**Promoting Engagement and Learning via Citizen Science and Artificial Intelligence Techniques**

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Citizen science platforms are now popular, and contribute to many applications related to conservation and understanding of nature. Over the past six years, our team has utilized data from three citizen science platforms for public health, specifically mosquito surveillance with the ultimate goal of controlling invasive and vector species (Carney et al 2022). The three platforms are NASA's GLOBE Observer (Mosquito Habitat Mapper, Land Cover), Mosquito Alert, and iNaturalist.

a. We have delivered thousands of 60X clip-on lenses to citizen scientists in the USA and Africa to enable them take smartphone pictures of mosquito larvae and upload them to Mosquito Habitat Mapper. To do so, we have leveraged our extensive connections with public health agencies in respective countries. We have documented evidence of success in these efforts (Carney et al 2023).
b. We have created a web portal called http://mosquitodashboard.org/ (Uelmen et al 2023), that integrates mosquito observations data from the aforementioned platforms, so that a single portal can serve needs of the general public and public health experts to be aware of mosquito observations of importance (e.g., invasive malaria vector *Anopheles stephensi*). We have advertised this portal using our connections across the globe, and we are aware of its use by agencies in several countries including the USA, Brazil, Nigeria, Ghana, Madagascar, Cameron, and India.

We want to further stimulate citizen engagement in mosquito surveillance. We are investigating the design of a system wherein citizens can opt in to receive "information" on their posts for their own curiosity in real-time. Our experiences with citizen scientists indicated genuine interest in such a service. We identify some possibilities here, and we hope more discussions on this can be stimulated at the CCC workshop. Option 1 is to ideally report back the genus and species of the mosquito whose image was uploaded. This would be the best-case scenario. Unfortunately, this is very challenging, considering that there are close to 4,000 species of mosquitoes in nature. A second option is to design image processing algorithms to just detect vectors (those that spread diseases). This maybe a more tractable problem, since only around 3% of mosquito species are known to spread diseases to humans. However, even for this problem, a robust database of vector mosquitoes is still lacking.

We have designed computer vision methods that can automatically extract anatomical components – head, thorax, wings, abdomen, legs – of a mosquito from image data (Minakshi et al 2020a,b). We are envisaging reporting these back to users along with morphological keys so that citizens can themselves visualize the individual anatomical components to make a classification. If and when identities are confirmed by experts – a process that can take time – feedback can be given to citizen scientists so that their own understanding can be validated and improved. Ultimately, our goal is to investigate, design, deploy, and validate AI-driven methods to incentivize citizen scientists participate in mosquito surveillance, a global problem of immense need given that there are over 700 million infections and nearly one million deaths due to mosquito-borne diseases every year.

**References:**

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