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EDITORIAL

Deep understanding of big geo-social data for autonomous vehicles

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This special issue contains 14 research articles that present solid and novel fundamental research studies in the area of geo-social data and geo-spatial data analytics for autonomous vehicle applications. All of the 14 papers went through at least two rounds of rigorous reviews by the guest editors and invited reviewers.

Wan et al. [1] propose an unsupervised active learning method with a loss prediction module named UALL, which uses a deep neural network to model the nonlinearity of data and considers three essential criteria simultaneously in active learning: representativeness, informativeness, and diversity.

Zhengand Chen [2] aim to resolve an open problem in traditional image segmentation methods. They cannot fully represent the information in high spatial resolution images and tend to yield unsatisfactory segmentation accuracy. To address the problem, the paper presents U-Net model for multi classification and binary classification of Gaofen-2 high spatial resolution remote sensing image data.

Liu et al. [3] propose an algorithm based on the greedy algorithm framework, which converts the influence maximization problem into a maximum inner product search problem. The proposed method can complete the selection of seed nodes for large-scale networks in nearly linear time, which greatly improves the efficiency of geo-social data analytics.

Zheng et al. [4] propose an Iterative Causal Structure Search algorithm for the high-dimensional social tags. The proposed approach benefits from the good scalability of the constraint-based approach. Further, it is capable of avoiding the Markov equivalence class problem with the help of the additive noise assumption.

Shi et al. [5] study the problem of outlier detection of traffic data. The authors propose a real-time urban traffic outlier detection (RUTOD) framework. RUTOD contains an individual outlier detection module based on current traffic conditions and group outlier detection module based on historical data. A street-based trajectory division is proposed to accelerate investigation. Experiments show that RUTOD is capable of detecting both individual outliers and group outliers in real-time scenarios.

Liu et al. [6] aim to address the problem of time-series prediction. To solve the problem, the authors first construct a graph by connecting upstream and downstream discovered in time-series data, and then obtain useful text features and topological features to predict the results based on time-series. Their proposal exhibits higher time-series forecasting accuracy compared to baselines.

Zhao et al. [7] propose an improved convolutional neural network, EDense, which takes advantage of the dense network connectivity to integrate a CNN model. Next, it expands the kernels in the convolutional layers to increase the width of the network model. Experimental results confirm the strong learning ability and high learning efficiency of EDense.

Zhong et al. [8] present an unsupervised domain adaptation framework named Joint Image and Feature Adaptive Attention-aware Networks (JIFAAN), which alleviates the domain shift for cross-modality semantic segmentation. Experiments show that JIFAAN surpasses the cutting-edge domain adaptation methods and achieves the state-of-the-art performance.

Zou et al. [9] propose an energy-aware decremental learning framework, SmartDL, that balances the energy efficiency and data privacy in an efficient manner. SmartDL improves the energy efficiency from both global layer and local layer. The authors prototype SmartDL on physical testbed and evaluate its performance using learning benchmarks with real-world traces. The results show that SmartDL can substantially reduce energy consumption compared to traditional federated learning methods.

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Wang et al. [10] target the problem of enhancing the performance to meet the real-time requirement of autonomous driving. For this purpose, the authors propose an end-to-end recurrent multi-level residual learning deraining network featured with the global attention mechanism and residual network architecture. A deep multi-level residual learning network is proposed to eliminate rain streaks in a single image. Experimental results show that the proposed model performs favorably against the state-of-the-art methods for removing rain streaks.

Cheng et al. [11] study the use of a generic graph representation on gynecology and obstetric surveys with geospatial features, and propose a bipartite approach, Geo-SPS, to mine the semantic relationship between low-quality health information data, which is capable of providing an effective method to semantic similarity metrics.

Xu et al. [12] develop a personalized attraction enhanced network learning for recommendation, PAENL, which has the capability of modeling heterogeneity information by convolutional neural networks and capture the essence of different users' emotional reviews by the attention neural model in a nonlinear sense.

Sun et al. [13] propose a Scale-free Heterogeneous CycleGAN (SH-CycleGAN) to utilize unpaired real-word images for boosting image defogging. The SH-CycleGAN contains a Heterogeneous Learning CycleGAN (HLCG) framework, and a generator with a Global Features Fusion module and an Adaptive Pooling module (GFFAP). Experiments compared against eight state-of-the-art image defogging methods on both synthetic and real-world images demonstrate that SH-CycleGAN outperforms state-of-the-art methods and obtains more pleasing visually defogging results.

Finally, Wang et al. [14] study the problem of Approximate nearest neighbor (ANN) search in high-dimensional spaces, which is a fundamental problem in Autonomous Vehicle-based applications. To solve the problem, the authors present a disk-based Locality-Sensitive Hashing (LSH) index that offers efficient support for both searches and updates.

Those 14 articles represent diverse directions in the fast-growing area of geo-social data analytics that may benefit Autonomous Vehicle-based applications. We expect that the aforementioned studies will foster the development of data analytic techniques related to Autonomous Vehicles and inspire more research in this promising area.

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