Project Alpha India 1

MV/AI for Wildlife Rehabilitation

ELECOMP Capstone Design Project 2024-2025

Sponsoring Company:

SANCTUARI
Box 559
Warren, RI 02885
https://sanctuari.org/

Company Overview:

SANCTUARI is a 501(c)(3) nonprofit wildlife care organization improving wildlife survival rates by leveraging modern technology. We are privately supported without federal, state, or municipal funds and are unaffiliated with other Rhode Island wildlife organizations.

Technical Director:

Joe Moreira
Founder and Board Chair
sanctuari.org@gmail.com

Project Motivation:

There are insufficient numbers of wildlife rehabilitators to serve wild animals in need. Many rehabilitators are overextended and therefore struggle to provide the highest quality of care. This project aims to help solve this fundamental issue with Machine Vision/Artificial Intelligence (MV/AI) technologies. These technologies today can fundamentally improve wildlife rescue and rehabilitation as well as veterinary medicine. SANCTUARI has amassed nearly 0.75 PB of proprietary, mission-critical video records. This project will intelligently filter those for relevant animal content which will then be used to develop AI for pairing with video monitoring systems. Those systems will greatly improve the carrying capacity and diagnostic effectiveness of wildlife caregivers via numerous methods to be demonstrated as the project advances.

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Anticipated Best Outcome:

Completing at least 3 of these 6 goals will be considered achievement of the Anticipated Best Outcome (ABO): (a) Design of a system for filtering the most relevant video records and (b) use of this system on all video files; in parallel, (c) design of a system for using videos which pass all filters to (d) properly train and (e) test an AI, which will then (f) deploy into active use as live video monitoring "virtual helpers" for wildlife carers.

Project Details:

Team members will function as if all are co-CEOs of a new organization. The team will achieve its goals by defining a comprehensive, complete logical workflow, with substantial help from their Technical Director (TD), then by building a system of software tools to implement that workflow. Multiple technical efforts will be pursued in parallel to make the project a success. Team members will be empowered to use their knowledge (and/or "their Googles") to leverage *existing* OS-embedded functionality, standalone software packages for purchase, free apps, and more to achieve the project goals. Products from Microsoft, Apple, Samsung, Google, Amazon, and others may be fully considered wherever the team recommends, and whatever cannot be achieved with such tools will be considered for coding "from scratch."

Below are a few examples of the technical work within the project's scope.

- Parameter homogenization and standardization – *notes:*
  - Files have no audio, so all engineering work will be on visual content only.
  - Files are sourced from ~50 cameras from ~4 systems (GW, Lorex, Firstrend).
  - All cameras are fixed position.
  - Roughly half are indoor and half outdoor, each with unique filtering challenges.
  - All cameras are day/night, so filtering must be tailored and tested both for full-color (daytime) and grayscale infrared (IR night vision) file content.
  - Cameras and systems may have different native resolutions, frame rates, lens types, default file formats (/codecs), so the team will collaborate with the TD to decide how best to standardize, and in some cases, upconvert.

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- Content filtering workflow – *notes:*
  - Relevant animal content is to be isolated from ~0.75 PB of videos.
  - Most files are generated via motion capture triggers, requiring filtering and/or area masking for non-animal triggers such as:
    - Changes in illumination, for example:
      - Lights turning on and off indoors,
      - Sun and clouds alternating outdoors,
      - Branches swaying in wind occulting streetlights at night, and
      - Passing vehicle lights, to name a few.
    - Non-animal motion triggers, for example:
      - Windblown items (leaves, branches…),
      - Rain, snow, hail…, and
      - Pollen at night, which is very IR-reflective and challenging to filter, as its appearance can resemble animal motions, such as a vole's eyeshine as it runs across a grassy field at night.
  - Videos must also be put through a "human filter" before all other filters.
    - All videos containing people sequestered and put through each of the other filters separately to satisfy privacy requirements (Amazon delivery drivers, donors and rehabbers who wish to remain anonymous, etc.)
    - A tri-redundant filtering system is desired for this step.
    - It must detect partial captures (just hands, just feet, just faces, etc.)
    - It must be able to blur faces/protect identity.

- Some AI uses for videos which pass all filters – *notes about attributes to deduce:*
  - Species (and number of each) in frame.
  - Individuals within species in frame.
  - Animal posture/positioning.
  - Macroscopic, visible injury, by species (missing limbs, lack of IR eye shine, missing patches of fur due to bites and/or mange, etc.)
  - Breathing rate.
  - Activity type (eating, drinking, grooming, sleeping, foraging, playing, etc.)
  - Abnormal posture and gait, by species.
  - Presence/absence of food/water in frame.
  - Need for caregiver to clean (for indoor cameras)

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Composition of Team:

2-4 Computer engineers. (Preference will be given to those taking the ML/AI course on Thursday evenings with Dr. Megan Chiavaro, from SeaCorp.)

Skills Required:

The most important team member attribute is deep concern for animal welfare.
SANCTUARI's extensive experience with these types of projects shows us that a group of engineers with "mediocre grades" who are passionate about the mission will be much more successful than a group of "A+ coders" who are ambivalent about the mission. Other desired traits include:

- Quick learning; high curiosity; comfort with various technologies/schemes.
- Propensity for meticulous analysis and testing.
- Self-motivation respecting research of existing, relevant solutions; capability to aggregate and compare strengths/weaknesses of "competitors" and useful related tech; willingness to engage with outside organizations to collaborate.
- Accountability and willingness to "own" the system design as a good startup CEO would.
- Desire to be hands-on with testing and drive to optimize and wring out design performance, allowing the system to "tell the engineers what it needs next."

Anticipated Best Outcome's Impact on Company's Business & Economic Impact:

Successful execution will allow us to rapidly produce and distribute devices and educational materials to our network of carers and supporters, including veterinarians and licensed rehabilitators. This will help fundamentally improve the quality of wildlife care.

Broader Implications of the Best Outcome on the Company's Industry:

Saving one animal, or expediting their recovery, along with proper documentation and communication, can quickly lead to the saving of thousands more. This project will generate systems to better care for wildlife and will generate data enabling carers to correlate, aggregate, publish, and refine best practices, giving animals better opportunities to thrive.

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