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Computational Social Science

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ABSTRACT : *Computational social science (CSS) is an academic discipline that combines the traditional social sciences with computer science. While social scientists provide research questions, data sources, and acquisition methods, computer scientists contribute mathematical models and computational tools. CSS uses computationally methods and statistical tools to analyze and model social phenomena, social structures, and human social behavior. The purpose of this paper is to provide a brief introduction to computational social science.*

Key Words: *computational social science, social-computational systems, social simulation models, agent-based models*

I. INTRODUCTION

The ongoing worldwide computerization has created new opportunities for researchers. The increasingly powerful instruments of computational have attracted considerable interests from researchers in relevant fields. Computing technologies such as data mining, machine learning, and statistics have been developed. The development of this field created new scientific disciplines like: computational biology, computational chemistry, computational economics, computational electrodynamics, computational electromagnetics, computational finance, computational economics, computational fluid dynamics, computational geophysics, computational mechanics, computational physics, computational science, computational mathematics, computational sociology, and computational statistics [1]. Computational social science (CSS) can span all the five traditional social science disciplines: psychology, anthropology, economics, political science, and sociology. It is to be the work of teams of computer scientists and social scientists. It is a multidisciplinary field that includes include computational economics, computational sociology, distributed algorithms, statistics, machine learning, data mining, and several substantive social science fields, including sociology, economics, psychology, political science, and marketing. Computational social scientists develop tools that enable studying how humans think, feel, or behave in social situations (psychology), relate to each other (sociology), govern themselves (political science), handle wealth (socioeconomics), and create culture (anthropology) [2].

II. APPLICATIONS

Computational social science is providing tools to process the vast amount of data emanating from social networking websites. It is taking place in places like Google, Yahoo, and the National Security Agency. Computational social science includes five core techniques: automated information extraction, geospatial analysis, complexity modeling, social simulation models, and social network analysis [3]. One reason human societies are complex is that there are several non-linear interactions between people. Society emerges from a constant, dynamic change. Agent-based simulations and models are developed by social scientist to explore social behavior and economic systems. The models are basically a form of mathematical model written in computer code. Early programming frameworks used languages such as FORTRAN, Basic, Pascal, and C. Recent efforts employ C++, Java, and Phyton [4]. Social scientists also use computing and informatics to explore social aspects of human-computer interaction. Anthropologists are using CSS methods to model social dynamics, test anthropological theory, and inform policy. Social networks are important in social sciences. The data in such networks can be massive and unstructured. It may require using big data architecture and the funneling method that handles the manageability of the data. Such data come in pictures, online purchases, mobile transactions, etc. The era of big data has made it possible for researchers to achieve transformations on how we study social phenomena [5,6].

III. ISSUES AND CHALLENGES

Although computational social science can be a great benefit, we must be aware of its challenges, risks, and potential for abuse by governments and private entities. Without resolving these ethical issues and obstacles that stand in the way of a computational social science, advancements in CSS may put the public at a risk. Understanding computational social science in both of its forms within the IC is an important and contemporary challenge. In social and economic interactions, there are possibilities for conflicts to arise. For example, there has been Internet presence of hate and extremist groups. CSS requires technical skills beyond the traditional confines of social science and may need collaboration with computer scientists. (For example, social scientists are trained to handle big data.) Such an interdisciplinary effort is often challenging due to different backgrounds of the researchers involved. CSS models are usually developed by highly specialized multidisciplinary team of experts and may take months. This

way of building models is slow and may not reflect the dynamicity of the social space. Crowd sourced modeling may be a solution to this problem [7].

The vast quantities of data used for computational social science analysis today are mainly being controlled by business and government. Computational social science may make surveillance, profiling of individuals, and targeting easily accessible. The potential damage from inappropriate disclosure of information is evident. As computational social science develops, issues concerning methodology and ethics should to be considered. Ethics deals with how information is accessed and how the information gained it is used. Guidelines and regulation must set the limits on the collection, retention, use, and disclosure of personal sensitive information [8]. Computational social science raises inescapable questions about the privacy and politics of data science research, particularly when it focuses on applications in government and the private sector. The privacy issue must be resolved by developing technologies that protect privacy while preserving data essential for research.

IV. CONCLUSION

Computational social science is practice-oriented discipline, where theoretical concerns have been pushed to the background. The emergence of the data-driven computational social science has been slow, mainly spearheaded by computer scientists and social scientists. Powerful computer simulations have been a particular boon to the young field. Computational social science, with its focus on large-scale data and social media data, offers great opportunities with serious research challenges. The potential value of CSS is gaining attention in several disciplines. To meet the need for computational social scientists, courses and degrees are being offered on CSS at various universities. Graduate students are required to have as background a bachelor's degree in social sciences, computer science, engineering, or a relevant discipline. Additional information on CSS is available in several books in Amazon.com.

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