The Field Robotics Center

Seminar Series

Tuesday, 23rd May

GHC 6501 12:00 – 1:00pm

Food will be served

Vibhav Ganesh

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Robotics Institute

Robust Distributed 3D Mapping with Communication Constraints

Abstract: Real-world communication constraints limit a robot from sharing large numbers of observations at high fidelity. Naively simplifying the information leads to loss of unique features and an increase in perceptual aliasing. Towards sharing the most relevant subset of information, we develop a scan utility function based on information theoretic measures for scan information and feature-based place recognition approaches to assess loop closure potential. Using the utility function to rank scans, we formulate an offer-response-request framework, Communication Constrained Information Routing (CCIR), that ensures operation under stringent bandwidth restrictions.

Given the ability to share rich 3D information over constrained networks, we pursue full 3D mapping via extensions and robustification techniques. The robust measures we introduce allow operation in the mine given substantial perceptual aliasing.

To enable operation in environments that exhibit aliasing that exceeds the performance characteristics of the developed framework, we detail first results for an approach that moves away from feature-based techniques and introduces a methodology utilizing Hierarchical Gaussian Mixture Models. Through regeneration of the point cloud from the HGMM model and Generalized Iterative Closest Point algorithms, we are able to detect loop closures accurately with an outlier rate significantly lower than feature-based methods.

Speaker Bio : Vibhav is a second year master's student in the Robotics Institute at Carnegie Mellon University, advised by Prof. Nathan Michael. Prior to his master's program, he received his B.S in Computer Science at Carnegie Mellon University. He is interested in distributed perception algorithms with real-world constraints.




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