Explainable Rip Current Detection and Visualization with XAI EigenCAM

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Abstract—Rip currents have long posed a serious threat to beachgoers and swimmers. Despite numerous preventive measures throughout the period, the fatality rate underscores the need for a robust rip current detection system. Recently deep learning models have shown promising results in rip current detection, outperforming traditional methods. However, these models still exhibit some accuracy limitations due to insufficient data distribution. To address this challenge, we incorporate a novel largest dataset comprising over 110,215 Korean coastline images. Through the comparative study of the state-of-the-art models, we aim to analyze the detection accuracy of each model and gain a deeper understanding of their intensity over rip current detection. In comparison to the other rip current datasets, the evaluation results on our proposed dataset demonstrate a remarkable elevation in accuracy, reaching 79.4 mAP. Further, we employ the EigenCAM (Eigen Class Activation Maps) to interpret the intense regions of the rip currents and to gain a deeper comprehension of rip current explainability. This comprehensive analysis marks a significant step toward improving rip current safety and understanding.

Keyword—Class activation maps, computer vision, largest rip current dataset, rip current detection, state-of-the-art models comparison

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