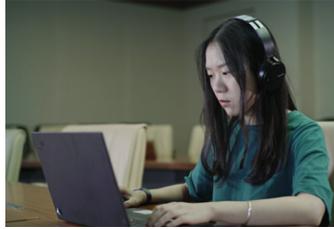


Safeguarding rainforests with AI

Every year deforestation leads to 50,000 species going extinct and, if current trends continue unchecked, the Earth's rainforests could disappear within 40 years. Here's how one NGO is using upcycled smartphones and artificial intelligence to stop illegal logging and protect species' habitats.

By Xing Jingfan





Tropical rainforests are the “lungs of the planet”, absorbing about 30 percent of the world’s carbon dioxide and helping to alleviate global warming. They’re also home to more than half of animal and plant species in the world and are vital to maintaining biodiversity. But due to illegal logging, more than half of the world’s rainforest areas have already been lost. They once covered more than 14 percent of the Earth’s land surface, but now only account for 6 percent. Studies show that deforestation is the source of approximately one-fifth of the world’s carbon emissions. Every year deforestation leads to 50,000 species going extinct. And if it continues, rainforests could disappear in the next 40 years.

AI leaves poachers nowhere to hide

Rainforest Connection (RFCx) is a non-profit organization founded in 2014 by ITER physicist and software engineer Topher White. It runs projects in the US, Peru, Brazil, Costa Rica, Romania, Bolivia, Indonesia, Ecuador, Cameroon, and South Africa, among other countries. RFCx works to prevent illegal logging using recycled mobile phones and conserve tropical rainforest ecosystems.

The idea first came to White a few years ago when he was volunteering to protect gibbons in Indonesia. He became keenly aware that, lacking an effective method, relying on manpower alone to discover and prevent logging is extremely time-consuming and ineffective. So, he began to upcycle old Huawei phones, turning them into solar-powered rainforest monitoring devices.

The devices, called ‘Guardians’, are deployed in rainforests and collect environmental sounds in real time. They can operate nonstop for at least two years in the extreme environments of high temperatures, high humidity, and heavy rain. When illegal logging is discovered, local forest rangers are alerted, helping them search more quickly and effectively.

Due to the challenges of managing a huge amount of data and optimizing the algorithms, RFCx needed systematic technical support to upgrade the solution. So the NGO teamed up with Huawei to develop a fully integrated intelligent ecosystem, including collection equipment, storage services, and intelligent analysis.

A number of challenges had to be overcome. The first was how to collect and transmit audio

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data in a continuous and stable way in a high-temperature, high-humidity environment with no fixed power supply, and then store and manage the huge and growing amount of data on a back-end platform. The second was that a high-precision recognition algorithm was needed for real-time, rapid analysis and the precise recognition of the complex data from the rainforest, so that the location of any logging could be accurately determined and sent to forest rangers.

Based on RFCx’s original chainsaw monitoring model, Huawei harnessed its advanced AI service, HUAWEI CLOUD AI, and ModelArts tools to develop an intelligent algorithm model that could more accurately identify chainsaw and logging truck sounds. And by applying the model in the actual environment, the accuracy could be constantly refined.

At the beginning of the project, RFCx reported that the buzzing of mosquitos was often being misreported as chainsaws. In fact, it was difficult for the human ear to distinguish between the two sounds. In response to the false positive data, Huawei began to retrain the model with

audio data from mosquitos. After repeated testing and refining, the latest model can detect 96 percent of chainsaw events.

According to RFCx’s chief operating officer Bourhan Yassin, “Using a high-precision model will significantly reduce the false positive rate and eliminate ineffective deployment of forest rangers.” Costa Rican rangers spend a lot of time and effort patrolling all corners of the rainforest daily to prevent illegal logging. A local ranger, Juan, says that he now walks a smaller area every day but can protect a wider swathe of land. As the model continues to be improved and optimized, fewer and fewer false alarms are generated.

Using AI to understand animal communication

Illegal logging in Costa Rica not only leads to the destruction of precious virgin rainforest, but also threatens the survival of endangered species such as spider monkeys. These rare monkeys play an important role in maintaining the ecosystem of the Costa Rican rainforest – they’re highly efficient seed dispersers that help trees to multiply by



spreading seeds throughout the forest.

But to protect something, you first need to find it. Locating spider monkeys in the vast rainforest is incredibly difficult. RFCx biologist Ruth has been tracking signs of spider monkeys for a year, often spending entire days doing so. It's very difficult to improve the efficiency of her work, she says, and a day of tracking primates leaves her exhausted.

To develop a more efficient way of conserving the spider monkeys, Huawei is helping RFCx build an intelligent model that detects and analyzes their sounds. It can identify the sounds using AI and send precise positioning information in real time. The model provides information about the primates' whereabouts and emotional state, helping RFCx to understand their living habits and conditions so that forest rangers and biologists can protect the endangered species better.

In the early stages of the project, there were a number of challenges in getting the AI model to identify spider monkey sounds. First, the RFCx provided too few sound samples of

spider monkeys and as few people have heard them, there was a lack of learning samples for the AI model. Second, spider monkeys have a call that varies in duration and their calls can be subdivided into three unique types. Moreover, the number of samples for each type varied.

To solve these problems, the HUAWEI CLOUD AI technical team superimposed the small number of samples they had over environmental sounds from the rainforest to generate a large number of data points that were close to the actual environment, mitigating the lack of samples. Then, the team looked at the dimensions of time division and number of frequency features. They reduced the detection window of the model from 1 second to 500 milliseconds and increased the number of frequency features from 40 to 96. These adjustments greatly improved the model detection accuracy.

Meanwhile, to help AI engineers optimize and train the spider monkey model, a Huawei team member accurately marked the start and end time of spider monkey sounds from the audio

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collected from the rainforest. Huawei’s animal language translator described her role as the “AI model breeder”, because the sound data she labelled helped the AI model to identify and learn more accurately.

The chainsaw monitoring model and the spider monkey sound model have been deployed separately in a number of countries and regions. Together, RFCx and Huawei have protected over 2,000 square kilometers of rainforest. Although data feedback on the recall of the spider monkey model is not yet available, the response of the local team has been very positive. Ruth has been able to create a map of spider monkeys based on the data analysis to accurately predict their activity. By better understanding their behavior patterns, she can improve her research and conservation efforts.

Jenna Lawson, a PhD researcher at Imperial College London, said, “AI allows me to train a machine, to train an algorithm to detect the species I’m researching. At the moment, I am collecting 200,000 hours of data. It would take me 60 years every single day to do the analysis on my own, if I wanted to listen to it. Without AI, we can’t analyze these large data sets. We will then use that data to find the different calls of

the animals, and build distribution maps of their habitats.”

When an earthquake struck the Costa Rica Osa Peninsula at 23:23 (local time) on June 25, 2019, the AI sound model accurately picked up the spider monkeys making abnormal sounds in the middle of the night after the earthquake.

Upgrading ecological protection with AI

Through their collaboration, Huawei and RFCx expect to protect 6,000 square kilometers of rainforest and 4 billion trees by 2020, reducing carbon dioxide emissions by 300 million tons. At the same time, 450 years’ worth of audio data will be collected to help us better understand the rainforest and conserve rainforest biodiversity.

With the help of AI, forest rangers and biologists in remote regions are no longer alone in their fight to safeguard the world’s rainforests. We look forward to working with more partners to achieve tremendous progress through small actions, bring digital technology to everyone, everywhere, and build a fully connected, intelligent world with technology. [www](#)