Toward Accurate Surveillance of Mosquito Breeding Grounds using Multispectral Imagery and mmWave Radar

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Both Zika and dengue are arboviruses that infect a significant portion of the global populace. Nearly 400 million dengue infections occur annually. Due to severe dengue fever, around half a million individuals need hospitalization and about 36,000 patients pass away every year. There is a dynamic behavior in dengue cases from year to year. In Sri Lanka, an unexpected peak of dengue cases was reported in 2017. A total of more than 150,000 suspected cases and around 450 deaths were recorded. Dengue fever can spread rapidly in densely populated urban areas. The main vectors for both dengue and Zika are the mosquitoes Aedes aegypti and Aedes albopictus. They procreate in pools of still or extremely slowly moving water. It is vital to reduce and control such potential breeding grounds and to prevent the spread of these diseases.

In this research study, we investigate the efficiency of multispectral imagery and mmWave radios on board of drones in order to discover mosquito breeding habitats. Our strategy for identifying breeding habitats through the detection of water areas is as follows: First, we explore the use of mmWave radios to detect and classify water areas that can be potential breeding habitats by examining the depth of detected water. Second, we analyze multispectral aerial imagery from drones in order to detect water reliably. We study the ability of the Normalized Difference Water Index (NDWI) to segment water retention areas and develop a new deep learning-based method to detect water retention areas in both urban and peri-urban settings. Further, we utilize a bathymetric log-ratio model to estimate the depth of water from multispectral data. Finally, we present promising results for classifying water with and without larvae by applying machine learning to multispectral imagery.