Prologue

Question answering (QA) has become one of the fastest growing topics in computational linguistics and information access. To advance research in the area of dialogue-based question answering, we propose a combination of methods from different scientific fields (i.e., Information Retrieval, Dialogue Systems, Semantic Web, and Machine Learning). The target audience for this book comprises of researchers and students interested in the application potential of semantic technologies for difficult AI tasks such as working dialogue and QA systems.

Humans adapt their dialogue behaviour over time according to their dialogue partner's knowledge, attitude, and competence. In terms of efficiency and effectiveness, this adaptation leads to optimised natural dialogues. The information should be quickly communicated and only contain the necessary information pieces. When users adapt to their dialogue partners, they try to make the conversation informative and relevant. We also assume that they avoid saying falsehoods or that they indicate a lack of adequate evidence. In order to learn similar dialogical interaction capabilities for question answering applications, we propose introspective methods for dialogue-based question answering. Accordingly, new AI applications should be dynamic and evolve over time.

In the information and knowledge retrieval context, information sources may change their quality characteristics, e.g., accessibility, response time, and reliability. Therefore, we suggest an introspective view on the processing workflow: machine learning methods update the reasoning process for dialogue decisions. More precisely, an introspective mechanism includes metadata management and a methodology on how to split dialogue processes into two interrelated levels.

Our aim is to bridge the gap from dialogue modelling to integration modelling; we address dialogue modelling in order to handle errors that occur after integration into a question answering system by developing adaptable rules for meta dialogue. An outstanding feature is that introspective models can be extracted and applied automatically. This paves the way toward question answering systems—and more generally, embedded machine learning systems—that adapt automatically to new situations. An empirical evaluation shows that the proposed introspective mechanism extracts useful features which will be explained in detail later. In combination with association rule mining and supervised classification, good model predictors can be induced in order to improve question feedback.

This book sheds light on adaptable dialogue-based question answering. We demonstrate the technical and computational feasibility of the proposed ideas, the introspective methods in particular, by beginning with an extensive introduction to the dialogical problem domain which motivates the technical implementation. The ideas have been carried out in a mature natural language processing (NLP) system, the SmartWeb dialogue system, which was developed between 2004 and 2007 by partners from academia and industry. We have attempted to make this book a self-containing text and provide an extra section on the interdisciplinary scientific background.

While the first part of this book provides the introduction and the scientific background, the second part presents the building blocks—ranging from ontological discourse and content representation to hub-and-spoke dialogue frameworks based on semantic message transfer. Ontologies represent the explicit knowledge representation structures. The third part discusses dialogue adaptivity, i.e., the automatic formulation of (meta) dialogue. We developed introspective methods to integrate adaptable models of the answer services. We show that (semi-) automatic acquisition of optimised dialogical interaction behaviour can be put into practice by mining ontology-based dialogue processing structures and generating predictive models. Finally, we evaluate the impact of the learned models on the dialogue performance, i.e., whether the adaptable models can be used for a more convenient dialogue formulation process. We show significant improvements in the resulting dialogues when using the machine learning (ML) models.