Connectivity

Global Mosquito-Sensing Network Being Built Using Smartphones

Researchers have created an app that can recognize mosquito species from the sound they make and then track their movement over time.

by Emerging Technology from the arXiv November 30, 2017

Malaria is a killer. Up to 600 million people suffer from the disease, and each year, one million die from it. According to UNICEF, most of them are children less than five years old living in sub-Saharan Africa.

So preventing the spread of malaria is a major goal. Health experts have various ways to control the spread of the disease. Some of these interventions have been hugely successful but others less so. But the difference between success and failure is often poorly understood.

One problem is that malaria is transmitted by infected Anopheles mosquitoes, and these make up only a tiny fraction of mosquito species. There are around 60 Anopheles species that can transmit malaria, out of 3,600 different mosquito species in total.

Anopheles stephensi--one of 40 mosquito species that can transmit malaria, out of 3,600 species in total.

Tracking mosquitoes over large areas is hard, and identifying their species even harder still. And that makes it difficult to understand how an intervention influences the populations of different species. To solve this problem, disease experts would dearly love to have a low-cost sensor system to monitor mosquito populations that can be easily distributed to remote places.

Enter Yunpeng Li and pals at the University of Oxford in the U.K., who say they have developed just such a system. Their approach exploits the fact that mosquito species can be identified by the noise their wings make as they fly. These noises can be picked up and recorded by a smartphone.

So the team's sensor system is an Android smartphone app called MozzWear that can record mosquito noises, along with the time and location, and then send the data to a central server where the species is identified.

Since smartphones are widely available, even in many developing

countries, this system can be widely distributed relatively easily. At least in theory.

Li and co's approach is to train a machine-learning algorithm to recognize the characteristic acoustic signature of different species and then identify the insects accordingly.

Various studies have shown how it is possible to identify mosquitoes by the noise they make. It is even possible to distinguish the sexes, since males vary their wing beat frequency to attract mates. Nevertheless, the data is sparse.

That's not good for machine-learning algorithms, which can only learn from vast amounts of data, usually annotated in advance by humans. In this case, those data sets just haven't been created. So Li and co have begun the huge task of creating their own database, with the help of colleagues and citizen scientists.

First, they gathered recordings of mosquitoes collected by the Centers for Disease Control and Prevention in the U.S. and the U.S. Army Military Research Unit in Kisumu, Kenya. These involved seven different species and a total of 62 different samples.

Next, the team marks the relevant features in a spectrograph of these recordings using the citizen scientist crowdsourcing service Zooniverse. The first task for these scientists is to mark the regions in each recording that contain identifiable mosquito sounds. They then use this data to train a machine-learning algorithm to recognize these seven different species from their sound alone.

Finally, Li and co test the system by loading the app onto a cheap smartphone—an Alcatel One Touch 4009X, which they say costs

about £20—and then using it to monitor the ambient noise levels as they play recordings of the mosquitoes.

The app sends these recordings to a central server, which uses the machine-learning algorithm to identify the flying beasts.

The results are not bad. The machine accurately detects the Anopheles species of mosquito about 72 percent of the time. "Detection accuracies for Anopheles mosquitoes, which are malaria vectors, are impressive," say Li and pals.

That's a useful proof-of-principle demonstration. It shows that low-cost smartphones can become low-cost mosquito sensors. "Our acoustic mosquito detection system, despite using low-cost smartphones, provides a promising avenue for live detection—and species classification—of mosquitoes known to vector malaria," say Li and co.

But there is significant work ahead. The team now needs to dramatically increase the number of species the MozzWear app can identify. That won't be easy, since high-quality recordings are not easy to make. It will also be time-consuming, given the 3,600 different species that are out there.

Then the team has to spread the app and persuade people to use it. That will be tricky, too. Some apps spread virally, but others require considerable marketing. And in places where battery power is at a premium, an interesting question is whether people can be persuaded to devote precious battery power to this kind of endeavor.

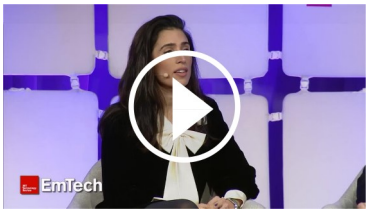
Let's hope they will. A better understanding of the way mosquito populations vary throughout the world and how they change over

time will be invaluable. It may even help reduce the incidence of malaria and the deaths it causes.

Ref: arxiv.org/abs/1711.06346: Mosquito Detection with Low-Cost Smartphones: Data Acquisition for Malaria Research

Related Video

More videos

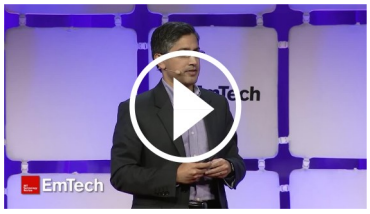


Connectivity

Yasmin Green: Using Technology to Make the World a Better Place 04:04

Connectivity

What is social media doing to society? 25:45



Connectivity

The Emerging Threat of Cybercriminal AI 19:35

More from Connectivity

What it means to be constantly connected with each other and vast sources of information.

01

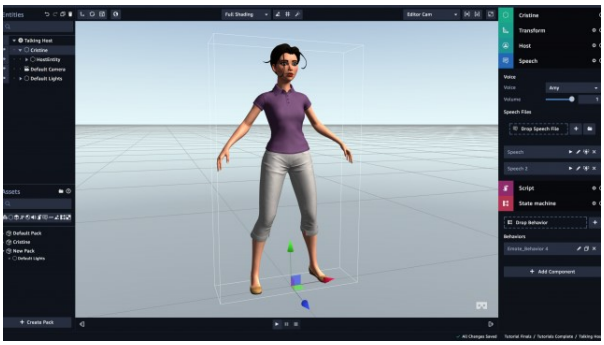
Hacking Back Makes a Comeback—But It's Still a Really Bad Idea

Some politicians want to make it legal for individuals and companies in America to pursue digital assailants.

by Martin Giles

02

Amazon Imagines a Lucrative Future in VR and AR Apps



Here's its business model: make it easy for you to create the apps, and then host them on its cloud services.

by Rachel Metz

03

Blockchains Are Poised to End the Password Era

Many technologists think blockchains can revolutionize how we keep track of our identities.

by Mike Orcutt

More from Connectivity