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CROWD ANOMALY DETECTION IN SURVEILLANCE VIDEOS USING HYBRID MODELS OF AUTOENCODER, GAN AND YOLOv8

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Abstract

Crowd anomaly detection is an essential aspect in computer vision applications, such as public security monitoring and surveillance in crowded scenes. It is generally not feasible to monitor manually, and consequently, the demand for automatic real-time systems has emerged. Individual and hybrid deep learning approaches, such as Convolutional Autoencoders (AE), Generative Adversarial Networks (GAN), as well as YOLOv8 are presently explored. Although YOLOv8 is not the latest iteration in the series of YOLOs, it remains worth due to its excellent balance between accuracy, speed, and the ability to support several tasks of computer vision at once (detection, segmentation, classification, etc.). Its simple-to-use ecosystem with full documentation and a small API enables it to be used in many applications. Even if newer releases may include improvements in specific areas like parameters or accuracy, YOLOv8 provides a solid, multi-tasking, well-supported solution that is easier to use for most scenarios. On the other hand, AEs are good at recovering the motion patterns, and GANs can achieve anomaly scoring, while YOLOv8 has a more accurate object-level detection. However, none of them have satisfactory performance in complex events. To tackle this issue, a hybrid framework comprising the three models was proposed in this work using decision-level fusion to raise accuracy and reduce false positives. Experimental results on UCSD Ped2 and UMN datasets demonstrate that the proposed hybrid model performed better than single models in terms of precision, recall, F1-score, and AUC. The proposed approach provides a scalable, robust, and real-time solution for a cognitive surveillance system.

Keywords*:* *Crowd Anomaly Detection, Autoencoder, Generative Adversarial Network, YOLOv8, Hybrid Deep Learning, Surveillance, Real-Time Detection.*