Nonfungible Tokens: Constructing Value Systems in Parallel Societies

WELCOME to the fifth issue of IEEE TRANSACTIONS ON COMPUTATIONAL SOCIAL SYSTEMS (TCSS) of 2021. As usual, we would like to share some great news first. Since April 2021, IEEE TCSS has been added to the Science Citation Index Expanded (SCIE) database in Clarivate Web of Science. We are excited to report that all TCSS articles published since 2018 have been backtracked and indexed by SCIE.

According to the latest update of CiteScoreTracker from Elsevier Scopus, the *Citescore* of TCSS has reached 7.1 by August 4, 2021, which suggests that the citation impact of TCSS is continuously rising. Furthermore, it indicates that the community well recognizes our journal as the premier journal in social computing and computational social system research. Great thanks to all of you for your efforts and supports.

In this issue, we publish nine regular manuscripts and a Special Issue titled "Advanced Machine Learning on Cognitive Computing for Human Behavior Analysis," which includes nine articles. Moreover, we will give a brief introduction of nonfungible tokens (NFT), which takes an important role in constructing the value systems in parallel societies.

Scanning the Issue

1. "On Followers Search" by *Li Ni, Wenjian Luo, Tao Zhu, and Peilan Xu*

This article studies the followers search problem and aims to find the followers of a given object. Based on the intuition that leaders are superior to followers and followers are close to leaders, superiority and closeness are used to capture followers. An algorithm to find followers for a given object is presented. Furthermore, the idea of followers to the market basket and recommender system datasets is applied. The experimental results demonstrate that the discovered followers on the market basket datasets are reasonable and the recommender system algorithm with followership is superior to the original recommender system algorithm.

2. "Deployment of Information Diffusion for Community Detection in Online Social Networks: A Comprehensive Review" by *Soumita Das and Anupam Biswas*

This article reviews the emergence of deploying information diffusion for community detection in online social networks. The study is mainly focused on how information flow affects various network properties and social facets and explored the possibility of deployment for community detection. Various information diffusion models and community detection algorithms are discussed in the context of network properties and social facets. Current challenges, future directions, and modalities for the deployment of information diffusion in community detection are also discussed. In addition, various widely used datasets, evaluation metrics as well as evaluation methods for evaluating community detection algorithms are given in detail.

3. "An Efficient Signature Scheme Based on Mobile Edge Computing in the NDN-IoT Environment" by *Haiping Huang, Yuhan Wu, Fu Xiao, and Reza Malekian*

This article proposes a certificateless signature scheme based on mobile edge computing (MEC). The data package authentication scheme in the package-level security mechanism is studied. Based on MEC, an efficient certificateless group signature scheme featured with anonymity, unforgeability, traceability, and key escrow resilience is proposed. The regional and edge architecture is utilized to solve the device management problem of the Internet of Things (IoT), reducing the risks of content pollution attacks from the data source. By offloading signature pressure to MEC servers, the contradiction between heavy overhead and shortage of end device resources can be avoided.

4. "Effect of Homegrown Mobile Applications on Africa's Development: Comparative Analysis" by *Chinedu Wilfred Okonkwo, Magda Huisman, and Estelle Taylor*

This article aims to define areas where the use of homegrown mobile applications (Apps) has a significant effect on Africa's growth and to compare the effect on the five selected countries from the five geographical regions of Africa. A survey is conducted, and quantitative data are obtained from different regions of Africa. The results reveal six areas where mobile apps services are influencing Africa's development and the comparative analysis shows the scale of the effect on each of the selected countries.

5. "Prediction of Land Suitability for Crop Cultivation Based on Soil and Environmental Characteristics Using Modified Recursive Feature Elimination Technique With Various Classifiers" by *G. Mariammal, A. Suruliandi, S. P. Raja, and E. Poongothai*

This article proposes a novel feature selection approach called modified recursive feature elimination (MRFE) to select appropriate features from a dataset for crop prediction. The proposed MRFE technique selects and ranks salient features using a ranking method. The experimental results show that the MRFE method selects the most accurate features, while the bagging technique helps accurately predict a suitable crop. The performance of the proposed MRFE technique is evaluated by various metrics such as accuracy,

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precision, recall, specificity, F1 score, area under the curve, mean absolute error, and log loss. From the performance analysis, it is justified that the MRFE technique performs well with 95% accuracy than other feature selection methods.

6. "Phase Transition in Group Emotion" by *Xuelong Yu, Fuzhong Nian, Yabing Yao, and Li Luo*

This article explores the formation and change of group emotion. The phase transition of group emotion is studied from the following two aspects: the group with and without network structure. For the group without network structure, the threshold of group emotional phase transition is obtained, and the phenomenon of group emotional polarization is verified. The new network evolution model based on node attractiveness is constructed, and the degree distribution of the network is analyzed. The results show that there are three phases of group emotion: disorder phase, neutral phase, and extreme phase.

