



# Editorial: Intelligent Multimodal Information Processing in Mobile Multimedia (MOBIMEDIA 2020)

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## Editorial:

With the prevalence of mobile devices (e.g., smartphones, tablets, digital cameras, wearable, and IoT devices), text, sound, images and video have become the main modalities of information being exchanged in our daily life. Emerging technologies, such as nature language processing, machine translation, speech understanding, mobile TV, 3D video, augmented reality and virtual reality, have received significant research interest from both academia and industry. They bring exciting mobile multimedia services and applications for monitoring, entertaining, education, public safety, health-care, and smart home, city, manufacturing, transportation, etc. Mobile multimedia data is usually collected by mobile devices from different Sensors. Therefore, they have a complex structure and composed by heterogeneous information. Noise of the data, non-universality of single modality, and performance bound of each modality make it extremely difficult to be processed and utilized without having an effective approach.

Intelligent information processing has revolutionized text analysis, speech recognition, image and video understanding, and natural language processing in the past thirty years, each involving a single modality in the input data. However, many mobile services and applications involve more than one modality. It is therefore of broad interest to study more complex and difficult issue of intelligent mobile multimedia processing across multiple modalities. Nowadays, there are

still many remaining issues are waiting for solutions, three major challenges exist: “What-To-Process”, “How-To-Process”, “How-To-Use”. Firstly, for mobile multimedia tasks, collecting paralleled multimedia data across all modalities can be quite difficult. Hence, leveraging pre-trained representation with desired nature properties of different modalities is often an effective solution to the problem. Secondly, we should focus on special architectures, workflow, methodology for the integration of the representation of unimodal signal for a particular task. Thirdly, selected areas of a broad interest for future applications will be discovered, such as image captioning, text-to-image generation, visual question answering, augmented reality (AR), virtual reality (VR).

This special issue features twelve selected papers with high quality. The first article, “Research on the Dynamic Monitoring System Model of University Network Public Opinion under the Big Data Environment”, authored by Weina He et al., to obtain the formatted data and extract the text feature items; through the network public opinion analysis module, the machine learning method is used to collect and cluster a large number of documents of the same event, identify the main theme of the document, track and evaluate the public opinion theme; through the network public opinion monitoring module, the probabilistic neural network is used to monitor the abnormal behavior of the university network public opinion data.

The second article titled “Design of Data Trend Analysis Algorithm in Multimedia Teaching Communication Platform” presented a new trend analysis algorithm in multimedia teaching and communication platform. The linear regression model is used to segment the data flow of the multimedia teaching and communication platform, the inverse lemma of a matrix is introduced to modify the model parameters of the data trend analysis of the multimedia teaching and communication platform, and the recursive regression modeling is used to design the data trend analysis algorithm of the multimedia teaching and communication platform.

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In the next article with the title “Privacy-Preserving Traffic Violation Image Filtering and Searching via Crowdsensing”, the authors proposed a traffic violation image filtering and searching scheme for multi-requester/multi-user mobile crowdsensing, which achieves image content and user query privacy preservation. Specifically, they firstly consider the multiple factors that impaired image quality, then give the grading metric to perform image filtering and obtain high-quality images. In query and searching processes, they achieve that unshared key multi-requester/multi-user image retrieval without any image content and query privacy leakage. Moreover, they proposed scheme supports the malicious users’ accountability based on the revealed private keys, which significantly improve the security and reliability. Finally, they conduct the privacy analysis, which satisfies the privacy-preserving and security requirements.

The fourth article titled “Research on standardized feature positioning technology of motion amplitude based on intelligent vision” proposed a motion amplitude normalized feature localization technique based on intelligent vision. The contour of the moving image is extracted by the method of color information segmentation. The motion process in time and space is simulated by intelligent vision, and the feature data are captured by the parameters of the human motion sensor. According to the horizontal rotation record and geomagnetic flux of the sensor, the feature data is processed by normalization, and the moving image features are selected by normalization. The amplitude function is established to optimize the foreground region feature marker of the motion image, and the motion amplitude standard feature location is realized.

The fifth article, “Precise Marketing Data Mining Method of E-commerce Platform Based on Association Rules” introduced improved association rules into precision marketing data mining of e-commerce platform. Optimize the background hardware of the e-commerce platform, collect and analyze the multi-source data. Information fusion method is used to optimize association rules, and combined with distributed similarity, accurate mining of marketing data of e-commerce platform is completed.

The sixth article titled “Construction of sports safety information mining platform based on multimedia data sharing technology” designed a sports security information mining platform based on multimedia data sharing technology. The hardware part of the platform includes teaching multimedia data sharing module, sharing server module, sharing client and Web server. In order to realize the information transmission with low time delay and low energy consumption, ZigBee technology is introduced into the software design to realize the communication function of information and complete the evaluation of mining quality.

