

# Special Issue on AI and FinTech: The Challenge Ahead

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■ **It is our** pleasure to share with you this special issue on AI and Fintech, which includes 17 articles published in the March/April (8 articles) and May/June (9 articles) issues of *IEEE Intelligent Systems (IS)*.

After our announcement in early September 2019 for this special issue on AI and Fintech for *IS*, we received a larger volume of manuscripts than anticipated by the January 2020 deadline. These worldwide submissions included both academic researchers and practitioners in IT and financial industries. After a long round of revisions from independent, anonymous referees that ultimately led to the current, official versions of the articles published in both issues, we would like to first and foremost thank all the contributors and the anonymous referees for their hard work on this project. Second, we give our sincere gratitude to the supportive effort of the *IS* team led

by Professor Venkatramanan Subrahmanian to ensure the timely publication of both issues.

We know that *Finance* has been one of the most active domains with increasingly bigger data, faster innovations, and more prosperous applications of artificial intelligence (AI) and data science, including algorithmic trading, cryptocurrency, blockchains, peer-to-peer (P2P) lending, digital and mobile payments, digital assets, crowdfunding, roboadvising, regtech transformation, etc. AI and data science are driving new-generation financial technology (FinTech), which profoundly disrupts existing theories of money, investment, credit, market, and regulation, and furthermore empowers new-generation financial innovations, products, services, operations, processes, and ecosystems. We hope that this special issue on AI and FinTech will collect the latest advancements in FinTech driven by advanced AI and data science that model complex interactions, relations, and their dynamics; their impact on big financial

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data analytics and complex financial behaviors across financial markets, products, systems, and networks; and their driving force behind smart financial innovations, services, markets, operations, processes, products, regulation, and risk management.

While most new concepts and related technology with applications for AI and Fintech are still in their infancy or integration stage, in the past few months, several specialized AI or Fintech topic issues have seen publication (e.g., see<sup>1</sup> and<sup>2</sup>). In dialogue with these articles, we hope that our journal brings something new and different to readers by featuring articles that discuss and address at least one true (or simulated) problem from the practice of Fintech with applications.

We have eight articles that focus on AI for the March/April Issue, and nine papers that concentrate on Fintech for the May/June issue. In the following, we give a brief introduction to each of the May/June articles that focus on Fintech.

For the first article entitled “Cooperative Mechanism of SME Growth in the Mesoscopic Structure With Strategic and Nonstrategic Partners” by Gao *et al.*,<sup>3</sup> by the fact that how to conduct the credit risk for small and micro enterprises (SMEs) is an open question worldwide, and by considering that bigdata techniques in Fintech could be used to find a possible solution for risk assessment of SMEs in the practice, the authors propose a coupled system subjected to the ratchet utility potential to model the cooperative growth mechanism of SMEs with strategic and nonstrategic partners under the “Tech-Economic Paradigm.” By decoupling the system, the paper first approximately obtains the average probability current to measure the mesoscopic performance in terms of growth ability and cooperation efficiency; then, the authors systematically study the performance dependence on system parameters and discuss the sensitivity to parameter changes. The results provide the latent support for regulating the growth behaviors and should be useful for people in the financial industry to create useful risk assessment decision rules in SME for the management in the practices.

The second article with the title “Formal Analysis of Smart Contract Based on Colored Petri Nets” by Wang *et al.*<sup>4</sup> proposes a multi-level smart contract modeling solution to analyze the security of contract. They then improve the program logic rules for bytecode and apply the Hoare condition to create a Colored Petri Net (CPN) model. The model detection method provided by the CPN tools can show the full state space and the wrong execution path, which helps us analyze the security of the contract from several perspectives. The example shows that the counterexample path given by the contract model is accord with our expected results based on code analysis, proving the correctness of the solution. In addition, the paper designs a highly automated modeling method, introducing custom call libraries and a path derivation algorithm based on backtracking, which improves the efficiency and pertinence of dynamic simulation of CPN models.

The third articles entitled “Blockchain-Based Fair and Secure Electronic Double Auction Protocol” by Liu *et al.*<sup>5</sup> proposes a blockchain-based fair and secure electronic double auction protocol (BFSDA). BFSDA modifies the data input and distribution mechanism of participants in DABSMPC, which improves the security of the protocol. Then, the BFSDA introduces and improves the blockchain-based fair and secure multiparty computation protocol to ensure fairness while increasing the success rate of secret recovery. In addition, BFSDA uses a fairer and more efficient protocol for secure two-party comparing to obtain the final marketing clearing price. The schema analysis result of BFSDA shows that the following.