7. "A Hybrid Approach of Bayesian Structural Time Series With LSTM to Identify the Influence of News Sentimenton Short-Term Forecasting of Stock Price" by *Paramita Ray, Bhaswati Ganguli, and Amlan Chakrabarti*

This study offers an application of the Bayesian structural time (BST) series model that is more transparent and facilitates better handling of uncertainty than the autoregressive integrated moving average (ARIMA) model and the vector autoregression (VAR) method. A hybrid model is proposed, which combines the long short-term memory (LSTM) model with the BST model along with the regression component. The proposed model detects unusual behavior or anomalous pattern of the stock price movement, which makes our model superior compared to the traditional methods. Our new hybrid model accumulates error with lower rates and shows a remarkable performance over some of the other existing hybrid models.

8. "Influence Maximization Problem With Echo Chamber Effect in Social Network" by *Jianming Zhu, Peikun Ni, Guangmo Tong, Guoqing Wang, and Jun Huang*

This article detects and models the echo chamber effect for the first time. The influence maximization with echo chamber (IMEC) problem aims to select k users to propagate information such that the expected number of activated users is maximized. They formulate this problem using a graph model and analyze the NP-hardness, and the objective of IMEC as a set function is proven to be neither submodular nor supermodular. An improved greedy algorithm is proposed, which is combined with metaheuristic strategies. Experimental results show that the proposed algorithm is effective in detecting the echo chamber effect and efficiency in selecting seed nodes.

9. "Green Computing and Carbon Footprint Management in the IT Sectors" by *S. P. Raja*

This article discusses the functioning of green information technology (IT) businesses that are environmentally friendly and cut carbon emissions and transportation costs. Green computing aims to reduce the adverse effects of computers on the environment by reducing air, water, and soil pollution. Green IT is not merely restricted to environmental strategies but is concerned with the overall development of people and society as a whole. In this regard, collaboration is to be explored to optimize business. They also present the carbon footprint analysis of an individual and in a computing center.

I. Nonfungible Tokens: Constructing Value Systems in Parallel Societies

A. NFT: Ownership of Digital Asset on Blockchain

With the rise and rapid development of blockchain technology [1]–[3], digital assets recorded on blockchains have attracted extensive attention from researchers in academia and industry. Originally, the value transfer mode on blockchains is mainly based on fungible tokens (FT), such as Bitcoin and Ethereum. These tokens follow the same homogenization protocol that can be replaceable, exchangeable, and divisible. However, due to their homogeneity, there is no difference between these tokens, which makes it impossible to distinguish them. Thus, it is difficult to track and trace their transaction and circulation processes.

In the real world, most assets are different. For example, for tangible assets such as houses and cars, there are neither two identical cars nor two identical houses in the world, and each house or car is different, indivisible, unique, and scarce. Therefore, it is necessary to create a kind of token to meet the needs of these assets with unique attributes.

NFT is a kind of digital asset ownership based on ERC-721 protocol on the blockchain, which is indivisible, irreplaceable, non-interchangeable, unique, verifiable, negotiable, and tradable [4], [5]. NFT introduces scarcity into cryptocurrencies, and its essence is a special digital asset on the blockchain. The transfer of the ownership of an NFT will be realized through smart contracts [6] and the transaction will be packaged and recorded in a block on the blockchain. As such, the complete circulation and transaction processes of the ownership are recorded on the blockchain. Due to the characteristics of decentralization, openness, transparency, traceability, antiforgery and nontampering of blockchain technology, any node on the blockchain can get all the transaction records of the NFT, which ensures the transparency, nontamperability and anti-duplication of the NFT transaction processes, and the transfer processes of the ownership of NFTs can be fully tracked and verified on the blockchain.

So far, NFT has been widely used in collections, encrypted artwork and games. For example, since NFT has the traceability, and its scarcity coincides with the natural attributes of artwork, it can be well applied in the auction processes of artwork. In the traditional auction of artwork, the opacity of information and the imbalance between supply and demand lead to the increasingly prominent problem of artwork forgery. In addition, the traditional transaction processes of artworks are usually recorded on a paper, which is prone to the risk of being tampered with or lost. With resort to NFT, the auction processes as well as the complete circulation of artwork can be record on the blockchain, and it cannot be tampered with and can be viewed by every node on the blockchain, which makes the whole processes of the auction circulation of artwork open and transparent. When there is a forgery problem, it is easy to trace the problem through encrypted signature and timestamp on the blockchain.

B. NFT-Based Asset Digitization

With the rise and development of Internet and blockchain, our society is moving fast toward the digital era. In the blockchain-based digital world, digital assets are indispensable, and they are the core elements of building the value system of the digital world. In the digital world, digital assets are stored on the blockchain, and since blockchain technology has the advantages of decentralization, openness, transparency, nontampering and traceability, the trading and circulation processes of these digital assets are realized through smart contracts, and cannot be intervened by human, which greatly simplifies the trading and circulation processes of digital assets and also improves the security of the whole processes. Moreover, its complete transaction and circulation records are recorded on the blockchain and are open and transparent to every node on the blockchain. Therefore, its transactions have the characteristics of authenticity, traceability, and difficult to tamper. At the same time, it also greatly simplifies its transaction and circulation processes and improves the transaction and circulation efficiency.

