S.A.F.E. - Shark Alert and Flagging Equipment: A Novel Approach to Shark Protection and Citizen-Oriented Threat Assessment

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Countless lives have been lost over the decades to a single animal: the shark. With its large mouth and razor-sharp teeth, even a small shark can inflict severe damage on an unwary beachgoer exerting as much as 4000 psi of bite force. However, Galeophobia and the perpetuation of paranoia have negatively influenced shark protection and management. Mitigation of sharks includes destructive techniques, such as meshing programs and baited drum lines, which inflict pressure on the population of endangered sharks that are critical to the ecosystem acting as apex predators. Our objective was to create a cost-efficient device aimed at minimizing human-shark interactions while safeguarding marine ecosystems. SAFE is a network of bots deployed at a distance from coastlines for early detection of sharks and determination of their location and trajectory. A single module consists of two interconnected subsystems: a low-power system (SYS-2) equipped with modified mmWave sensors for passive heat fluctuation detection, and the former, (SYS-1) leveraging deep learning algorithms for real-time shark classification using infrared imagery. An accurate and well-trained SSD Mobilenet learning algorithm is developed to distinguish sharks from other aquatic organisms. If sharks are detected, an alert signal would be sent to beach operators or lifeguards through a tuned mobile app. SAFE's modular design is versatile for different objects; it provides easy interface with deep learning capabilities and customization for diverse coastal environments, enhancing its utility and effectiveness.

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