Informatics

Interdisciplinary Project
Low-Energy ML in Veterinary Medicine

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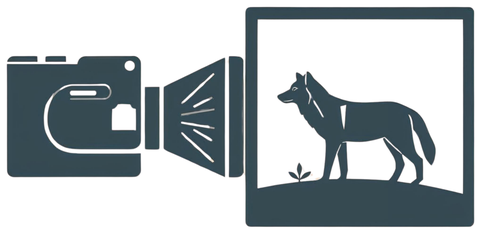
ABSTRACT

The Vienna University of Veterinary Medicine is interested in exploring the field of low-energy machine learning in veterinary medicine. In three phases, potential use cases for computer vision for animals were gathered, then combined with relevant models applied, and finally tested against a dataset. As a result, we deliver a reproducibility experiment on the study by Carl et al. [1], which tests the Inception-ResNet-v2 model for wildlife animal identification. We achieve an overall classification accuracy of 62%, aligning with the 71% accuracy reported by Carl et al. We provide all components required for reproducibility: data, source code, and runtime requirements [2]. Based on the observed results, we support the validity of the original study and present clear recommendations on future work that could ultimately yield a powerful and energy-efficient model able to provide accurate predictions for a set of relevant wildlife images.

LITERATURE RESEARCH
Low-Energy Machine Learning in Veterinary Medicine



DOMAINS

Livestock farming

- health tracking
- fertility monitoring
- behavior analysis

Wildlife research

- data collection for population control
- wildlife conservation
- behavioral research

Pet care

- remote health tracking and diagnostics
- smart wearables

STRATEGIES

Internet of Things

- Specialized low-energy sensors collect data.
- Cloud services process the data with powerful hardware and ML models.

Edge AI

- Edge devices run inference on low-power computing hardware.
- Model feedback is directly used for the continuous operations.

ALGORITHMS

Supervised models were found to be more popular in veterinary medicine applications.

Supervised models

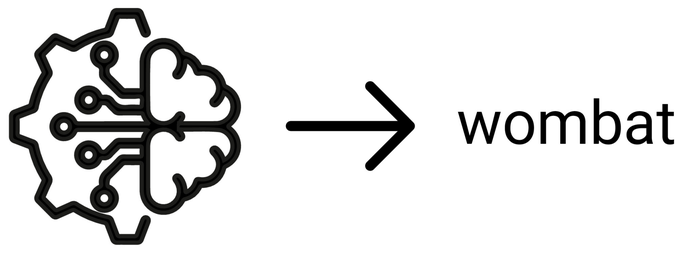
- Convolutional Neural Networks
- Support Vector Machines
- Random Forests
- Regression models

Unsupervised methods

- Clustering
- Anomaly detection

Transfer learning of deep convolutional neural networks is particularly popular and can yield powerful models for various computer vision tasks in veterinary medicine.

REPRODUCIBILITY EXPERIMENT
Automated Wildlife Species Detection



MODEL

- Inception-ResNet-v2
- 55M parameters
- Pretrained on ImageNet dataset with 1,000 output classes

DATA

- Public Google Image dataset
- 90 different species
- 10 samples per species

RESULTS

We support the findings from Carl et al. With a larger data set and a significantly larger number of different species, we still achieve a comparable overall accuracy.

Total accuracy in original study: 71%

Reproduced accuracy with larger dataset: 62%
Macro F1 score: 0.28 (-> accuracy varies significantly)

Species	Accuracy
bison, bear, boar, crab, elephant, eagle, dog, chim- panzee, cockroach, snake, panda, pelecaniformes, pig, koala, orangutan, ladybug, leopard, lobster, hornbill, jellyfish, hyena, hummingbird, goose, goldfish, fox, fly, sandpiper, zebra, wombat, turtle	1
parrot, shark, starfish, squirrel, otter, kangaroo, penguin, coyote, butterfly, flamingo, badger, bee, antelope, hare, gorilla, porcupine, tiger, hamster	0.9
sheep, lizard, lion, cat, dragonfly, wolf	0.8
beetle, hippopotamus, ox, grasshopper	0.7
whale	0.6
duck	0.4
owl, goat, crow	0.3
swan	0.1
caterpillar, bat, dolphin, donkey, cow, deer, mosquito, horse, hedgehog, okapi, moth, mouse, octopus, seal, raccoon, rat, possum, pigeon, oyster, seahorse, rhinoceros, reindeer, squid, sparrow, turkey, woodpecker	0
TOTAL	**0.62**

FUTURE WORK

We propose two adaptions to the experiment to develop a powerful model fit for deployment in wildlife camera traps:

- Switch to MobileNet or EfficientNet to reduce power usage
- Refit model to relevant wildlife species to increase prediction accuracy

REFERENCES

[1] Christin Carl, Fiona Schönfeld, Ingolf Profft, Alisa Klamm, and Dirk Landgraf. Automated detection of European wild mammal species in camera trap images with an existing and pre-trained computer vision model. European Journal of Wildlife Research, 66(4), 7 2020. ISSN 1439-0574. doi: 10.1007/s10344-020-01404-y. URL http://dx.doi.org/10. 1007/s10344-020-01404-y.

[2] Tobias Haider. tobsel7/research-vetmedwien-animal-species-identification: More detailed evaluation and description of experiment results, 2025. URL https://zenodo.org/doi/10.5281/zenodo.17116549.