PROJECT SUMMARY

Overview:

Wildlife population biology and conservation research has been recently revolutionized by the advancement of ubiquitous computing, data science, and computer vision technologies. Together, they offer solutions for large-scale data collection and rapid curation of raw data for population modeling and social network analysis; they can empower not only researchers and technicians but also citizen scientists. People, with different skill sets and goals, are central to the success of this socio-technical system. For instance, conservation scientists want to know who the animals are and when and where they are seen, but citizen scientists may want to know about a single animal or species, follow their sightings, and virtually adopt one. While the former is a domain expert, the latter can contribute rich data (e.g., geo-tagged photos). Technicians, who currently collect and analyze wildlife monitoring data manually, are indispensable in improving the intelligence of autonomous systems through varied levels of supervision--but are rarely tech savvy. Leveraging this complex and deeply coupled relationship between different user types and their diversified use of technology can paradigm shift the capability of wildlife researchers to advance science and conservation efforts. But how to design human-centered data science (HCDS) tools for this socio-technical system? To that end, this project will (1) gather and analyze data from different stakeholders to establish user requirements; (2) design machine learning algorithms tailored for human use and understanding; (3) iteratively design and build an HCDS tool, Wildbook, leveraging our existing data science and computer vision infrastructure (Image-Based Ecological Information System); and (4) evaluate Wildbook in several deployment configurations. We seek to improve our fundamental understanding of how human-centered data science can advance wildlife science and conservation.

Keywords: Human-centered data science, HCI, data science, socio-technical system, computer vision, citizen science, animal behavior, conservation, image analysis

Intellectual Merit:

First, this project will deliver a data science tool, Wildbook, that integrates seamlessly into the sociotechnical ecosystem of wildlife science and conservation. By exploiting the wealth of image data from scientists, eco-tourists, and casual photographers, Wildbook will enable large-scale animal population surveys, home range and social network analyses. Not only will the scale and scope of these studies be transformed by the wealth of data on individual animals and their actions, but also these studies are increasingly becoming urgent for understanding and managing threatened or endangered species. Second, our project will advance human-centered data science: By employing a human-centered design approach in developing Wildbook for large-scale analysis of heterogenous wildlife monitoring data, we will contribute a deeper understanding of the associated design challenges. For instance, how do we achieve algorithmic transparency to bring users in-the-loop? How do we design to provide value to the producers of ?big data?? The knowledge generated will reveal new theoretical constructs and yield a set of design principles for Human-Centered Data Science in wildlife monitoring.

Broader Impacts:

Wildlife researchers, both scientists, and technicians, will be empowered via data science and computer vision methods to answer questions about individual animals and their ecological and behavioral decisions as well as the outcomes of those decisions on the dynamics of their populations. Wildbook will support inquiries never before possible in wildlife science and conservation. By developing Wildbook as human-centered, scalable to many animal species, and easily-deployable, we will be providing a ready-to-use wildlife monitoring and conservation tool to the wildlife research community that is both far more advanced and far easier to use than anything currently available in practice. With Wildbook, conservation policies will be evidence-based and rapidly evaluated, enabling more agile conservation action, saving our planet's biodiversity. Finally, ordinary citizens will need to only upload a few images to Wildbook to see results and learn about specific animals and their life histories, thus, getting engaged in science and conservation as never before. Empowering general public to become citizen scientists will create data-driven educational opportunities and awareness of science and environment, build a sense of community and even ownership, and attract onlookers. Access to nature, science, and education will be democratized.