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EDITORIAL

IEEE ACCESS SPECIAL SECTION: SEQUENTIAL DATA MODELING AND ITS EMERGING APPLICATIONS

I. INTRODUCTION

With the tremendous advance of technologies in data collection and storage, sequential data are becoming more and more ubiquitous in a wide spectrum of application scenarios. There are various embodiments of sequential data such as time series/video frames, biological data, and event data. It bears important practical utility for learning and understanding the dynamic behavior as well as the causality relationships across sequences, and it also calls for robust models to handle noisy and incomplete sequence data in real-world settings. Thus, machine-learning-based methods can be applied to efficiently analyze and model these sequential data.

The goal of this Special Section titled ''Sequential data modeling and its emerging applications'' in IEEE ACCESS is to bring together the state-of-the-art research contributions that address key aspects of sequential data modeling and their novel applications, such as sequence learning for clinical trials in healthcare, biological sequence data for gene editing, failure tickets in device maintenance, and transactions in e-commerce. These will help identify the fundamental methodology and key technologies for cross-discipline research and applications.

In this Special Section, we received a total of 66 high-quality submissions, and after a rigorous review process, 25 articles have been selected for publication according to their quality and relevance, which are briefly discussed in this Editorial.

The first article titled ''Facial expression recognition from image sequence based on LBP and Taylor expansion,'' by Ding *et al.*, presented a double local binary pattern to identify the peak expression from the video frame. This method uses a logarithm-Laplace (LL) domain and Taylor feature pattern method to obtain robust facial features. They demonstrate that their new method is superior to the state-of-the-art method for facial expression feature extraction and can be used in real-time application.

Next, in ''Efficient sequential data migration scheme considering dying data for HDD/SSD hybrid storage systems,'' Lin *et al.* presented a data migration schema for a HDD/SSD hybrid storage system. They defined a new state, ''dying state,'' to identify the live data and used a benefit-to-cost ratio to select the data block and copy it to free space instead of migrating it. The results indicate that the new proposed schema is better than the existing schemas.

In the article ''Identify key sequence features to improve CRISPR sgRNA efficacy,'' by Chen *et al.*, the authors proposed a feature selection-based method to identify important features for improving CRISPR sgRNA efficacy. They first extract multiple sources of features from DNA sequences and proteins encoded by this DNA. Then, maximum-relevance-minimum-redundancy and an incremental feature selection method with a support vector machine are combined to select those features with the best performance for CRISPR sgRNA efficacy. This article covers the sequential data from the biological field.

In ''Latent Dirichlet truth discovery: Separating trustworthy and untrustworthy components in data sources,'' by Zhang *et al.*, the authors proposed a model based on latent Dirichlet truth to discover Trustworthy and Untrustworthy Components in Data Sources. This method defines a random field for possible configurations and infers the best one using maximum a posteriori method from observed claims. The results on real data demonstrate that this new approach achieves promising performance.

The article ''BundleNet: Learning with noisy label via sample correlations,'' by Li *et al.*, presented a deep- learning-based method, BundleNet, to handle the noise in the data. The bundle module in BundleNet takes sample correlations into account and behaves similarly to the regularization trick dropout. The authors demonstrate that the BundleNet is effective and promising in analyzing the noisy data.

The next article titled ''Cascaded regional spatio–temporal feature-routing networks for video object detection,'' by Shuai *et al.*, developed a cascaded regional spatiotemporal feature-routing network for object detection in video. This new method uses correlation filter tracking on the feature maps from convolutional neural networks to generate spatial proposals. Then, three region classification and regression networks are cascaded to refine the bounding boxes from the generated proposals. The results demonstrate that this new approach achieves promising performance on the Pascal VOC 2007 dataset and the ImageNet VID dataset for detecting unconstrained objects in cluttered scenes.

In ''Sequential fault diagnosis based on LSTM neural network,'' by Zhao *et al.*, the authors presented a long, short-term memory (LSTM)-based method for fault diagnosis. This new approach first trains a LSTM on the raw process data to learn the dynamic information buried in the raw data, and then

the test data are used to evaluate the diagnosis results on the trained LSTM. The results on Tennessee Eastman benchmark process show better fault diagnosis performance.

The article "Fast deep neural networks with knowledge guided training and predicted regions of interests for real-time video object detection," by Cao *et al.*, developed a new method for training deep neural networks on data sets with limited labeled samples. The method uses a cross-network knowledge projection to improve the network performance by combining with a large, pretrained teacher network. The results show that the new method speeds up the network training by up to 16 times with comparable object detection performance.

In the article "Scene video text tracking with graph matching," by Pei *et al.*, the authors proposed a graph-matching-based method for template matching. The new approach incorporates the relationship between two objects into the graph matching to reduce the mismatch of the same object in different frames. The results demonstrate that the tracker based on the graph matching method can better detect the candidate objects and trajectories.

The article titled "Supplementary virtual keypoints of weight-based correspondences for occluded object tracking," by Cao *et al.*, presented a short-term tracking approach using features-supplemental points and optical flows for a static-adaptive target. The results show that the new approach can yield better performance than the state-of-the-art methods under the scenes of object deformation and occlusion.

In "Discovering the trading pattern of financial market participants: Comparison of two co-clustering methods," Shi *et al.* compared two co-clustering methods, smooth plaid model (SPM), and parallel factor decomposition with sparse latent factors (SLF-PARAFAC). The results show that both SLF-PARAFAC and SPM are appropriate for financial data.

