Explanation and Interaction: The Computer Generation of Explanatory Dialogues

Alison Cawsey
(University of Glasgow)

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ACL–MIT Press Series in Natural
Language Processing, edited by
Aravind K. Joshi, Karen Sparck Jones,
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Cawsey presents an excellent treatment of explanation generation within the context of a system that must describe the working of a complex device. Since such explanations are generally long and complex, the system must interact with the user to make certain that the user understands the explanation as it progresses and to give the user the opportunity to clear up any misunderstandings or confusion. Thus Cawsey employs a reactive incremental planner that relies on a dynamically updated user model in order to produce an extended explanation that is sensitive to the system's current beliefs about the user and the existing dialogue situation.

One of the most notable features of this book is its outstanding analysis of work in other areas and its integration into a system for generating explanations. Cawsey's system, called EDGE (Explanatory Discourse GEnerator), is strongly influenced by previous work on AI planning, tutorial dialogues, conversation analysis, and user modeling. For example, Cawsey collected transcripts of both interactive and noninteractive explanations in the domain of electronic circuits. She found a marked similarity in content between the interactive and noninteractive explanations, and she therefore built on previous work in text planning to develop a mechanism for identifying the appropriate content of an interactive explanation. Cawsey also compared her analysis of the interactive explanations with Sinclair and Coulthard's (1975) model of classroom discourse. She found that although their model captured much of the conventional structure of these dialogues, it needed to be extended to capture certain exchanges, such as the system checking whether the user is familiar with a concept before determining how to formulate the explanation. These insights are reflected in the EDGE system. It combines goal-based reasoning, captured in content-planning rules, with dialogue conventions captured in dialogue-planning rules; goal-based reasoning is used to identify and organize the content of an explanation, and dialogue conventions are used to manage the interaction and determine such features as the use of discourse markers and meta-comments.

The book emphasizes EDGE's flexibility with respect to the content of an explanation. The system can choose among different content-planning rules depending on whether or not the rule's constraints are satisfied, and it can include or omit background information (captured in prerequisites of the content-planning rules) depending on whether or not it is already known to the user. If an explanation is unsuccessful,

EDGE can replan by retracting an assumption about user knowledge suggested by the user model or by selecting alternative content-planning rules. Since the plan for the explanation is developed incrementally, with execution interleaved with planning, the system can easily adjust its planning to take into account interruptions by the user or newly acquired information about the user's knowledge.

A chapter of the book focuses on the role of user modeling in generating extended explanations. EDGE represents the system's beliefs about the user's knowledge of the domain in an overlay model that distinguishes among concepts according to the system's beliefs about whether the user is, or might be, familiar with the concept. The user model is initially constructed using stereotypes to reflect knowledge that is typical of people with the user's stated level of expertise. It is subsequently updated by taking into account the user's responses to the explanation and to the system's questions; these are used both to directly change the assumptions recorded in the user model and to indirectly alter the assumptions by adjusting the user's presumed level of expertise. The user model can influence the content of the explanation by indicating concepts that can be omitted from an explanation and by distinguishing appropriate rules whose constraints are satisfied; it can influence the dialogue interaction by suggesting that the system query the user regarding knowledge of a concept in order to make decisions regarding the appropriate explanation content or strategy.

EDGE was evaluated by having subjects use the system to obtain explanations of four circuits. The sessions were recorded, and at the end of each session the subject completed a questionnaire addressing different aspects of the system's performance and acceptability. The main purpose of the evaluation was to identify ways in which the system might be improved rather than to evaluate the validity of EDGE's underlying approach to generating explanations. Cawsey provides a summary of her analysis of the evaluation data.

The book's presentation of the EDGE system and its underpinnings is thorough and well organized. However, the model has some limitations, many of which Cawsey notes and discusses at length. For example, EDGE does not provide a general intention-based model of dialogue, its use of discourse markers and meta-comments is relatively rigid and inflexible, and it restricts user initiative in directing the explanation. In addition, the user interface is menu-based, which constrains the interaction in many ways, and responses are realized using a simple template-based approach. Nonetheless, the book is an excellent piece of work, both in its contributions to flexible explanation generation and in its treatment of previous research in related areas. Both active researchers in natural language generation and those relatively new to the field will find the book enjoyable and illuminating.

Reference

Sinclair, J., and Coulthard, R. M. (1975).
  *Towards an Analysis of Discourse: The English
  Used by Teachers and Pupils.* Oxford
  University Press.

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