, scientific and medical visualization and high performance computation.

Course Co-ordinator

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