

Evaluation Report of the PhD Thesis

Goal Oriented and Open Domain Dialogue Management by Miroslav Vodolán

Miroslav Vodolán is submitting the "Goal Oriented and Open Domain Dialogue Management" theses dealing with one of the latest technological trends spoken language dialog. With the advances of Automatic Speech Recognition, we notice a dramatic growth of voice-controlled devices and applications such as Siri, Google Assistant, Alexa, etc. The main goal of these devices is to simplify user interaction since natural language is the most natural way to communicate. Current applications are still in its infancy. They handle mostly only simple factoid questions answering, but some of the latest applications are already attempting the simplest dialogs. The emerging simple dialogs are accelerating the research in extending the system's capabilities of conducting an open natural language dialog. The submitted theses is a significant contribution to these technological trends.

The first part of the thesis is focusing on efficient dialogue management for goal-oriented tasks. The second part of the thesis deals with incremental learning from dialogues.

The first part of the thesis is building on extensive work in belief tracking, which was motivated by several Dialogue State Tracking Challenges (DSTC). Thanks to these challenges, there are available goal-oriented annotated dialogs databases allowing an objective comparison of different approaches. The candidate compares his new algorithms to the state of the art methods using the DSTC databases.

The first part of the thesis presents three incremental steps for improving belief tracking. Chapter 3 describes the first tracker designed without in-domain data. The dialogue state tracker with trainable transitions introduced in Chapter 4 is further improving belief tracking with fully trained transitions. The improvement is achieved using machine learning in combination with first tracker equations. Chapter 5 describes the details of the third version. This tracker is adding a trainable Spoken Language Understanding (SLU) unit. The suggested trainable SLU allows the tracker to fix typical ASR errors better, resulting in further improving belief tracking accuracy. All trackers achieve state-of-the-art accuracy in most of the DSTC categories.

The second part of the thesis is a very innovative contribution to open dialogue systems research. It is opening a new segment of interactive learning techniques. Learning from a dialog is crucial for creating real natural dialogs. Currently, researchers are only starting finding new algorithms in this field. The suggested algorithms are, therefore showing new possible research directions. At the end, of the second part, the real experiments demonstrate the ability to learn from its users.

The second part starts with Chapter 7 and describes the used information sources. Next, Chapter 8 discusses what and how is the information extracted from the dialogues. Chapters 9 and 10 show the testing set and evaluation design for the experiments. Alone the testing of dialog with the information extraction is a difficult task. The candidate has selected and designed a task demonstrating the information extraction from natural language utterances collected from real users. Finally, the last chapters describe experiments with simple rule-based baseline algorithms and a more advanced neural attention-based model. Both demonstrate the capability of learning from a dialogue. Also, the last chapters present new findings: the conversations are becoming more effective as a consequence of new knowledge the system is learning.

The dissertation satisfies all the formal requirements of a work of this type. An extensive list of literature accompanies the text. All the chapters are referring to the key papers from this field, and they contain clear and well-prepared graphs and tables.

Overall the dissertation, especially the second part, is introducing new approaches to automatic enriching the dialogues. The experimental part of the thesis validates the theoretical assumptions and is showing improvement compared to the current state of the art algorithms. The thesis is a significant contribution to the field of dialog management, and it satisfies all requirements. The high standard of the thesis and the collection of published papers proves that Miroslav Vodolán has all the required talent and abilities to continue in a successful research carrier. It is my pleasure to **recommend the submitted thesis for defense.**

My question for the defense discussion: I would like the candidate to propose and discuss the future steps and directions in the development of knowledge extraction from dialogues and its organization in knowledge databases.

Jan ŠEDIVÝ
Leader of the Group