Fuzzy Logic for Mobile Robot Navigation Applications

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**Abstract:**

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# Introduction

## Motivation

Mobile robot navigation is a broad field with around a century of invested research dating back to early autopilot systems, depending on what exactly one considers as the first mobile robot with navigation capabilities. We now profit from many applications using this technology such as scientific exploration with rovers, autonomous warehouses, and modern autopilot systems. The self-driving car is an example of how mobile robot navigation technology could impact many private lives, if present trends in the industry continue. While some may find the scope of its applications inspiring, the scope of problems in mobile robot navigation may be daunting to potential innovators. This paper is written to the end of bridging the gap between user and designer, exploring mobile robot navigation functionality based on common-sense human experience, rather than various abstract mathematical treatments of the navigation problem removed from human experience.

Fuzzy logic applications are chosen as the focus of this paper because the author believes that mobile robot technologies stand to benefit from integration of a fuzzy rule-based programming interface, suitable for programming by average consumers. Simplified mobile robot customization through a fuzzy programming language consisting of perhaps several verbs, measurements, logical operators, and qualitative magnitudes, could offer typical consumers more sophisticated or better tuned robot behavior than technically knowledgeable professionals can program before robot deployment. The author believes further that a guide matching mobile robot navigation problems with fuzzy logic solutions could be informative in designing such a fuzzy programming interface.

Fuzzy rule-based navigation schemes can be represented as a set of sets of fuzzy implication relations or rules, {{R11, R12, …, R1n}, … {Rm1, Rm2, …, Rmp}} of the form:

Where

For the purposes of this paper, a mobile robot is any machine (physical or simulated) which

# Perception