Talking Robots

Andrea Vanzo, Emanuele Bastianelli and Daniele Nardi

Sapienza University of Rome, Via Ariosto 25, 00185 Rome, Italy
{lastname}@dis.uniroma1.it

Introduction. Robots are becoming more ubiquitous and capable of performing complex and different tasks. For this reason, the importance of enabling untrained users to interact with them has increased. Natural Language can be an expressive, flexible and intuitive interface for robots, especially when interacting with non-expert users. The interaction between human and robots can be treated as a dialogue, where the user is expecting a feedback from the counterpart and the modeling of such dialogues introduces different issues that are recently being investigated by many researchers (see, for instance, the 2011 Special Issue of the AI-Magazine [1]). We identified two different aspects that affect this particular type of interaction: Command Interpretation and Sentiment Detection. We propose here two feasible strategies that aim at modeling these tasks: an AIML-based lightweight tool for Command Interpretation and contextual model for Sentiment Detection of utterances within dialogues.

1 Command Interpretation through lightweight tools

Command Interpretation is the problem of processing Natural Language commands to actions and control structures, that can correspond to robot plans or behaviors. This issue has been investigated so far within the Human-Robot Interaction field. In the last years, this research area has become more and more promising, especially because robots are spreading in the market. Robotic platforms are expected to become part of human everyday life and, as a consequence, they should be aware of human expressiveness and able to handle different types of dialogue with different types of user.

During the last years, this task has been addressed by several approaches. In [3] interpreting commands is realized through a rule-based framework, where the meaning of utterances of the dialogue, participants and other information are represented as logical forms of compositional semantics. In [7, 12] a probabilistic approach is presented. The proposed technique aims at addressing the symbol grounding problem, according to the linguistic structure of a command. Contrariwise, in [8] the problem of modeling dialogues has been analyzed with more attention. They discuss an ontology-based approach to multi-layered conceptual spatial mapping that aims at providing a common ground for human-robot dialogue.

We propose here an approach that addresses both dialogue modeling and command interpretation at the same time, through the application of a lightweight tool, such as an AIML-based Knowledge Base. AIML (Artificial Intelligence Markup Language) [15] is an XML-compliant dialect for creating chatbots [14], whose interfaces are in Natural Language. AIML implements the classical *Stimulus/Response* pattern, where the Stimulus is a simple pattern that matches what a user may say or type, whereas

the Response represents the correct reply w.r.t. the corresponding Stimulus. The whole KB can be interpreted in really small amounts of time and, consequently, the AIML represents a suitable solution in real-time applications.

Under this perspective, AIML enables the definition of sets (or subsets) of dialogues, whose flow can be dynamically controlled by a proper usage of internal variables. These variables can be used at runtime to model the flow of interactions according to the state of the robot. The idea is to support the interpretation of commands and the interactions between humans and robots through domain-specific dialogues, by defining dialogue modules that are able to handle different types of situation.

2 Dialogue-based Sentiment Detection

Sentiment Detection is the computational study and automatic recognition of opinions and sentiments as they are expressed in free texts. In the recent years, this area is magnetizing the attention of several research works [10, 9], because of the huge stream of data that comes from Social Networks. Indeed, many recent works tried to model the sentiment in short messages, such as tweets [4–6, 11, 16]. Moreover, the actual applications in everyday life are intriguing several researchers. As robots are going to become ubiquitous in the near future, the task of detecting sentiments in human-robot dialogues can be a significant research topic even in the Robotics area.

In order to model the sentiment of utterances within streams of data, such as dialogues, we propose the application of contextual models that have been developed in [13] to the interaction between humans and robots. The cited work proposes a novel model for Sentiment Analysis of Twitter's statuses, that exploits a richer set of observations, such as conversations rather than single messages, and defines a context-sensitive approach for Sentiment Detection along two lines: first, by enriching a tweet representation to include the conversational information; second, by introducing a more complex classification model that works over an entire message sequence instead of working on one message at a time. The SVM^{hmm} learning algorithm [2] is there employed, as it implements a Markovian formulation of SVM, so that it allows to classify an instance based upon an entire sequence. The outcomes that are observed in [13] suggest that sentiment polarity is strictly related to contextual information and a single observation is often insufficient in order to disambiguate the sentiment polarity.

The idea is that the approach is applicable to other domains, whereas a context is available. Sentiment Detection of robots can be modeled by employing this approach in conjunction with a set of relevant features and contexts that can be extracted from robot's perception of the environment, such as the human speech intonation. Accordingly, the sentiment profile of the user the robot is interacting with becomes relevant as well, as the interaction mood depends on the entities that are involved into the conversation.

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