



A 501(c)(3) Nonprofit for Wildlife

Project Alpha India 3

MV/AI for Wildlife Rehabilitation

ELECOMP Capstone Design Project 2026-2027

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(s):

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Project Motivation:

There are insufficient numbers of wildlife rehabilitators to serve wild animals in need. Many rehabilitators are overextended and so struggle to provide high quality care. This project aims to help solve this fundamental issue by leveraging rapidly advancing Machine Vision/Artificial Intelligence (MV/AI) technologies. These can fundamentally improve wildlife rescue and rehabilitation as well as veterinary medicine. SANCTUARI has amassed nearly 1 petabyte of proprietary, mission-critical video records. This project will build upon the previous team's work by deploying refined AI to intelligently filter those for relevant content which will then be used to further develop the AI for pairing with video monitoring systems. Those systems will greatly





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improve the carrying capacity and diagnostic effectiveness of wildlife caregivers via the numerous methods to be demonstrated as the project advances.

Anticipated Best Outcome:

Completing at least **10 of the 30 items** listed with [parenthetical numerical markers](#) herein will constitute achieving the Anticipated Best Outcome (ABO).

Project Details:

Executive Summary

- Team members will be empowered to function as if all are co-CEOs of a new organization. The team will achieve its goals by defining comprehensive and complete logical AI workflows for sorting video content, with substantial help from their Technical Director (TD) and Consulting Technical Associates (CTAs). Both CTAs are from previous Alpha India teams and built a custom hardware solution with software tools to implement several fundamental workflows.
- As much of the work as possible will be done with local AI given security and intellectual property protection concerns.
- This year's team will substantially expand the work of previous teams as the field of AI continues its rapid advance.
- Multiple technical efforts will be pursued in parallel to make the project a success.
- Team members will be empowered to use *existing* AI functionality wherever possible, including standalone software packages for purchase, free apps, and more. Whatever cannot be achieved with such tools will be considered for building "from scratch."

Videos to be analyzed

- The files have **no audio**, so all work will be on **only visual content**.
- Files are from **~50 cameras** from **~4 systems** by GW, Lorex, and Firstrend.
- All cameras are **fixed position**, roughly 50% **indoor** and 50% **outdoor**, each with unique filtering and masking challenges.
- All cameras have **day/night recording** capability, so filtering must be tailored and tested for full-color (daytime) and grayscale infrared (IR night vision).



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- Cameras and systems have different native **resolutions**, **frame rates**, lens types, default **file formats** (/codecs), **motion** trigger **sensitivities**, and pre-/post-record lags.

Content filtering workflow

Files are generated via motion triggers, requiring filtering and/or area masking for non-animal triggers. The previous Alpha India teams structured the AI to allow users to manually mask areas containing irrelevant triggers and then have the AI analyze remaining areas. The team then allowed for enablement of workflows wherein the AI is intelligent enough to ignore irrelevant motion triggers on its own.

Non-animal triggers include changes in illumination, such as from indoor lights turning on and off, indoor lights turning on through a window which is in view of an outdoor camera, sun and clouds alternating outdoors, branches or power lines occulting lights at night by swaying in wind, and passing vehicles, pedestrians, and any of their associated lights (especially when occulted by foreground items at night). Other non-animal motion triggers still being optimized include phenomena such as windblown leaves and branches.

Filtering Weather Phenomena

Designers will look for tools or implement their own from scratch to compliment the existing workflow implemented by previous designers. The team will deploy tools for ignoring (1) rain, (2) snow, (3) sleet, (4) hail (which complicates AI detection by bouncing), (5) fog and (6) pollen (night recording renders fog and pollen brightly due to their infrared reflectivity, and they are challenging to filter, as their motion can resemble animal motion... for example, the nighttime eye-shine of an animal bounding across a field).

Privacy Protection

Videos must also be put through a “**human filter**” before all other filters for sequestration given privacy requirements (donors and rehabbers who wish to remain anonymous, Amazon delivery drivers, USPS postal workers, and so on). A tri-redundant filtering system is desired for this step. One filter was set up by a previous team, leaving (7) (8) two more to deploy to also (9) detect partial field of view incursions (ex.: just hands, feet, and/or faces) and (10) blur faces.



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Note that the previous team implemented Deface for this, but further work is needed to improve the functionality.

Performance Boosting

The Alpha India 3 team will test and possibly (11) refine the previous teams' existing AI hardware platform for speed. The current system can process at a 10:1 ratio for most video formats, taking 1 hour to process and label every frame of 10 hours of video.

Eliminating false motion triggers (prevention of saving of videos of no value)

The team will research, test, and (12) deploy open source software capable of stopping false triggers by intelligently analyzing incoming video data live in real time.

Basic Sortation Refinement

The Alpha India 3 team may choose to (13) improve the previous teams' AI for sorting existing motion-triggered videos accurately and precisely into four basic content categories: animal, human, both, and neither.

Advanced AI recognition of filtered content

Some, but not all, AI uses for distinguishing video content or input which otherwise passes all preceding animal relevancy filters include:

- (14) Species distinguishment (partially done by previous teams)
- (15) Flagging when an animal is not in frame but should be
- For animals in rehabilitator care, determining (16a) presence/absence of food and (16b) water in frame, (16c) the need for cleaning, (17a) enablement of manual masking for exercise wheel recognition or even (17b) AI recognition of wheel use and speed
- Behavior recognition on a per-species basis (initiated by the prior team with LabGym) can include (18) distinguishment of individuals within each species in frame, including (19a) recognition of juvenile evolution to adult and (19b) weight gain/loss or other size/form factor changes, (20a) animal positioning relative to camera, including (20b) recognition of abnormal posture (indicating pain, such as nose-to-ground or "S-pose"),



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macroscopic, visible injuries such as (21a) missing limbs, eyes, ears, noses, etc., (21b) lack of eye shine in infrared, (22a) missing patches of fur, (22b) mange, (22c) conjunctivitis, (22d) lacerations and/or bleeding, (22e) abscesses, parasitic issues such as (22f) fleas, (22g) ticks, and (22h) fly strike, (23) breathing rate, when visible (depth, wave motion, abnormal or alarming known breathing patterns) and similarly with (24) pulse/heart rate where discernible (stress-startle, healthy/unhealthy), (25) juvenile group monitoring (distinguishment of fighting vs. playing), sortation of basic activity types such as (26a) foraging, (26b) eating, (26c) drinking, (26d) grooming, (27a) resting and awake vs. (27b) sleeping vs. (27c) dreaming motions, (28) carrying items, (20c) sitting vs. (20d) standing vs. (29) warning displays, (20e) walking vs. (20f) running, (20g) normal vs. abnormal gait, (20h) climbing vs. (20i) falling, (20j) jumping, (30a) coughing vs. (30b) choking vs. (30c) gape vs. (30d) yawn vs. (30e) “clicking” vs. (30f) “chuffing” vs. (30g) “hissing” (again from video imagery only without sound), (20k) seizing/convulsing vs. (20l) voiding.

Composition of Team: 2 Computer Engineering majors. An Electrical Engineering major who is passionate about this project will be given preference and should write to Professor Sunak.

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.