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**News Release-the Ecological Society of America**

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**July 23, 2020**For Immediate Release   
  
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**Machine learning streamlines detection of African forest elephant vocalizations**

*A neural network model reduces the amount of audio data requiring human inspection by 98%*

A new artificial intelligence application can pinpoint low-frequency elephant calls buried within vast stores of audio recordings, bypassing the bottlenecks that researchers face when they sort through data by hand. Jonathan Gomes-Selman and Nikita Demir, both recent graduates of Stanford University, trained an artificial neural network to “listen” to audio files and pick out all the sound bites containing the rumblings and grumblings of African forest elephants.

Isolating elephant rumbles from the cacophony of other rainforest sounds has traditionally been a time-intensive process requiring a lot of human effort — an effort that Gomes-Selman himself has contributed to. While volunteering for the Cornell Lab of Ornithology’s Elephant Listening Project as a high school student in 2013, Gomes-Selman was responsible for sifting through recorded audio data and manually identifying the elephant calls. “Moving forward, I always had in the back of my mind the idea that the work I had been doing surely could be automated and knew how powerful such a tool could be,” says Gomes-Selman.

Gomes-Selman has since followed through on this idea, working with Demir to develop a neural network model using data collected by The Elephant Listening Project, whose autonomous recording devices, placed in elephant habitat across Central Africa, have collected audio data amounting to over a century’s worth of playback time. The lab’s recordings have guided efforts to combat poaching and other human-induced stressors that threaten the species’ survival, and may hold answers to long-pondered mysteries of elephant communication and social behavior. Dr. Andreas Paepcke of Stanford University and Dr. Peter Wrege of Cornell University are advisors on this project.

Much of the data collected by the Elephant Listening Project comes from open forest clearings, called “bais,” where elephants often congregate. But Gomes-Selman and Demir were interested in a setting where elephants’ social behaviors are more shrouded in mystery: the densely vegetated lowland rainforest of Nouabalé-Ndoki National Park. The park, located in the Republic of the Congo, consists of nearly a million acres of pristine forest.

While moving about in lowland rainforest, elephants communicate partially through “rumbles,” a low-frequency, long-range vocalization that is often undetectable to the human ear, but can be picked up by passive audio monitoring devices. And even though deploying the recording devices in such a remote region can require days — or even weeks — of hiking, the devices, once placed, can detect elephant rumbles anywhere within 3km^2 of surrounding forest.

Many conservation crowdsourcing projects have popped up in recent years and provide volunteers with the opportunity to participate in “people-powered” research. But the field of conservation biology is also full of opportunities for computer scientists — or future computer scientists — who want to use their skills and ideas to make conservation efforts more efficient and more effective.

Gomes-Selman plans to continue bridging his interests in conservation and computer science, including specific plans to continue collaborating with the Elephant Listening Project. “Right now we are working primarily on post-processing of data that has been extracted from the field,” he says, “but one ultimate goal is to eventually help design or influence the creation of real-time detectors that can be deployed in the field and transmit real-time data to assist in elephant conservation.”

This contributed talk, “Automatic detection for passive acoustic monitoring of the African elephant,” is part of a [session](https://eco.confex.com/eco/2020/meetingapp.cgi/Paper/86627) all about methods and tools for working with big data in ecology. Other presentations in the session include:

* [Establishing monitoring systems for Vietnam's payments for forest environmental services mechanism](https://eco.confex.com/eco/2020/meetingapp.cgi/Paper/86571)— Lauren F. Keller, Truong Le Hieu, Dang Thuy Nga, Le Thanh Binh, and Nguyen Phan Dong, Winrock International
* [Assimilation of tree ring and forest inventory data to forecast future growth responses of Pinus ponderosa](https://eco.confex.com/eco/2020/meetingapp.cgi/Paper/86604) — Kelly Heilman, University of Arizona; Michael C. Dietze, Boston University; John D. Shaw, USDA Forest Service; R. Justin DeRose, Utah State University; Stefan Klesse, Swiss Federal Research Institute WSL; Andrew O. Finley, Michigan State University; Jacob Aragon, Andrew T. Gray, Alexis H. Arizpe, and Margaret E. K. Evans, University of Arizona

COS 125 - Big Data In Ecology - Methods and Tools 7**— Automatic detection for passive acoustic monitoring of the African elephant**

* Jonathan M. Gomes-Selman, Nikita N. Demir, and Andreas Paepcke, Stanford University; Peter Wrege, Cornell University
* Presentation [abstract](https://eco.confex.com/eco/2020/meetingapp.cgi/Paper/86627)
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