The machine vision technology is used to solve the problems of low positioning accuracy and long positioning

time in the traditional motion three-dimensional teaching method. The seventh article, “Research on the Positioning Technology of Sports 3D Teaching Action Based on Machine Vision” presented a method of action location in three-dimensional motion teaching. The work of this method is as follows: (a) using machine vision method to determine the world coordinate system of the image; (b) using MRF algorithm to extract the features of 3D teaching action image; (c) determining the spatial correlation of 3D teaching action data. In the three-dimensional teaching action image, the smooth filtering technology is used to suppress and eliminate the noise. Then the convolution neural network (CNN) is used to reconstruct the three-dimensional teaching action image. The entropy of three-dimensional teaching behavior of physical education is determined by CNN.

The eighth article with the title “Intelligent Spot Detection for Degraded Image Sequences Based on Machine Vision” proposed an intelligent detection technology of degraded image sequence spots based on machine vision, the binary mask image is obtained through the mathematical model of degraded image spots, and the existing spots in the degraded image are detected, and the probability density of candidate spots detected in the neighborhood of the degraded image is calculated, according to the principle that the probability density of the actual candidate spots is less than that caused by noise, the problem of high false detection rate caused by defects and noise is solved.

Spectral clustering is a recent proposed popular method for unsupervised image clustering problem, whose performance relies on a well-designed affinity matrix that measures the similarity among data. The ninth article, “Multi-view Subspace Clustering via Two Dimensional Structures Preservation on Heterogeneous Features” proposed a novel heterogeneous feature based strategy for image clustering by combining projection learning and affinity learning into a joint learning framework. Inspired by multimodal information integration, heterogeneous modal-based projection learning scheme, that maps each type of heterogeneous feature into the latent subspace in a two-dimensional way, is built with original image and their multi-modal heterogeneous features respectively to preserve more useful structural information. Then, the ensembling projected data of each modal are jointly used to establish an affinity learning model based on the shared ridge regression that considers cues from all modals simultaneously, which can greatly improve the similarity metric performance. Moreover, the graph-based constraint on affinity matrix is also adopt to capture the extra nonlinear structures of the data, which provides help for keeping their neighbor relationships. An iterative numerical scheme is designed to solve the objective function of the proposed framework and ensure convergence.

The tenth article titled “A Lightweight Intrusion Detection Model for 5G-enabled Industrial Internet” proposed a lightweight intrusion detection algorithm based on density-awared fuzzy clustering. Firstly, the algorithm introduces data local density and data feature distance into fuzzy clustering method, which improves the clustering effectiveness and reduces the cluster convergence time. Secondly, the algorithm applies the fuzzy membership degree obtained by the improved fuzzy clustering method as the fuzzy factor for the fuzzy support vector machine to reduce the subjectivity caused by the artificial selection of the fuzzy factor, and minimize the influence of the noise point and the isolated point for the classification.

Nowadays, the widely used end-to-end encryptions have prevented the Deep Packet Inspect (DPI) method applied in Quality of Experience (QoE) prediction and optimization. The eleventh article, “Ignoring Encrypted Protocols: Cross-layer Prediction of Video Streaming QoE Metrics” proposed a Cross-layer Predicting framework of Video Streaming QoE (CPVS) to monitor and predict video indicators that affect user QoE, such as startup delay, stalling rate and stalling events. The most prominent advantage of the CPVS is that it can predict the video QoE indicators without the prior information of transmission protocols, whether it is encrypted or not. Furthermore, the general framework, CPVS, shows high predicting accuracy both in a time granularity as small as one second and in video-session prediction, even can perform well with only 6 features.

In mobile communication, automatic modulation recognition of mobile signals has always attracted attention. In the more and more complex electronic environment, the researchers are trying their best to deal with the communication signals, the study of this part can be used in the reality of the war environment, and it has the most important significance for the complex environment. The last article titled “Mobile Signal Modulation Recognition Based on Multimodal Feature Fusion” investigated efficient trust prediction in a large-scale social network. The authors proposed a mobile signal modulation recognition algorithm based on multimodal feature fusion. The features extracted from the two modes of the time–frequency diagram are fused to realize the signal recognition. In order to solve the problems that they were less consider about the connections between different characters of the signals, this paper used the convolutional neural network to solve this kind of problem. The results of the simulation experiments show that the TF-CNN and TF-Resnet of this paper have better performance at low signal-to-noise ratio, they can achieve the high precision signal automatic modulation recognition and classification.

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