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Abstract

Robot control with natural language commands

Known **primitives** from **corpus**

Unknown compounds derived from primitives

Description of **Instruction-Based-Learning**

Data structures, primitives, natural→computer translation

Introduction

Justification for project: intelligent robots + naive users + user-specific applications = **need for user-specific learning**

Alternatives to IBL = **imitation, reinforcement** = poor knowledge structures, lengthy, low-level motor control

Natural language = potential for **conciseness, symbolic-level** instructions (versus sensor-motor instructions)

IBL model

System architecture

Corpus collection and data analysis

40 subjects were surveyed in specific conditions to generate command primitives, using a total of 144 natural-language routes

Primitive specification: landmarks are not user-defined, all primitives have landmark references

Discussion & Conclusions

SETUP & SPECS

Robot

Camera for visual navigation

Differential drive system

Wireless communication & onboard computer

Environment

Obstacles in a familiar format

Resembles a problem that requires user-specific learning

Onboard software

Speech → Text conversion

Natural language → Computer language translation

Learning of complex instructions

DEFINITIONS

Chunking, Sequencing, Repair, Corpus, DRS

ROUTE INSTRUCTIONS CORPUS

PROGRAM ARCHITECTURE

Dialogue Manager (DM)

Bidirectional interface between human and computer (RM, DRS)

Robot Manager (RM)

Process Manager (PM)

The control unit of the robot

Parses semantic chunks for learning (new procedures) and execution (existing procedures), prompts DM for clarification on mapping failure

Procedure Execution Module (PEM)

Executes procedures called by PM

DM and RM run in parallel, and their communication allows for interrupts

NATURAL LANGUAGE PROCESSING

INSTRUCTION-BASED LEARNING

DISCUSSION & CONCLUSIONS

Primitive complexity depends on user and expectations of the robot

Open vocabulary = user-defined primitives, requiring low-level primitives from a low-level corpus OR dialogue to redefine unknown procedures

Learning is done at the **symbolic level** = comprehensive initial corpus, route validation for repair can be done before execution

Testing not included = difficult to judge viability, but leaves it open for personal research