Preface

Imagine a scenario where millions of aspects of the physical world around us, including weather patterns, stock prices, social phenomena, traffic information, disease incidents, and so on, are accessible to anybody who so desires. Similarly, each individual has access to rich personal data about themselves ranging from their heart rates to movement patterns, to temperature, to gaze, to social interactions, and so on. Such a scenario is not merely science fiction, but rather increasingly becoming a reality for more people than ever before at a pace faster than ever seen before.

This marks a significant change in the human thinking about data. In the past, our scientific thinking has often been clouded by the *scarcity* of data; we collected data only when really needed and the potential insights to be drawn from it were defined even before the data was created. Increasingly we have an *abundance* of data, i.e., we have more data than what we have the tools and abilities to comprehend and convert into actionable insights. This means that the bottleneck for making significant progress in fields ranging from health to business analysis and to disaster response is no longer the existence of data but rather the tools and techniques to make sense of the data.

This book makes a contribution toward converting these multitudes of data streams into actionable insights. Specifically it computationally defines the notion of situations as an abstraction of millions of data points into actionable insights for individuals, describes a computational framework to model and evaluate such situations, and presents an *open-source* web-based system called EventShop that can be used by different users to create their own situation-aware applications.

We parse these goals into three different parts of the book. The first part focuses on *Understanding and Defining Situations*, the second one proposes a *Framework for Recognizing Situations*, and the third one describes an operationalization of this framework as *EventShop: An Open-Source Toolkit for Situation Recognition*. We conclude the book with a summary of the contributions made as well as the many remaining challenges and directions for future work.

Part I on Understanding and Defining Situations includes three chapters, which focus on painting a vision for the data-rich eco-system that we are stepping into and how situation recognition will play an important role in such a setting. The next

chapter reviews the interpretations of *situations* as used in different domains and synthesizes them into a computational definition for situations. The third chapter reviews related work which covers different aspects of this work including defining situations, building computational models for their recognition from heterogeneous data, and creating toolkits that allow users to experiment with and build their own situation recognition applications.

Part II describes a Framework for Recognizing Situations and includes three chapters. The first chapter discusses the overall framework including the process of situation modeling, situation recognition, and personalized alerts. The next chapter zooms into the process of creating S2S (situation-to-source) models, which are schematic blueprints for the conversion of the high level, and often vague, mental models of situation of interest (e.g., epidemic) into detailed list of data sources and operators needed to recognize them. The third chapter describes the computational framework needed to implement and test the S2S models. This includes the definition of appropriate data structures and an algebra of situation recognition operators, which can be combined together to define arbitrarily complex situation recognition modules.

Part III focuses on EventShop: An Open-Source Toolkit for Situation Recognition. It includes four chapters and starts with a description of the system architecture of EventShop. The next chapter focuses on the practical usage of EventShop and discusses how different users can configure and build their own situation recognition applications using EventShop. The third chapter highlights case studies on using EventShop for practical applications including wildfire recognition using satellite imagery and social data, flood evacuation in Thailand, and personalized asthma/allergy recommendation system. The last chapter provides a summary of the contributions of this book and discusses the many open challenges in this important research area.

We expect this book to serve two primary purposes. One, it acts as a primer for a data enthusiast or an information professional interested in harnessing the value of heterogeneous, "big", data for building diverse situation-based applications. Second, it could be used as a reference text by researchers working in the areas ranging from database design to multimodal concept recognition, to middle-ware and ubiquitous computing to design and develop frameworks that allow users to create their own situation recognition applications.

In fact, in keeping with these goals, we consider the last chapter on open-research questions a critical component of the book. Being ambitious in its goals, the book's contributions lie as much in defining the problem statements as they do in providing the solutions. Clearly, many of the solutions or approaches proposed are what should be termed as *early* efforts. There exist multiple opportunities to enhance and improve the proposed framework to tackle relevant challenges including scalability, user experience, and privacy. Based on early application experience, we are confident that a framework so developed would have the potential to transform multiple aspects of human life including traffic, health, business analysis, political campaign management, cyber security monitoring, disaster response, crisis mitigation, and homeland security.

It is with this hope of sharing our excitement, and urging you to join in this effort toward democratizing the process of generating actionable insights from all the world's data, that we present you, our dear readers, this book.

Yours sincerely,

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