Keeping an Eye on Children: A Swimmer-following Vehicle Enabled by Edge Intelligence

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Drowning incidents involving children in pools often result from human oversight. Prior research has highlighted the early warning potential of deep learning-based object detection methods. However, these single-frame techniques often lack perceivable spatio-temporal context. Additionally, existing fixed-camera solutions encounter challenges in tracking distant, small swimmers. To address these issues, this study aims to develop a novel swimmer-following vehicle enabled by Edge Intelligence. Our platform first applies a cross-frame spatio-temporal model using a customized lightweight neural network to detect the swimmer's status, then employs a Lidar mapping-based following algorithm for tracking. Lastly, the user can observe the swimmer through a remote client. Inspired by the shape of the pool, we propose an innovative Vanishing point-based optimization method to improve detection accuracy. Also, we implemented an improved DeepSort algorithm to reduce swimmer switching. Furthermore, to overcome computational constraints on embedded vehicles, we propose a distributed deployment strategy to offload computing-intensive core algorithms (including big Transformer models) to an edge server. Moreover, we use AIGC data augmentation and Mosaic processing to protect swimmers' privacy in public pools. Experimental results demonstrate our vehicle's real-time detection through distributed deployment. While our current focus is primarily on drowning detection, we aim to expand the application to a wider range of scenarios and dangerous behaviors in the future. This innovative vehicle offers remote monitoring for parents or pool lifeguards and provides valuable application scenarios for further research in Embodied AI.

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