Biodiversity conservation

Focus area

The problem

The current state of biodiversity conservation often involves manual data collection, which can be inefficient and laborious, leading to gaps in knowledge and limited understanding of ecosystem dynamics. Furthermore, monitoring elusive species such as those in dense forests or underwater habitats presents significant logistical hurdles and often requires substantial resources. The lack of real-time monitoring capabilities also hampers conservation efforts, as timely intervention is crucial for mitigating threats such as habitat destruction and poaching. Additionally, the sheer volume of data generated from various sources, including field surveys, remote sensing, museum collections, and citizen science initiatives, poses challenges in data management, analysis, and interpretation. These issues collectively hinder the effectiveness of biodiversity conservation initiatives.

The opportunity

AI applications offer a range of tools and technologies that significantly contribute to monitoring, analyzing, protecting, and restoring diverse ecosystems. One key application is the use of AI in data analysis, where machine learning algorithms can process vast datasets, identify patterns, and predict changes in biodiversity in space and time that can support conservation efforts. This aids researchers in monitoring species populations and trends, tracking migration patterns, and assessing ecosystem health. It can additionally help the conservation community identify the highest conservation priority areas, informing the design of wildlife corridors and protected areas. Furthermore, machine learning algorithms can assist in identifying endangered species, combating illegal poaching, and managing invasive species. Integrating AI into conservation strategies enhances the precision and speed of decision-making, ultimately contributing to the preservation of biodiversity in the face of numerous environmental challenges. It's also worth noting that the above-mentioned applications need not apply only to wild species. They can also be used on domesticated species, most notably cattle. Computer vision and facial recognition platforms would avoid the need for physical tagging, and AI can also

leverage satellite imaging and machine learning algorithms to trace cattle movement across large tracts of land.

Some of the potential tools and uses that could be used with AI for biodiversity conservation include:

- **Endangered species monitoring:** Important species that are targets for conservation can often be elusive, hard to track, and unknown in terms of behavior and population numbers. Camera traps have opened a new frontier by capturing images of elusive species in different ecosystems, and today there are millions of images that can be used to identify and monitor biodiversity, but we don't have the capacity to analyze them.

- **Discovery of hidden biodiversity:** The vast majority of species that we conserve are neither seen nor heard and come in the form of microbes and fungal communities. Environmental DNA is a tool that is transforming our ability to do conservation science. One notable example is the use of AI in eDNA metabarcoding analysis. Machine learning algorithms can process large volumes of genetic data extracted from environmental samples, identifying and cataloging species present in ecosystems more rapidly and accurately than traditional methods. This accelerates biodiversity assessments, aiding in the monitoring of endangered or elusive species. Additionally, AI can contribute to the development of predictive models that analyze eDNA data alongside environmental variables, helping researchers understand how different factors impact biodiversity.

- **Bioacoustics tools:** These tools allow us to build soundscapes, comprised of the diverse sounds produced by ecosystems, that offer valuable insights into the health and dynamics of natural environments. This type of tracing can aid conservation and rewilding efforts by furthering understanding of population numbers, preferred habitats, and human interactions. AI algorithms, particularly those designed for audio analysis, can efficiently process large volumes of acoustic data, distinguishing and identifying individual species' vocalizations. This capability enables researchers to monitor biodiversity, assess population dynamics, and detect changes in ecosystems over time. AI-driven acoustic monitoring systems facilitate real-time data collection,

aiding in the early identification of disturbances or threats to wildlife. Additionally, AI can contribute to the creation of responsive soundscapes, mimicking natural conditions to attract and support specific species. By harnessing AI in the analysis and management of soundscapes, conservationists can better protect and restore nature.