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VISION AND NAVIGATION FOR THE CARNEGIE-MELLON NAVLAB

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1. INTRODUCTION

Robotics is one place where Artificial Intelligence meets the real world. AI deals with symbols, rules, and abstractions, reasoning about concepts and relationships. The real world, in contrast, is tangible, full of exceptions to the rules, and often stubbornly difficult to reduce to logical expressions. Robots must span that gap. They live in the real world and must sense, move, and manipulate real objects. Yet to be intelligent, they must also reason symbolically. The gap is especially pronounced in the case of outdoor mobile robots. The outdoors is constantly changing, due to wind in trees, changing sun positions, even due to a robot's own tracks from previous runs. And mobility means that a robot is always encountering new and unexpected events, so static models or preloaded maps are inadequate to represent the robot's world.

The tools a robot uses to bridge the chasm between the external world and its internal representation include sensors, image understanding to interpret sensed data, geometrical reasoning, and concepts of time and of motion over time. We are studying those issues by building a mobile robot, the Carnegie-Mellon Navlab, and giving it methods of understanding the world. The Navlab has perception routines for understanding color video images and for interpreting range data. CODGER, our "whiteboard," proposes a new paradigm for building intelligent robot systems. The CODGER tools, developed for the Navlab and its smaller cousin the

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