Wildlife Monitoring Literature Review

Pytorch Wildlife:

This GitHub Repo contains State of the Art detection and classification models for animal detection. The Pytorch Wildlife library uses the Megadetector(made by Dan Morris) to detect animals in a picture, and further uses the AI4GAmazonRainforest classifier(trained on to classify the animals.

This library in particular is considerably relevant to our project since the project deployed in Margalla is using the Megadetector as well. But the catch is that the Megadetector has only been trained on ideal images, and faces a challenge when the images from the deployed cameras in Margalla are a bit hazed by snow, making the snow leopards camouflaged.

These camouflaged images pose a difficulty in classification, but we are not sure as to whether the project currently faces a problem in detection or classification. For the former, we aim to use COD(Camouflaged Object Detection) to enhance the Megadetector, and pass its output onto the AI4GAmazonRainforest classifier.

Camouflaged Object Detection

MIFNet:

This Camouflaged object detection (COD) is a challenging yet vital task for wildlife monitoring systems, particularly in scenarios where animals like snow leopards blend into complex natural backgrounds. Recent research has focused on integrating additional cues beyond standard RGB features to improve detection accuracy.

For example, MIF-NET introduces a dual-branch mixture convolution along with multi-level interactive fusion to expand the receptive field and capture both local and global context. Although this approach enhances feature representation we are not too sure if this will be too resource intensive as one of the goals in the end is to make the model suitable to run on mobile devices.

Moreover, this model does fail in certain scenarios where the background is too complex(contains complex patterns) or if there are multiple camouflaged objects, which could be a problem because this project's goal is to improve classification on not too ideal images.

R2CNet:

Similarly, R2CNet proposes a dual-source information fusion strategy that combines a referring branch—designed to extract common representations from auxiliary images—with a segmentation branch that incorporates mask generation and feature enrichment. This method focuses on detecting specific camouflaged objects rather than all candidate regions, potentially offering improved localization.

This model is an interesting prospect as it outputs the result in a highlighted image as a part of the original image, in contrast to most other COD models that just print a white shape of the detected object, which we are not sure if the Pytorch Wildlife Classifier will give a good classification result from.

AGLNet:

In another significant contribution, the Adaptive Guidance Learning (AGLNet) framework presents an end-to-end model that unifies various auxiliary cues—such as boundary, texture, edge, and frequency information—into the detection process. By employing modules for additional information generation, hierarchical feature combination, and recalibration decoding, AGLNet achieves substantial performance gains over existing methods. Integrating these advanced techniques with established pipelines, like those available in the Microsoft CameraTraps repository [CameraTraps], could enhance wildlife monitoring systems by improving the detection and classification of camouflaged animals, especially under challenging conditions.

Some Questions, Concerns and Ambiguities:

- Which classifier is the margalla project currently using? Is it the Pytorch wildlife (AI4GAmazonRainforest) classifier?
- Does Pytorch wildlife find it difficult to detect or classify?
- Even if we improve the detection of the Megadetector with COD State-of-the-art, the outputs are all white shapes of the object, can the Megadetector classify these?
- We haven't explored Salient Object Detection(SOD) techniques as Megadetector a is State-of-the-art model for SOD, we can't really do much better than that

References

- Pytorch Wildlife and Microsoft CameraTraps Repository: https://github.com/microsoft/CameraTraps.git

- MIF-NET: A Holistically Point-guided Text Framework for Weakly-Supervised Camouflaged Object Detection. Available at: https://arxiv.org/pdf/2501.06038

- R2CNet: Towards Accurate Camouflaged Object Detection with Mixture Convolution and Interactive Fusion. Available at: https://arxiv.org/pdf/2101.05687

- AGLNet: Adaptive Guidance Learning for Camouflaged Object Detection. https://arxiv.org/pdf/2405.02824