- 1) The real total demand and total supply data will not be revealed as long as one participating node is not compromised.
- 2) Honest participants can get the result or economic compensation.
- 3) Participants only need to pay the deposit once and a large amount of complicated verification operations are carried out off the chain, which ensures the efficiency of the protocol.

The fourth article entitled “Domain Adaptation Learning based on Structural Similarity Weighted Mean Discrepancy for Credit Risk Classification” by Chen *et al.*<sup>6</sup> proposes an improved algorithm based on mean discrepancy embedding with structural similarity, which aiming at the contribution of each sample to the integral measure on the performance of target domain model by using labeled source samples and unlabeled target samples. The discrepancy between both marginal and conditional distribution are minimized with dimensionality reduction procedure to feature extraction with structural similarity weights for all samples from the source and target domains. The results of empirical analysis demonstrate that the proposed method has higher performance over several state-of-the-art methods in the credit risk classification.

For the fifth article entitled “XGBoost Model and Its Application to Personal Credit Evaluation” by Li *et al.*,<sup>7</sup> they investigate the application of eXtreme Gradient Boosting (XGB) method to the credit evaluation problem based on big data. In particular, they first study the theoretical modeling of the credit classification problem using XGB algorithm, then apply the XGB model to the personal loan scenario based on the open dataset from Lending Club Platform in the USA. The empirical study shows that XGB model has obvious advantages in both feature selection and classification performance compared to the logistic regression and other three tree-based models.

The sixth article entitled “An AI Model for Oil Volatility Forecasting” by Wang *et al.*<sup>8</sup> first proposes a genetic algorithm learning with a classifier system, and then constructs an AI model for oil volatility forecasting on the basis of internal information and external information. The model provides decision support for mark-to-market portfolio and risk management by forecasting whether 1-day-ahead volatility is above a given threshold. Moreover, authors explore the dynamic influencing mechanism of different types of information through information usage frequency in the learning process. In particular, they find that the jump component of oil realized volatility is efficient only in bull market, and currency information contributes most rather than

oil information in bear market. Therefore, this study provides an AI method to forecast oil volatility as well as to improve the information structure of forecasting models.

For the seventh article “Three Algorithms for Solving High-Dimensional Fully-Coupled FBSDEs Through Deep Learning” by Ji *et al.*,<sup>9</sup> the goal is to solve fully coupled FBSDEs through deep learning and provide three algorithms and the numerical results show remarkable performance especially for high-dimensional cases.

For the eighth article entitled “A Data-Analytics Approach for Risk Evaluation in Peer-to-Peer Lending Platforms” by He *et al.*,<sup>10</sup> the goal is to study the roles of individual behavior characteristics and Internet finance industry risk in the light of bank run theory for P2P. By the fact that the risk evaluation is clearly important for P2P lending platforms in China, as during the last two years, the industry has experienced thousands of platform crashes. Traditional approaches to evaluating enterprise risk are increasingly ineffective in this industry, due to the difficulty of assessing the real information. In addition, the Internet business model makes it possible to record new kinds of information. By applying a data-driven analytics method, authors build an intelligent risk evaluation model for P2P platforms that have comparable targeting platforms. The case study shows that our risk evaluation method can generate early warning signals regarding platform or industry risk, which is able to provide effective supporting for P2P business in practice.

For the ninth article entitled “Multi-Angle P2P Borrower Characterization Analytics by Attributes Partition Considering Business Process” by Liu and Wu,<sup>11</sup> they propose a multiangle data mining method for lending data by attributes partition considering the business process and then characterizes the P2P borrowers from multiple perspectives, which provides a new idea for the study of high-dimensional lending data. This study collects true loan order data of a typical online lending platform and tests the proposed method. The experimental results show it is reasonable and meaningful to partition the attributes considering business process. It depicts the important characteristics of borrowers that affect the results of approval and

the amount of loan obtained from multiple perspectives and makes the research on the characteristics of P2P borrowers more comprehensive and specific.

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