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EDITORIAL

Business Analytics and Data Science: Once Again?

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1 Introduction

"Everything has already been said, but not yet by everyone". We wouldn't be surprised if the title of this editorial reminds you of this famous quote attributed to Karl Valentin. Business Analytics is a relatively new term and there does not seem to be an established academic definition. Holsapple et al. (2014) write, "a crucial observation, on which the paper is based, is that 'the definition' of analytics does not exist". They describe Business Analytics as "evidence-based problem recognition and solving that happen within the context of business situations", and also highlight that mathematical and statistical techniques have long been studied in business schools under such titles as Operations Research and Management Science, Simulation Analysis, Econometrics, and Financial Analysis. However, their article shows that the availability of large data sets in business has made these techniques much more important in all fields of management.

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At the same time, Data Science has become a very popular term describing an interdisciplinary field about processes and systems to extract knowledge or insights from data. Data Science is a broader term, but also closely related to Business Analytics. In a recent book by one of the authors, Data Science is defined as follows: "Data science is an interdisciplinary field aiming to turn data into real value. Data may be structured or unstructured, big or small, static or streaming. Value may be provided in the form of predictions, automated decisions, models learned from data, or any type of data visualization delivering insights. Data science includes data extraction, data preparation, data exploration, data transformation, storage and retrieval, computing infrastructures, various types of mining and learning, presentation of explanations and predictions, and the exploitation of results taking into account ethical, social, legal, and business aspects" (Van der Aalst 2016).

Dhar (2013) starts his article asking why we need a new term and whether Data Science is different from statistics and gives an affirmative answer. He mentions new types of data being analyzed, new methods, and new questions being asked. Clearly, both definitions are overlapping. Both Business Analytics and Data Science want to "turn data into value".

It is not surprising, that these terms have been adopted quickly by those in our community who are close to Operations Research and the Management Sciences (OR/MS). Data analysis and optimization have always been at the core of the INFORMS, and the INFORMS Information Systems Society (ISS) is one of the large INFORMS sub-communities. Many sessions at the INFORMS Annual Meeting or the Conference on Information Systems and Technology (CIST), which is organized by the INFORMS ISS just before the Annual Meeting every year, devoted to

predictive or prescriptive analytics. But the range topics is much wider than that.

Process mining has become an important direction in Business Process Management (BPM). About half of the papers presented at the International Conference on Business Process Management are about data-driven process management. A successful track on Data Science and Business Analytics has been established at ICIS in the recent years, and many papers combining data analysis, information technology, and optimization are submitted to our BISE department "Computational Methods and Decision Support Systems" and the department "IS Engineering and Technology". For the remainder of this editorial we will only talk about Analytics for brevity, and leave the question open which term may be adopted in which community in the in the future.

As many recent topics in Information Systems, Analytics is multi-disciplinary. There are colleagues in Econometrics, in Machine Learning, and Operations Research who contribute significantly. In this brief editorial, we want to discuss how Analytics contributes to our field, and how our profession can contribute to developments in Analytics. Given the vast amounts of data that we are collecting, this topic will most likely stay with us for a long time and eventually have a significant impact on both our research and teaching.

2 Research

Internet-based systems generate huge amounts of data, which allow us to better understand how people interact on markets or in social media. Many new types of information systems draw on the availability of data about user behavior or sensor data about the environment. Such information systems adapt to the users and provide better ways to coordinate. Let's pick a few examples to make the point.

Recommender systems are probably among the most well-known types of analytics-based information systems. They collect data about user preferences to then provide tailor-made recommendations for books, movies, or other products. By now, there is a large body of literature about mathematical methods such as matrix factorization or collaborative filtering, which allow for effective recommendations. At the same time, there is a growing behavioral literature analyzing the impact of these systems on human decision making. Thus, the topic addresses both, design and user behavior, a combination that was always at the core of information systems research.

Interactive marketing is another field which heavily draws on analytics. Real-time bidding (RTB) is a means by which display advertising is bought and sold on a per-impression basis via auction. With real-time bidding, advertising buyers bid on an impression and, if the bid is won, the buyer's ad is instantly displayed on the publisher's site. This is the fastest growing segment in the digital advertising market and it combines predictive models to better estimate the preferences and tastes of users and the bidding in a highly automated fashion. The topic addresses a wealth of problems ranging from distributed systems to auction theory, machine learning, and, last but not least, data privacy!

Also, the Internet-of-Things has led to many new applications which require data analysis, distributed systems, and optimization to go hand in hand in ever growing applications. We have all seen case studies on smart mobility solutions, intelligent ports and transportation systems, or smart home solutions where sensors communicate and coordinate with humans in real-time, often with a substantial increase in economic efficiency. Consider for example condition-based maintenance making use of the analysis of sensors data: maintenance is performed when analytical techniques suggest that the system is going to fail or that performance is deteriorating.

These are just a few examples. Analytics are used in many other domains ranging from customer journeys, call-centers, and credit rating to staffing, e-government, and delivery services. Moreover, there is no reason to assume that the trend towards more data and evidence-based management and analytics-based information systems will end.

In the BISE editorial statement "information systems are understood as socio-technical systems comprising people, tasks, and information technology". The above examples suggest that Analytics opens up many new and exciting research questions for our community, eventually leading to a new class of *analytics-based information systems*, which sense their environment and respond to the users that they ultimately serve. This requires an integrated view addressing privacy concerns, engineering challenges, and a thorough "social science" analysis of the impact of new systems. In summary, Analytics provides many new opportunities for our field and describes an almost natural progression of many lines of information systems research.

3 Teaching

Information Systems, as it is taught at most universities, is already well-prepared for the design and analysis of this new breed of analytics-based information systems. On the one hand, Information Systems programs typically include topics such as data engineering, data mining, software engineering, distributed systems, and operations research, which are essential for their design.

On the other hand, our field is also a social science and as such most curricula have courses on Econometrics and empirical methods. Techniques for causal inference and discrete choice models have always been important ingredients of a social scientist's education, and they prove to be incredibly valuable for business analysts. Econometrics and Machine Learning will be essential elements of new curricula in most schools in the future, if this is not already the case. Overall, the fact that we address "design and behavior" in our education can be a significant advantage for our students in the job market and in research.

While our Bachelor and Master programs are well positioned, there are many new developments in education in Analytics. There are so many new Bachelor and Master programs in either Business Analytics or Data Science at various universities that we do not even start to list specific programs. The European Data Science Academy (http://edsa-project.eu/) is an EU Horizon 2020 funded program providing useful information. For our field, it is important to stay abreast of these new developments.

4 Conclusion

Analytics is not just a short-term trend. The availability of more and more data from sensor networks or human–computer interaction leads to new types of information systems in which data analysis plays an important role. Analytics will help us to better understand the environment and to adapt to the needs of users and organizations, when we design new systems. It is important to reflect this development also in our curricula. Analytics is inherently linked with our field, and we are looking forward to a growing number of submissions in this area.

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