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Guest Editorial: Explainable and trustworthy methods for next-generation artificial intelligence for Reasonable Data Size

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This special issue showcases cutting-edge research in artificial intelligence and computer vision, with a focus on novel deep learning architectures and algorithms for various recognition and analysis tasks. The collected papers present innovative approaches that push the boundaries of performance and efficiency across applications ranging from infrastructure inspection to pedestrian analysis.

In the paper "Advancing Crack Segmentation Detection: Introducing AAMC-Net Algorithm for Image Crack Analysis", the authors introduce AAMC-Net, an innovative convolutional neural network algorithm that leverages a mixed domain attention mechanism to enhance feature extraction for road crack segmentation. The proposed approach demonstrates superior performance in crack detail processing, model training efficiency, and real-time detection compared to several traditional algorithms, achieving notable improvements across multiple evaluation metrics. By addressing challenges in road crack segmentation while maintaining flexibility for broader image segmentation tasks, AAMC-Net represents a significant advancement in computer vision techniques for infrastructure maintenance and safety applications.

The paper titled "Enhancing Architectural Image Processing: A Novel 2D to 3D Algorithm Using Improved Convolutional Neural Networks" introduces an innovative architectural image processing model that combines Restricted Boltzmann Machines (RBMs) with Convolutional Neural Networks (CNNs) to convert 2D architectural images into 3D models. The proposed approach demonstrates superior performance in terms of accuracy and efficiency, achieving a 97% detection rate and significantly outperforming comparative algorithms in runtime and efficiency. By integrating advanced preprocessing techniques with a novel deep learning architecture, this research makes a valuable contribution to the field of architectural digitization and smart city development.

In the paper "Attention Mechanism for Image-based Person Re-identification", Liu and Zhou introduce a novel hybrid framework called PGAN (Patch-Global Attention Network) for person re-identification, which combines a patch-network and global-network with a channel-wise attention mechanism to learn discriminative feature representations. The proposed approach incorporates CSwin Transformer to re-extract features from residual blocks and demonstrates superior performance on benchmark datasets, achieving state-of-the-art results with mAP scores of 91.3%, 83.4%, and 81.8% on Market-1501, DukeMTMC-ReID, and CUHK03-NP datasets respectively. By effectively integrating local and global features through attention mechanisms and transformer architectures, this work makes a significant contribution to improving the accuracy and efficiency of person re-identification systems.

In the paper "Semantic Feature-Based Test Selection for Deep Neural Networks: A Frequency Domain Perspective", Jiang et al. introduce SaFeTS, an innovative test selection method for deep neural networks that leverages frequency domain analysis to extract semantic features from test cases. By clustering these features and sampling diverse test cases, SaFeTS demonstrates superior performance in exposing varied model errors and improving adversarial and out-of-distribution robustness compared to baseline methods. The authors' approach offers a fresh perspective on enhancing DNN testing and robustness by focusing on semantic diversity, with experiments showing up to 20% improvement in adversarial accuracy over existing techniques.

In their paper "AI Large Models Bring Great Opportunities to Reusable Design of CAD Software", Sun et al. explore how AI large models can enhance reusable design in CAD software by improving rule-based and case-based reasoning techniques. The authors propose a novel framework that integrates large language models, knowledge graphs, and databases to enable more intelligent and interpretable design reuse. By leveraging the advanced language understanding and reasoning capabilities of large AI models, this approach aims to overcome limitations of traditional methods and open new possibilities for computer-aided engineering augmented by artificial intelligence.

The paper titled "A Hybrid GA-Powell Algorithm for Geometric Constraint Solving" introduces a novel hybrid GA-Powell algorithm to address limitations in traditional geometric constraint solving methods. By combining the global search capabilities of genetic algorithms with the local refinement strengths of Powell's method, the proposed approach demonstrates superior accuracy and efficiency in solving multi-solution problems compared to existing techniques. The researchers' findings offer valuable insights for enhancing CAD systems and geometric constraint solvers, potentially advancing the field of computer-aided engineering design.

In the paper "ALFormer: Attribute Localization Transformer in Pedestrian Attribute Recognition", ALFormer, a novel transformer-based framework for pedestrian attribute recognition that addresses limitations in accurately localizing discriminative regions has been introduced. By incorporating Mask Contrast Learning to suppress misleading regional correlations and Attribute Spatial Memory to capture inherent attribute locations, ALFormer achieves state-of-the-art performance on benchmark datasets. The authors' approach demonstrates the potential of leveraging spatial consistency to enhance fine-grained recognition tasks in computer vision.

In conclusion, this special issue highlights several promising directions for advancing AI and computer vision capabilities. The presented works demonstrate the potential of hybrid architectures, attention mechanisms, and large language models to address key challenges in tasks like image segmentation, 3D modeling, person re-identification, and attribute recognition. By combining global and local feature extraction, leveraging spatial consistency, and enhancing robustness through semantic diversity, these approaches offer new paradigms for developing more accurate, efficient and interpretable AI systems. As the field continues to evolve rapidly, the novel techniques introduced here provide valuable insights to guide future research and development of intelligent visual analysis systems. We hope you enjoy reading the papers as well as we did.