New acoustic technology makes tracking biodiversity faster and cheaper

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Video Abstract

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Abstract

New sound-recording technology could help researchers keep closer tabs on biodiversity—a rapidly dwindling measure of global health. Biodiversity is critical to maintaining the global ecosystems that provide our basic needs – air, water and soil able to grow food. Human activities such as overexploitation of resources, pollution, habitat alteration and climate change are causing biodiversity loss so extreme that many caution we are entering the sixth mass extinction. But it's not too late. World leaders have united to promise to conserve biodiversity. Meaningful efforts, however, require cost-effective strategies. One of the most promising solutions to emerge in recent years is passive acoustic monitoring. Natural soundscapes provide rapid insight into the diversity of animals in a certain location, based on metrics known as acoustic biodiversity indices. These audio features are proven to predict the number of species in a given area. Although very promising, current acoustic technology is high in cost and low in energy efficiency. Many critical biodiversity hotspots are in remote areas with no Wi-Fi or power networks, limiting the potential for much-needed long-term monitoring. Now, this all-in-one sensor design could make acoustic monitoring significantly more convenient. Equipped with a microphone, a low-cost signal-processing chip, and a network signaling module, the device can capture and analyze acoustic signals and immediately send the results to a central hub. Deceptively simple, this design represents two important improvements over existing devices. First, the device is faster. Most state-of-the-art systems carry out signal measurement and processing separately. In this new system, measured signals are automatically converted to a corresponding acoustic biodiversity index. That means researchers can get the results they need directly. Second, the design is more energy-efficient. The system runs lightweight communication protocols, and only the calculated index is immediately transmitted to a server, ready for review. Compared with similar detection systems, the new device showed considerable performance improvements. With no degradation in acoustic data quality, the new system offered power savings of up to 280%. And the acoustic index of a 1-minute recording could arrive to the server 30 seconds after being recorded, allowing for near-real-time analysis. Further improvements could yield even greater gains in performance. For example, data collection and processing efficiency could be boosted by deploying a large network of connected sensor devices. These and other tweaks could make the new system a powerful tool for monitoring biodiversity around the globe.