University of Peradeniya

Artificial Intelligence and Unmanned Aerial Vehicle for automated potential-mosquito breeding site detection

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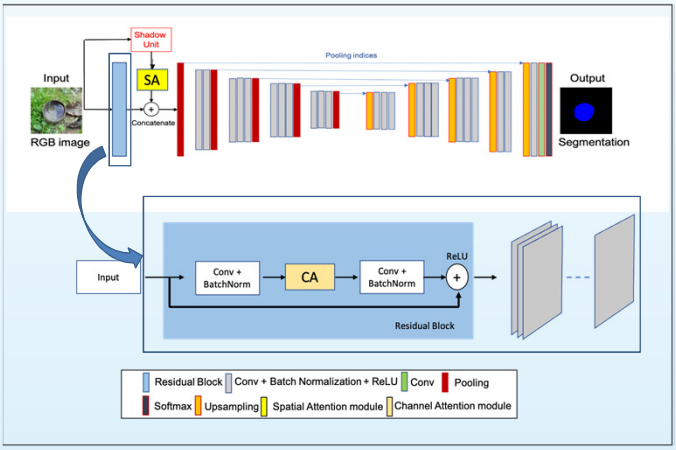
Abstract- Effective vector control strategies are essential to achieve and maintain a decrease in dengue-related morbidity. The goal of this work is to accurately segment water bodies in aerial images using AI techniques. Traditional methods encounter difficulties in selecting suitable image textures, dealing with building shadows, and meeting real-time processing needs. In this project, we propose a supervised learning-based architecture to automatically detect and segment potential mosquito breeding sites at inaccessible places to a human, using drone images.

Outcome: We employ the SegNet architecture, a state-of-the-art CNN-based semantic segmentation method, as the backbone for our model. Compared to the standard SegNet model, the modified SegNet model demonstrates significant improvements in accurately predicting water areas. The proposed model achieves an impressive increase in overall accuracy for water prediction (96%), showcasing the effectiveness of the proposed model.

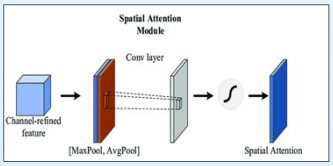


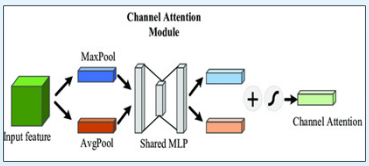
SA-ESegNet model Improvement:

❑ **A shadow unit coupled with a residual block.**
This fusion facilitates the merging of their individual characteristics, allowing the model to capitalize on the insights acquired from both the residual block and the distinct features captured by the shadow unit.

❑ **A spatial attention module**
By incorporating a spatial attention mechanism, the model's capacity to concentrate on pertinent spatial details is heightened, thus enabling it to focus on crucial areas within the input data selectively.

❑ **The residual block is equipped with a channel attention module.**

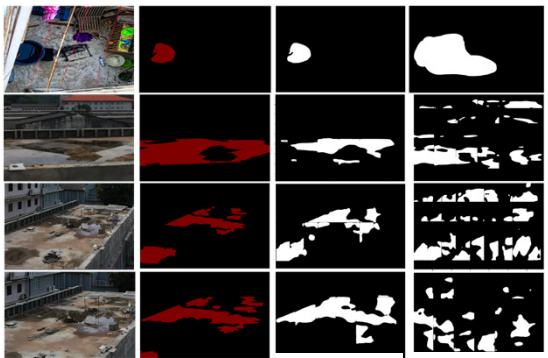




Experimental setup:

During the training phase, the proposed model underwent transfer learning-based domain adaptation. Initially, the model was trained on the large water area dataset, and then the learned weights of the model were transferred to the encoder part of the proposed architecture. The training process involved 50 epochs with a batch size of 16. During training, the stochastic gradient descent (SGD) optimizer with a momentum of 0.9 and a fixed learning rate of 0.001 was employed.

Experimental Results:



Original image | Label map | SA-ESegNet Proposed model | SegNet (current literature)

Algorithm	Dice score	Accuracy	Precision
SA-ESegNet	96.31%	96.37%	98.27%
SegNet	84.71%	85.63%	90.49%
Improvement	11.6%	10.74%	7.78%

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