ElSa: A Novel Real-Time Wildlife Poacher Detection Solution Leveraging Machine Learning-Driven Spatio-Temporal Analysis of Nighttime UAV Thermal Infrared Videos

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Wildlife poaching of endangered species such as elephants in Africa has become a biodiversity crisis, which has also been highlighted by the United Nations Sustainable Development Biodiversity Goal of halting biodiversity loss. Recently, UAVs equipped with thermal infrared cameras coupled with computer vision software have been deployed to help park rangers monitor vast protected areas at night when illegal wildlife poaching typically occurs. To maximize the area covered within fixed flight time & battery constraints, the UAVs fly at high altitudes of approximately 400 ft; this results in small animal/human sizes in captured thermal images & consequently poor poacher detection accuracy, as low as 20%. In this research, a novel Spatio-temporal model that significantly improves poacher detection accuracy in thermal infrared drone videos for prevention of wildlife poaching is developed, leveraging Spatio-temporal nature of the video data, i.e., the difference in the movement patterns of animals and humans over time (ex. number of turns, turning radius, speed, etc.). When tested on a real-life night-time infrared videos dataset, collected from 4 national parks in Africa, this method detected poachers with over 90% accuracy - a 4X improvement over existing state-of-the-art methods. Furthermore, a low-cost ($300) design prototype ElSa is demonstrated, which mitigates the need for costly high-resolution thermal cameras (costing up to $10,000), easing the burden on resource-constrained parks in Africa. This novel high accuracy real-time wildlife poacher detection solution leveraging machine learning driven Spatio-temporal analysis has the ability to save thousands of endangered animals, a significant contribution to the UN Sustainability Development Biodiversity goal.

Awards Won:

First Award of $5,000

Peggy Scripps Award for Science Communication