In the digital era, how to realize the digitization of the physical assets in the real world to the digital world, and build a complete value system in the digital world become the core issue and challenge. As the value machine of the blockchain-based digital world, NFT can provide an effective solution to the above issue. NFT represents the ownership of digital assets on the blockchain in the digital world, its characteristics such as unique and indivisible scarcity are consistent with the attributes of physical assets in the real world. Moreover, NTF is easy to create on the blockchain, and can be used to digitize any physical assets in the real world and linked them to the blockchain, and for physical asset in the real world, there is only a unique NFT corresponding to it. Therefore, the ownership of physical assets in the real world can be mapped to the ownership of digital assets in the NFT-based digital world.

With NFT-based asset digitization, the assets in the real world can be mapped to the blockchain, and realize value circulation and appreciation through the digital world. The whole transaction and circulation processes are completed on the blockchain according to smart contract, which has the characteristics of fast circulation speed, wide range, simplified processes, and low cost. When the execution conditions of the smart contract are met, the smart contract will be executed automatically, so as to ensure the security, authenticity, openness, and transparency of the ownership transfer process of digital assets. The whole processes are completed on blockchain without the participation of centralized institutions, which can effectively avoid the risks caused by human factors in centralized transactions.

C. Toward NFT-Based Parallel Societies

With the popularity of blockchain technology, the value in the digital world becomes more and more recognized. As the value machine of everything, NFT is expected to break the value gap between the real world and the virtual world, and effectively connect the physical value and digital value of everything. As such, it can be regarded as a crucial breakthrough in the value transmission between the real world and digital world. As a bridge linking the assets in real world and those in digital world, NFT can map the physical assets of the real world to digital assets in the digital world through asset digitization, and in the digital world, the NFT corresponding to each physical asset is unique.

Since NFT has the abilities to transfer everything to the digital world, in the future, everything in the real world can be mapped to the blockchain through NFT. That is, everything such as human, city, and enterprise in the real world will has a corresponding NFT in the virtual world. As such, there are all kinds of NFTs in the virtual world, such as human NFTs, city NFTs, enterprise NFTs, and so on. In other words, with the help of NFT, we can generate a digital world completely mirror the real world. In this sense, NFT can be regarded as the identification of the things of the real world in the digital world, and the process of confirming the ownership of NFT is actually a process of identification.

NFT can solve the issue of separating the value in the real world and that in the digital world, so as to realize the unity of the values in these two worlds. When the ownership of the assets in the real world is transferred, the ownership of the corresponding digital assets in digital world will also be transferred accordingly. Similarly, when the ownership of digital assets in the digital world changes, it will also lead to the change of the ownership of the assets in the real world. In other words, any changes in the real world will lead to the corresponding changes in the digital world, and any changes of the digital assets in the digital world will also lead to the changes of the assets in the real world.

Compared with the real world, the NFT-based digital world is much broader and can play an important guiding role to the real world. In the real world, the development of each event can only follow one direction. Although each event has a variety of different development possibilities, it can only develop along one possibility in the end, and thus only one result can be realized. This is a serious limitation since whether this is the result we expect or not, it just stays here, and we cannot change it. The NFT-based digital world can break this restriction, and allow the events develop in parallel along all possible directions. As such, we can get all possible results for these directions in the digital world, and according to these results, we can guide the real world to the direction that leads to our expected result. Therefore, we can ensure "less mistakes" in the real world to the greatest extent through "more trials and errors" in the digital world, and help "a gain or more gains in your wit" in the real world through "A fall or more falls into the pit" in the digital world, so as to improve the intelligent level of our societies in an efficient way with low cost.

In addition, the NFT-based digital world is also a world that can run independently. In this world, in addition to the NFTs corresponding to the things in the real world, it will also generate more and more NFTs that do not exist in the real world, and these newly generated NFTs may affect the real world in two ways. The first way is to affect the original NFT in the digital world firstly, so as to change the digital

world and in turn affect the real world. The other way is that these newly generated NFTs may also appear in the real world through digital capitalization, thus directly affecting the real world. It is undeniable that no matter which way is taken, the future real world and digital world will exist and operate in parallel, and they will interact and influence each other, so as to form a parallel societies with virtual–reality interactions [7].

In the future parallel societies with the feature of virtual–reality interactions, real things can become virtual things, and virtual things can also become real things. In this process, NFT will become a value machine linking the real world and the digital world, and build a unified value system to realize the interconnection, value transmission, virtual–reality interactions, and parallel operations of these two worlds.

Parallel societies are coming, and we are entering a new era of parallel societies.

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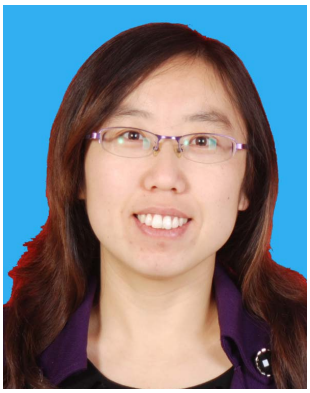

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