Spatial Intent Recognition using Optimal Margin Classifiers

16.412J Cognitive Robotics
Final Project Report

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5/11/05

Abstract

Human-robot collaboration will be crucial to the productivity and success of future space missions. A simple yet intuitive means of communication between two parties—such as communication through gestures—is critical to the success of such collaboration. Optimal margin classifiers can be used for the classification and recognition of such gestures. Two pattern input methods are used to test the behavior and performance of these classifiers. The first is a 2-dimensional computer mouse interface which allows for ease of control and visualization of the patterns. Patterns obtained through this input include circles, lines, and written numerals 2, 3, and 4. The second is a 6 degree-of-freedom hardware tracking device comparable to systems that may be integrated into actual spacesuits. Patterns for this input include gestures designed to convey the intentions of “come here,” “lift,” and “move.” These gestures are meant to mirror the ones actual astronauts may make to communicate with their robotic assistants. We demonstrate a basic linear optimal margin classifier based on support vector methods to efficiently learn and recognize input patterns from multiple categories. We test the algorithm’s capability not only to distinguish different patterns but also to differentiate same pattern made by different users. We further characterize the performance of this algorithm and its sensitivity to training corpus size and input sampling resolution. Finally, we discuss directions for further development of these algorithms to support flexible, intuitive astronaut collaboration with automated space systems.

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