Classummary:
Introducing Discussion Summarization to Online Classrooms

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Abstract

This paper describes a novel summarization system, Classummary, for interactive online classroom discussions. This system is originally designed for Open Source Software (OSS) development forums. However, this new application provides valuable feedback on designing summarization systems and applying them to everyday use, in addition to the traditional natural language processing evaluation methods. In our demonstration at HLT, new users will be able to direct this summarizer themselves.

1 Introduction

The availability of many chat forums reflects the formation of globally dispersed virtual communities, one of which is the very active and growing movement of Open Source Software (OSS) development. Working together in a virtual community in non-collocated environments, OSS developers communicate and collaborate using a wide range of web-based tools including Internet Relay Chat (IRC), electronic mailing lists, and more.

Another similarly active virtual community is the distributed education community. Whether courses are held entirely online or mostly on-campus, online asynchronous discussion boards play an increasingly important role, enabling classroom-like communication and collaboration amongst students, tutors and instructors. The University of Southern California, like many other universities, employs a commercial online course management system (CMS). In an effort to bridge research and practice in education, researchers at ISI replaced the native CMS discussion board with an open source board that is currently used by selected classes. The board provides a platform for evaluating new teaching and learning technologies. Within the discussion board teachers and students post messages about course-related topics. The discussions are organized chronologically within topics and higher-level forums. These 'live' discussions are now enabling a new opportunity, the opportunity to apply and evaluate advanced natural language processing (NLP) technology.

Recently we designed a summarization system for technical chats and emails on the Linux kernel (Zhou and Hovy, 2005). It clusters discussions according to subtopic structures on the sub-message level, identifies immediate responding pairs using machine-learning methods, and generates subtopic-based mini-summaries for each chat log. Incorporation of this system into the ISI Discussion Board framework, called Classummary, benefits both distance learning and NLP communities. Summaries are created periodically and sent to students and teachers via their preferred medium (emails, text messages on mobiles, web, etc). This relieves users of the burden of reading through a large volume of messages before participating in a particular discussion. It also enables users to keep track of all ongoing discussions without much effort. At the same time, the discussion summarization system can be measured beyond the typical NLP evalua-

tion methodologies, i.e. measures on content coverage. Teachers and students' willingness and continuing interest in using the software will be a concrete acknowledgement and vindication of such research-based NLP tools. We anticipate a highly informative survey to be returned by users at the end of the service.

2 Summarization Framework

In this section, we will give a brief description of the discussion summarization framework that is applied to online classroom discussions.

One important component in the original system (Zhou and Hovy, 2005) is the sub-message clustering. The original chat logs are in-depth technical discussions that often involve multiple sub-topics, clustering is used to model this behavior. In Classummary, the discussions are presented in an organized fashion where users only respond to and comment on specific topics. Thus, it eliminates the need for clustering.

All messages in a discussion are related to the central topic, but to varying degrees. Some are answers to previously asked questions, some make suggestions and give advice where they are requested, etc. We can safely assume that for this type of conversational interactions, the goal of the participants is to seek help or advice and advance their current knowledge on various course-related subjects. This kind of interaction can be modeled as one problem-initiating message and one or more corresponding problem-solving messages, formally defined as Adjacent Pairs (AP). A support vector machine, pre-trained on lexical and structural features for OSS discussions, is used to identify the most relevant responding messages to the initial post within a topic.

Having obtained all relevant responses, we adopt the typical summarization paradigm to extract informative sentences to produce concise summaries. This component is modeled after the BE-based multi-document summarizer (Hovy et al., 2005). It consists of three steps. First, important basic elements (BEs) are identified according to their likelihood ratio (LR). BEs are automatically created minimal semantic units of the form head-modifier-relation (for example, "*Libyans | two | nn*", "*indicted | Libyans | obj*", and "*indicted | bombing | for*"). Next, each sentence is given a score which is the sum of its BE scores, computed

in the first step, normalized by its length. Lastly, taking into consideration the interactions among summary sentences, a MMR (Maximum Marginal Relevancy) model (Goldstein et al., 1999) is used to extract sentences from the list of top-ranked sentences computed from the second step.

3 Accessibility

Classummary is accessible to students and teachers while classes are in session. At HLT, we will demonstrate an equivalent web-based version. Discussions are displayed on a per-topic basis; and messages belonging to a specific discussion are arranged in ascending order according to their timestamps. While viewing a new message on a topic, the user can choose to receive a summary of the discussion so far or an overall summary on the topic. Upon receiving the summary (for students, at the end of an academic term), a list of questions is presented to the user to gather comments on whether Classummary is useful. We will show the survey results from the classes (which will have concluded by then) at the conference.

References

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