The article "Dynamic modeling of failure events in preventative pipe maintenance," by Zhang *et al.,* proposed a point process-based system for failure events in a water pipeline. This system incorporates both the past failure event data and individual pipe-specific profile. The results on an urban-scale pipe network demonstrate a promising performance, and this new system is deployed in real applications.

The article "Joint multiple image parametric transformation estimation via convolutional neural network," by Gu *et al.*, proposed an approach based on convolutional neural network for geometric matching. The new approach introduces sequential cycle consistency checks for multiple images during model learning. The results on the public benchmark set show that the new approach yields better performance for two-image matching.

In "Publication popularity modeling via adversarial learning of profile-specific dynamic process," Xiao *et al.* proposed a neural network-based point process method for predicting the number of citations of individual papers. The method takes the paper-specific features and citation traces into account and learns the neural network model in an adversarial way. The results on the publicly available academic publication repository demonstrate a large margin over the state-of-the-art methods.

The article titled "An integrated approach for massive sequential data processing in civil infrastructure operation and maintenance," by Yu *et al.*, presented a multilayer, task execution-based method for massive sequential data. The new method consists of extract–transform–load task partition, mode selection, and modeling. The new approach is demonstrated to be promising for massive sequential data.

In "Sentence vector model based on implicit word vector expression," Wang *et al.* proposed a new vector model s2v. s2v represents the words, sentences, and paragraphs in a unified way, and the vectors for sentence and paragraph are trained with the word vectors. The results demonstrated that s2v can retrieve the information with a similar meaning for different words.

The article "Learning deconvolutional network for object tracking," by Lu *et al.*, exploited deconvolution networks in visual tracking, which is a learnable upsampling network and is trained as a regression issue in an end-to-end way. The results on two tracking benchmark sets show promising performance.

In "An accurate multi-row panorama generation using multi-point joint stitching," Zheng *et al.* proposed a multirow panorama generation (MRPG) method for generating a large viewing field panorama. MRPG first uses a scanning path to obtain a large viewing field, then a multipoint joint stitching method is used to eliminate the seams to accurately integrate the frame into the panoramic canvas from all directions. The results demonstrate that MRPG can generate a more accurate panorama than existing methods.

The article "Graph-based safe support vector machine for multiple classes," by Wang *et al.*, proposed a safe, semisupervised, multiclass, graph-based support vector machine. The new method first defines a criterion based on the cost function, then a safe, multi-class strategy is used to generate the final label assignment. The results on multiple benchmark sets show promising performance.

The article "Multi-view transformation via mutual-encoding infogenerative adversarial networks," by Sun *et al.*, presented a Mutual-Encoding InfoGenerative Adversarial Networks (MEIGANs)-based algorithm for Multiview Transformation. The method learns multiview representations using a mutual-encoding representation learning network and an infoGenerative Adversarial Networks-based transformation network for transforming multiviews. The new method yields promising performance on MNIST, CelebA, and multiview angle transformation tasks on 3-D rendered chairs and multiview clothing.

The article "A human-tracking robot using ultra wideband technology," by Feng *et al.*, proposed an ultra-wideband (UWB)-based tracking method, which overcomes the challenge of the measurement errors by a modified hyperbolic positioning algorithm and tracks the target persons using a modified virtual spring model. The experimental results on a real-world robot demonstrate the effectiveness of the proposed method.

The article ''Semantic sequential query expansion for biomedical article search,'' by Fang *et al.*, presented a semantic sequential dependence model by combining semantic information and the conventional sequential dependence model. The results of 2016 and 2017 BioASQ benchmark test sets demonstrated that the new proposed method outperforms the baseline methods and other competitive methods.

In ''Modeling similarities among multi-dimensional financial time series,'' Cheng *et al.* proposed a tensor-based framework for capturing the intrinsic relations among multiple factors. The new method represents the firm-time-trading using tensors, which is processed by a tensor decomposition method to find multilinear patterns. The results on S&P 500 index demonstrates better performance than the state-of-the-art methods.

The article ''Occlusion-aware correlation particle filter target tracking based on RGBD data,'' by Zhai *et al.*, described a tracking method based on occlusion-aware correlation particle filter for RGBD data. The new method first yielded a target occlusion judgment mechanism, and formulated the tracking mechanism using a maximum likelihood estimation particle filter algorithm, which takes scale variation and target size into account. The results demonstrate that the new method can detect target occlusion and track targets well using fewer calculations.

The final article titled ''Joint sparse representation model for multi-channel image based on reduced geometric algebra,'' by Shen *et al.*, proposed a sparse representation model for color images, which applied geometric algebra to bear multiple channels. The method presented a reduced geometric algebra (RGA) theory, which is used to model color images. Then the K-RGA-based singular value decomposition (K-RGASVD) is used for dictionary learning. The results demonstrate that the new method can remove the data redundancy with a lower computational complexity and preserve the inherent color structures.

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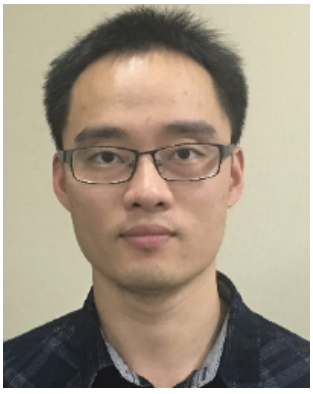

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