Chapter 7
Harnessing Collective Intelligence Through Pattern Mining in Social Computational Systems

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ABSTRACT

Due to the digital nature of the web, the social web mimics the real-world social dynamics that manifest themselves as data and can be easily mined as patterns, making the web a fertile ground for business and research-oriented analytical applications. Collective intelligence (CI) is a multifaceted field with roots in sociology, biology, and many other disciplines. Various manifestations of CI support the successful existence of large-scale social systems. This chapter gives an overview of the principles of CI and the concept of "wisdom of crowds" and highlights how to maximize the potential of big data analytics for CI. Also, various techniques and approaches have been described that leverage these CI concepts across a diverse range of ever-evolving social systems for commercial business applications like influence mining, expertise discovery, etc.

INTRODUCTION

The aim of the research, experiments, and applications of the field of artificial intelligence (AI), since long, has been to develop systems that can closely emulate human intelligence, emoting, decision-making and problem-solving abilities (Tiwari V. and Thakur R.S., 2015). Over the past few years, especially with the emergence of Web-based social networks (SNs), a paradigm shift is being witnessed in AI towards social and collective intelligence (CI). CI is a shared intelligence that emerges from the collaboration of individuals. The focus of our chapter will be to explore how to harness the power of CI exhibited

on online SNs for a variety of business applications. This chapter provides a structured perspective on approaches to model and analyzes CI in social computational systems.

With the emergence of Web as an all-pervasive communication medium over the last few years, especially due to the advent and deep penetration of SNs into our lives, this concept and its applications have become an active field of research. Also, this deep penetration is marked by the fact that these social networks have established another parallel world which closely mirrors and models the real world characters, their relationships, and collaborations; and factors affecting those relationships like trust, reputation, and expertise.

It provides an unparalleled opportunity to meet the goals of AI, like never before:

- **WBSNs Acting as Enablers for CI to Emerge as a New "Form Of Life":** This concept and phenomenon called CI, like many other concepts is not new and has existed in fields like sociology, communication, and behavior. Families, companies, communities, ant colonies and the research on their "collective" behavior, the human brain and its intelligence as a result of the collective behavior of the neurons, and much more such communities – all embody this phenomenon to the core.

However, the presence of the digital/social networks as a communication medium has opened many avenues to solve many intractable real-world problems through collective human and machine intelligence (ML) by enabling subject matter experts and non-experts (which, by the way, are equally important sometimes, to bring in novelty and the self-organizing nature of collectively intelligent systems fits everything into the right "perspective") from across the globe to collaborate easily and effectively and then machine intelligence (ML) supplementing it, to together generate higher levels of learning and knowledge which no single individual (howsoever elite/intelligent) or a sub-group of individuals can exhibit independently.

Wikipedia is a living example of such an intelligent "life" form that lives and breathes; and consumes and disseminates (new information), and constantly evolves and adapts. Something that has never existed before! Similarly Google's search engine is a counterpart of a researcher doing a literature review - who does research on a topic, searches and reads multiple books, papers, articles, interviews experts, finds more references and reads further and so on; and then compiles them and rank orders them to provide as an output, the latest, most relevant and popular details about the subject. These are but just two examples. Many such intelligent beings (manifestations of CI) are living and thriving (as probably overlapping entities, in some cases) across the rich information bedrock of Web.

- **To Study the Phenomena of CI and Design Effective Applications:** These SNs and their analysis enable to understand and visualize the relationships and the factors that enhance or inhibit the collaboration and sharing of information and knowledge in a (formal or informal) organization of individuals. The benefit, in this case, is that the data related to these collaborations is abundant and available in a digital form already and hence, can be utilized to study the phenomena of CI.

Researchers talk about the paradigm shift in AI towards CI. Somehow, this paradigm takes AI closer to its goal. So far, many biological metaphors (Artificial Neural Networks, Genetic Algorithms, etc.) have been used to make artificially intelligent systems to solve real-world intractable problems. On a similar note, CI has given to the AI researchers a metaphor and a method to help machines solve "intractable

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