

Li Niu, Jie Lu, and Guangquan Zhang

Cognition-Driven Decision Support for Business Intelligence

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Cognition-Driven Decision Support for Business Intelligence

Models, Techniques, Systems and Applications

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Preface

Cognition-driven decision support system (DSS) has been recognized as a paradigm in the research and development of business intelligence (BI). Cognitive decision support aims to help managers in their decision making from human cognitive aspects, such as thinking, sensing, understanding and predicting, and fully reuse their experience. Among these cognitive aspects, decision makers' situation awareness (SA) and mental models are considered to be two important prerequisites for decision making, particularly in ill-structured and dynamic decision situations with uncertainties, time pressure and high personal stake. In today's business domain, decision making is becoming increasingly complex. To make a successful decision, managers' SA about their business environments becomes a critical factor.

This book presents theoretical models as well practical techniques of cognition-driven DSS. It first introduces some important concepts of cognition orientation in decision making process and some techniques in related research areas including DSS, data warehouse and BI, offering readers a preliminary for moving forward in this book. It then proposes a cognition-driven decision process (CDDP) model which incorporates SA and experience (mental models) as its central components. The goal of the CDDP model is to facilitate cognitive decision support to managers on the basis of BI systems. It also presents relevant techniques developed to support the implementation of the CDDP model in a BI environment. Key issues addressed of a typical business decision cycle in the CDDP model include:

- natural language interface for a manager's SA input;
- extraction of SA semantics;
- construction of data warehouse queries based on the manager's SA and experience;
- situation information retrieval from data warehouse;
- how the manager perceives situation information and update SA;
- how the manager's SA leads to a final decision.

Finally, a cognition-driven DSS, FACETS, and two illustrative applications of this system are discussed.

Two important features of this book clearly distinguish itself from other books in similar areas:

(1) It is the first book to systematically discuss the theories, technologies and applications of cognitive decision support for BI.

(2) It reflects the latest academic research progress as well as the state-of-art BI technologies by combing contemporary cognitive psychology, DSS, BI, and data warehousing.

This book is mainly based on our past few years' research developments in this field. The technologies presented in this book is up-to-date throughout some results come from ours and other authors' recent publications.

The potential readers of this book are organizational managers and practicing professionals, who can use the provided methods and software to solve their real decision problems; researchers in the areas of decision making, DSS and BI; students at the advanced undergraduate or Master's level in management or business administration programs; and students at the advanced undergraduate or Master's level in information systems, information technology and computer science programs.

This book was organized into four major parts.

(1) Concept part (Chapters 1, 2, 3 & 4) covers concepts and frameworks of decision making and general decision-making techniques in DSS.

(2) Model part (Chapter 5) presents readers with the framework of cognitive decision support and the model of cognition-driven decision processes.

(3) Technique part (Chapters 6, 7 & 8) discusses the specific techniques (methods and algorithms) of cognitive decision support. Readers will learn how information technologies are combined with cognitive psychology models to solve business decision-making problems.

(4) System and Application part (Chapters 9, 10 & 11) introduces a cognition-driven DSS, FACETS. FACETS is a successful implementation of the cognition-driven decision process model, which was developed based on the models and techniques presented in this book. This part also demonstrates the evaluation results of FACETS and its two illustrative applications in business and public health respectively.

Readers can gain various advantages from this book:

As an academic, you will know the latest research progress of cognitive DSS in our research laboratory. This book provides a wide range of literature in many related areas, such as BI, data warehousing, cognitive psychology, naturalistic decision making, recognition-primed decision making, and natural language interface to databases. It also points out some potential topics for further research.

As an information technology practitioner, reading this book, you will stay abreast of BI, and knowing the new generation of BI systems. The models, techniques and algorithms presented in this book will help you understand how to better support business managers' work using the state-of-art BI technology.

As a business manager, you will be presented with a new methodology to interpret your business problems from a new perspective. The technologies included in this book will provide a new vision for you to understand and handle your business problems. After reading the book, you should be able to identify

decision-making problems from real practices, to build mental models, and then to use the cognition-driven DSS provided in the book to support your decision making.

As a tertiary student, you will have a chance to touch on a wide range of information technologies, which will be a starting point for your future study and career. You will also learn how to convert business problems into research projects.

We wish to thank the Australian Research Council (ARC) as the work presented in this book was partially supported under ARC Discovery Projects DP0559213 and DP0880739; the many researchers who have worked in DSS, BI and related areas over the past several decades, whose significant insights we have drawn on in the book and whose well-known publications are included in the bibliography; the researchers and students in the Decision Systems & e-Service Intelligence (DESI) research laboratory, and from the Faculty of Engineering and Information Technology at the University of Technology Sydney (UTS), who suffered through several versions of the DSS presented in this book and whose comments improved it substantially; and the editors and production staff at Springer, who helped us to ensure the book was as good as we were capable of making it.

Sydney
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