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IRTG 1792 Discussion Paper 2020-002



# Service Data Analytics and Business Intelligence

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# Service Data Analytics and Business Intelligence

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## 1. INTRODUCTION

With growing economic globalization, the modern service sector is in great need of business intelligence for data analytics and computational statistics. The joint application of big data analytics, computational statistics and business intelligence has great potential to make the engineering of advanced service systems more efficient. The purpose of this COST issue is to publish high-quality research papers (including reviews) that address the challenges of service data analytics with business intelligence in the face of uncertainty and risk. High quality contributions that are not yet published or that are not under review by other journals or peer-reviewed conferences have been collected. The resulting topic oriented special issue includes research on business intelligence and computational statistics, data-driven financial engineering, service data analytics and algorithms for optimizing the business engineering. It also covers implementation issues of managing the service process, computational statistics for risk analysis and novel theoretical and computational models, data mining algorithms for risk management related business applications.

Service data analytics and business intelligence have become an important topic in today's complex, interrelated global environment, replete with threats from larger amounts of aspects, such as natural (Kiremidjian et al., 2007), political (Akhtaruzzaman et al., 2017; Busse and Hefeker, 2007), economic (Corbett and de Groot, 2000; Jin et al., 2014; Wu et al., 2019; Yu et al., 2008), energy (Wen et al., 2019; Xiao et al., 2018), and technical sources (He et al., 2016; Pan et al., 2019). Data analytics about business intelligence can provide various reality-based examples or projects to examine the economical evaluation and risk assessment, which not only expands literature of service data analytics but also facilitates industry-academy combination. There are still many challenges in service data analytics and business intelligence fields. We therefore also solicited a dozen of submissions from the 2017 conferences on October 17-18, 2017 held in Hainan ([http://www.hainu.edu.cn/lvyou/2017zt/index\\_eng.html](http://www.hainu.edu.cn/lvyou/2017zt/index_eng.html)) and on July 7-9 held in Beijing (<http://artc2017.csp.escience.cn>).

## **2. THIS ISSUE**

This special issue contains five accepted research papers. These papers focus on recent advances topics of service data analytics and business intelligence including the risk analytics in shadow banking system, queuing problem in the hospital, the distressed companies' prediction, real data analytics in manufacturer industry, and the dynamic behavior of short-term interest rates analytics.

The work by Wang et al. analyze the development of shadow banking system in China catalyzes the expansion of banks' off-balance-sheet activities. The paper incorporates banks' overall risk, endogenously into bank's production process as undesirable by-product for the estimation of banks' total factor efficiency (TFE) as well as TFE of each production factor. The results show that, compared with a model incorporated with banks' overall risk, a model considering on-balance-sheet lending activities only may over-estimate the overall average TFE and under-estimate TFE volatility as a whole. Higher overall risk taking of banks tends to decrease bank TFE through 'diverting effect'. However, significant heterogeneities of bank integrated TFE (TFIE) and TFE of each production factor exist among banks of different types or located in different regions, as a result of still prominent unbalanced development

of Chinese commercial banks today. Based on newly estimated TFIE, the paper also investigates the determinants of bank efficiency, and finds that a model with risk-weighted assets as undesirable outputs can better capture the impact of shadow banking involvement.

The work by Tang et al. attempts to compare the performance between a single-stage appointment scheduling system and two-stage appointment scheduling system. A queuing model is firstly formulated with the objective of maximizing the weighted hospitals benefit minus the cost of patient waiting and doctor overtime, for a two-stage appointment scheduling system considering no-shows in this paper. The performances of two-stage appointment scheduling systems varying with no-show probabilities and probabilities that patients have a second-stage diagnosis are presented. Experimental results indicate that the optimal number of patients needs to be more than the capacity of doctors in the first few slots, and less than those in the last few slots. The results show that Under a higher no-show probability, arranging more patients than the workload reduces the waste of doctors capacity; and on the contrary, under a higher probability of doing examinations, arranging fewer patients than the workload can reduce system congestion.

The work by Zheng et al. predicts the distressed companies by a factorial discriminant model based on interval data. Interval data makes both average and volatility information comprehensively included in the proposed prediction model, which is expected to improve prediction performance on the distressed companies. A comparison based on a real data case from China's stock market is conducted. The results show that *i*-score model is more accurate and more reliable in identification of companies in high risk of financial distress in advance of 2 years.

The work by Qiao et al. addresses the production optimization and/or management problem in the manufacturing industry with real data analytics. The main motivation of this paper is to explore methods for analyzing and evaluating big data with domain knowledge. For this purpose, real production data from a semiconductor manufacturing workshop are adopted as the data object. Besides, this paper proposes quantitative calculation methods of data value density to determine the extent to which data quality can be improved by the proposed data processing techniques. The

work in this paper has the potential to be further extended and applied to other big data applications beyond the manufacturing industry.

The work by Yan et al. proposes a semiparametric time-dependent jump diffusion model in an effort to capture the dynamic behavior of short-term interest rates. The newly proposed model includes a wide variety of well-known interest rate models, incorporating the time-varying instantaneous return, volatility as well as jump component. The local likelihood density estimation technique together with pseudo likelihood estimation method is employed to estimate the parameters of the model. Some simulations are conducted to examine the statistical performance in the paper. The proposed procedure is then applied to analyze daily federal funds rate.

We would like to extend our appreciation to all the authors who have submitted their impressive works for this special issue. We also thanks to all the reviewers for their service and commitment to this journal. It is crucial to analyze the application of engineering risk with the fast development of various engineering projects. This special issue involves various risk analytics models as well as applications, which could provide advanced perspective to existing literature.

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- 002 "Service Data Analytics and Business Intelligence" by Desheng Dang Wu, Wolfgang Karl Härdle, January 2020.

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