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Editorial

Advancements in Computer Vision: Bridging Perception and Intelligence

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The field of computer vision is evolving very fast with its applications in medical imaging, autonomous driving, remote sensing, robotics, and precision agriculture. The journey of computer vision travelled from recognizing images to intelligently perceiving the environment using RGB monocular cameras, omnidirectional cameras, and 3D laser scanners. For many of the computer vision applications, it has become integral to perceive, interpret and interact with the environment in a safer way.

A journey from pixels to understanding

The traditional computer vision methods work my extracting feature points and descriptors around the feature points using classical image feature extraction methods such as SIFT, SURF, and ORB. However, with the advancements in deep learning models such as CNNs, the feature extraction procedure has become automatic instead of manually extracting the features from the images. The recent model such as diffusion models, vision transformers, CLIP, and SAM have further enhanced the performance of computer vision algorithms. These models outperform many other models and generalize across various domains. Therefore, the direction of computer vision has changed from the general image analysis to active perception, and reasoning. The multimodal learning in which vision models interact with audio, text, and video have also been attempted by many researchers.

Major challenges

Although computer vision algorithms perform well in many situations. However, there are many challenges that need to be addressed in the computer vision community. The challenges like occlusion, motion blur, non-uniform lightening conditions, dynamic environment, and reflections, etc. pose a challenging task for the computer vision models to understand the environment. There have also been ethical concerns in performing computer vision tasks. The generalization across domains due to missing data and imbalanced datasets is also a challenge to be tackled. The high computation cost of vision models and requirement of expensive GPUs is another challenge for the computer vision researchers.

The Road Ahead

The collaboration of neuroscientists and computer vision researchers is a great way to accelerate the computer vision research. Edge AI and neuromorphic computing help in enhancing the robustness of computer vision algorithms. Explainable AI offers visual reasoning to the predictions made by the models.