

Chapter 18

Applications of Artificial Intelligence in the Realm of Business Intelligence

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ABSTRACT

The objective of this chapter is to discuss the integration of advancements made in the field of artificial intelligence into the existing business intelligence tools. Specifically, it discusses how the business intelligence tool can integrate time series analysis, supervised and unsupervised machine learning techniques and natural language processing in it and unlock deeper insights, make predictions, and execute strategic business action from within the tool itself. This chapter also provides a high-level overview of current state of the art AI techniques and provides examples in the realm of business intelligence. The eventual goal of this chapter is to leave readers thinking about what the future of business intelligence would look like and how enterprise can benefit by integrating AI in it.

0. INTRODUCTION

The purpose of this chapter is to provide an overview into how recent advances in Artificial Intelligence (AI) can be applied to Business Intelligence (BI) systems thereby making the latter truly intelligent. This chapter is divided into five main sections: (1) the first section defines BI and AI, discusses their pros & cons, and how they are used in industry today, (2) the second section provides a high-level introduction of the fundamental concepts in AI. Readers who are well versed with the basics of AI can skip this section. (3) the third section discuss the technical considerations of integrating AI systems into existing BI systems, (4) next section discusses open issues and challenges related to learning, storage, processing and organizational structure of big data, and (5) the last section discusses the applications of AI combined with BI, some current examples from industry and direction of future research.

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1. DEFINING BUSINESS AND ARTIFICIAL INTELLIGENCE

1.1 Business Intelligence

The term “Business Intelligence” first appeared in the year 1865 in the context of gathering data (Devens, 1865). However, it was not until the technological advancements in 20th century that the BI gained traction. In fact, it was a seminal paper by IBM that described BI as an “automatic system” designed to share information to various parts of an organization (Luhn, 1958). Since then the term BI has been defined as an engineering product with a set of software applications that aim to organize the raw data into meaningful information to be used in decision making (Sabherwal, 2007). It has also been defined as a set of processes, methodologies and technologies that leverages information to aid in analysis and decision making (Evelson & Norman, 2008). Thus, the main objective of a BI system is to aggregate the vast amount of structured and unstructured data in an automated fashion so as to provide the following:

- Continuous reporting of the metrics that define the health of a company,
- Aid in both tactical and strategic decision making by surfacing descriptive statistics from the data,
- Report on observed anomalies in the data, and
- Provide Online Analytical Processing (OLAP) support to enable quick and customized insights from the aggregated data

The ever-increasing quantity, multitude of sources, and access to cheaper technologies to log raw data implies that BI systems need to continuously evolve to distill any meaningful actionable information from big data. In order to describe the so called “Big Data”, Gartner defined 3 essential aspects of the data using 3 V’s namely: Volume, Velocity and Variety. The fourth dimension (Veracity) was added later on to denote uncertainty in the data.

- **Volume:** Refers to the amount of data. We are living in a world of ever increasing data sets
- **Velocity:** Refers to the speed/frequency at which data comes in.
- **Variety:** Refers to the sources and types of data. Is there one source or multiple sources? Today, in a complex competitive environment, decision makers often look at multiple sources and types of aggregated data to reach a decision.
- **Veracity:** Refers to uncertainty in the data. Uncertainty here implies uncertainty about the quality of the data. In other words, whether the data that is collected is accurate or not?

The BI system needs to take into account the above four dimensions of the data to deliver a product. It needs to be flexible enough to accommodate increasing Volume, changing Variety, different Velocities and while taking into account the data’s Veracity. To do so, most of the BI tools focus on Extract, Transform and Load (ETL) processes and converting the raw data into some form of visualization (Chen et al., 2012; Watson & Wixom, 2007; Turban et al., 2008). BI system is all about aggregating raw data from a variety of sources into concise actionable information. Business needs to pre-define the aggregation logic and desired output metrics (also called Key Performance Indicators or KPIs). By robustly and reliably presenting the KPIs, the BI tools help in providing uniform access across the organization to any information and reduce subjectivity in decision making. Thus, BI does an excellent job to provide

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