Chapter XVIII
Problems-Solving Map Extraction with Collective Intelligence Analysis and Language Engineering

Asanee Kawtrakul
Kasetsart University, Thailand & Ministry of Science and Technology, Thailand

Chaveevarn Pechsiri
Dhurakij Pundij University, Thailand

Sachit Rajbhandari
Kasetsart University, Thailand

Frederic Andres
National Institute of Informatics, Japan

ABSTRACT

Valuable knowledge has been distributed in heterogeneous formats on many different Web sites and other sources over the Internet. However, finding the needed information is a complex task since there is a lack of semantic relations and organization between them. This chapter presents a problem-solving map framework for extracting and integrating knowledge from unstructured documents on the Internet by exploiting the semantic links between problems, methods for solving them and the people who could solve them. This challenging area of research needs both complex natural language processing, including deep semantic relation interpretation, and the participation of end-users for annotating the answers scattered on the Web. The framework is evaluated by generating problem solving maps for rice and human diseases.

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INTRODUCTION

Accumulation of knowledge and Collective Intelligence on certain topics is crucial for building a Knowledge Society. Best practices or experience on focus areas can be found and shared through writing research reports, visiting blogs, and even participating in Wikipedia. Anyway, Information on new events should be extracted from newspapers and news sites for updating, monitoring or tracking the important events. However, these sources of valuable knowledge are scattered over many different sources, and they come in many different formats. Moreover, desired information/ knowledge is more difficult to access from scattered sources since search engines return ranked retrieval lists that offer little or no information on the semantic relationships among scattered information, and even when such information is found, it is often redundant or in excess volume since there is no content filtering or correct answer indicated. Accordingly, as we move beyond the concept of simple information retrieval and simple database queries, automatic content aggregation, question answering, and knowledge visualization become more important.

Moreover, to make smart access to a "one-stop service", semantic-based knowledge aggregating and organizing are needed for shortening the time it takes to grasp the knowledge. PMM map (Problem--Methods of problem solving--huMan map), a smart visual browser, is then developed. Since the web consists to a large extent of unstructured or semi-structured natural language text, generating PMM map needs language engineering techniques such as named entity recognition, discourse relation recognition for specific information and knowledge extraction. However, PMM map generation also needs collaborative intelligence to create the community knowledge pool and contribute to both annotate problem-solving solutions scattered on the web and verify the ones that extracted by the Q&A system.

This chapter focuses on problem solving map extraction using 'know-why' and 'know-how' analyser as a means of indicating specific answers to queries on topics *"cause-and-effect* "such as disease and symptoms, " *problem-and -how-to-do* " such as disease prevention or control, and biomedicine preparation. Section 2 describes the background and related works. Section 3 gives the conceptual framework for PMM map generation. Section 4 describes the problems that need language engineering to solve and gives a brief of specific knowledge annotation. Section 5 summaries the experiments related to the language processing.

BACKGROUND AND RELATED WORKS

The lessons learned from solving past problems (e.g. how to protect oneself from a disease, how to control the plant disease) and gaining valuable information from previous experience (e.g. disease diagnosis) and the history of disease recurrences (e.g. disease outbreaks) are invaluable for guaranteeing food safety and human health. To reduce the time that users take to learn from such information, a salient information space with semantic link should be developed.

Problem-solving is an intelligent behavior (Kennedy J., et al., 2001) where the goal is to find a solution which satisfies certain criteria. It requires abductive reasoning whereby we apply deductive reasoning in combination with natural language processing. In classical applications as well as in expert systems, abductive inference (Shohei K., et al., 2003) is a complex problem (creation and maintenance) as it is simulated by deductive procedures or rules. On the other hand, qualitative reasoning concerns modeling and inference techniques where continuous phenomena are discretized into a finite number of qualitative categories. In this chapter, language engineering is described as a tool for extracting knowledge

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