Chapter 2
An Enterprise Integration Method for Machine Learning-Driven Business Systems

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ABSTRACT

There is an overestimation of the benefits that may be provided by machine learning (ML) applications. Recent studies report the failures of ML projects, inadequate return on investment, or unsatisfactory project outcomes. Software engineering challenges, business and IT alignment, holistic management of business processes, data, applications, and infrastructure may be some causes. However, the author believe that the integration of ML applications with enterprise components is a serious issue that is often neglected. Therefore, the main argument of this study is that the enterprise integration models are critical for the long-term benefits and sustainability of ML-driven systems. In this study, the author developed an enterprise integration method for ML-driven business systems by using enterprise architecture methods and tools. Finally, this method is applied to an online shopping system in a business case study and presented important findings and insights.

INTRODUCTION

The proliferation of Artificial Intelligence (AI) has enabled new business models and provided innovative solutions for enterprises. As a subfield of AI, Machine Learning (ML) and its successful implementations, may have a great impact on the

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competitiveness of enterprises. It is possible to see various examples of complex ML-driven business systems in the domains, such as industry, finance, defense, healthcare (Nalchigar et al.,2021). However, recent studies also report the failures of ML projects, their inadequate return on investment, or unsatisfactory project outcomes. There is an overestimation of the solutions and benefits that may be provided by ML applications. Therefore, business systems employing ML solutions can be at a high risk of failure or they can easily fall short of their business objectives (Kelly and Kaskade, 2013).

There may be various causes for the failures of ML applications when they are viewed from the perspectives of different disciplines, such as System Engineering (SyE), Computer Science (CS), Data Science (DS), and Software Engineering (SE) (Ishikawa and Yoshioka, 2019). For example, Ponsard et al. (2017) and Saltz et al. (2017) indicate that the majority of ML studies focus on technical aspects. Bughin et al. (2017) present the factors for transforming an organization towards AI. Ransbotham et al. (2017) report the challenges in the adoption of AI systems as AI-related skills and knowledge, cultural and organizational barriers, limited technological capabilities, lack of management support, and unclear business cases. Some research studies explore ML and DS project management methods from project management perspectives and report their efficiency and implementation challenges (Saltz et al. 2019, Uysal 2021a).

From a historical perspective, ML may be thought of as it is in the early days of SE. Therefore, analyzing and specifying requirements, managing stakeholders' expectations, correct estimations, design of effective test cases, and configuration management can be the major SE challenges when engineering ML-driven business systems (Giray, 2021). Moreover, SE and ML modules can be entangled in various ways, and thus, the development of the ML-integrated modules is usually more difficult than traditional SE modules (Amershi et al., 2019) Therefore, there is a clear need for the integration of ML workflow management into SE practices (Lwakatare et al., 2020). The integration of SE infrastructure with ML processes also speeds up the ML experimentations.

In terms of business and IT alignment, one important challenge is the holistic and integrated management of business processes, data, enterprise applications, and infrastructure. However, regarding the strategies needed for the integration of ML applications with enterprise components is often neglected when developing or maintaining ML-driven business systems (Uysal and Mergen, 2021b). Advances in hardware, software, communication, software applications, and data processing technologies have also paved the way for integrating cutting-edge solutions into business systems, such as Internet of Things (IoT) (Xu, 2011). However, these developments have even worsened the management and integration issues. The majority of the research studies and industrial applications explore ML in specific