Identifying Wildlife in Camera Trap Images

Jillian Etheredge

There are currently over 1,300 mammal species threatened with extinction

Wildlife Population Data

- Labeling wildlife image datasets is time-consuming
- Automation of data labeling to shorten data processing time in dataset creation

Snapshot Serengeti

Images from camera traps in Serengeti National Park, Tanzania

This project used about ½ Million of these images

49 different labels

Modeling

Model Creation

- Tools: Google Cloud Platform, Fast.ai's Vision library, PyTorch
- Transfer Learning: Resnet50
  - CNN with residual connections 50 layers deep
    - Pretrained with ImageNet database
- Metrics: Validation Loss and F1 Macro Score

Workflow

- Data Preprocessing
- Train using frozen layers

- Train with unfrozen layers

- Load corrected data set
- Fine tune with unfrozen layers

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Model Creation

- **Initial Results:**
  - Validation Loss: 0.29
  - F1 Macro Score: 0.70
- **Problem Areas:**
  - Incorrect labelling from original data set
    - Single label for multi-species images
    - Images in sequence groups share a label

Model : wildebeest
Dataset: wildebeest

zebra
zebra

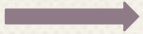
zebra
wildebeest

zebra
wildebeest

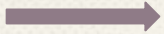
Initial Results Examples

Workflow

- Data Preprocessing
- Train using frozen layers



- Train with unfrozen layers



- Load corrected data set
- Fine tune with unfrozen layers

Fine Tuning

- Addressing Incorrect labeling:
  - New version of training set
    - Only first frame from image sequence
- Results:
  - Validation Loss: 0.14
    - decrease of 0.15
  - F1 Macro Score: 0.79
    - increase of 0.09
  - Improved performance but mislabelling issue remains

Model : empty
Dataset: empty

wildebeest
wildebeest

gazellethomsons
gazellethomsons

empty
warthog

Fine-Tuned Results Examples

Testing on Unseen Data

- App Creation
  - Way to interact with the model while testing on data from a variety of sources

Wildlife Image Classifier

This app uses an image classifying model I created to identify animals in wildlife from camera trap images used by Snapshot Serengeti. Here's a list of animals it's trained on so far! Load a picture of one of these animals and test it out!

- Wildebeest
- Zebra
- Thomson's gazelle
- Hartebeest
- Grant's gazelle
- Buffalo
- Guinea fowl
- Warthog
- Giraffe
- Elephant
- Spotted hyena
- Other bird
- Female lion
- Impala
- Eland
- Topi
- Reedbuck
- Dik Dik
- Cheetah
- Male lion
- Baboon
- Hippopotamus
- Kori bustard
- Ostrich
- Hare
- Jackal
- Bat-eared fox

App Demo

Future Work

Improvements and Applications

Future Improvements

- Addressing single labels for multi-species images
  - Create bounding boxes
    - Label individual animals
    - Allows for collection of count data

Future Applications

- Create a mobile app to identify invasive species
  - Identification, monitoring, and removal of invasive species
  - Educates and gets users involved with wildlife conservation

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Thank you for your time!

Questions?

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For more information about this project:

/Jilliane1993/Wildlife_Image_Classification

Appendix

It's surely our responsibility to do everything within our power to create a planet that provides a home not just for us, but for all life on Earth.

-Sir David Attenborough

128,918 species assessed

Plants, animals, fungi

> 35,500 threatened with extinction

28% of all assessed species

26% of assessed mammals

assessments completed for around 6% of the world's described species

Prediction/Actual/Loss/Probability

zebra/empty / 17.85 / 0.98

warthog/empty / 15.18 / 1.00

cheetah/hyenaspotted / 14.70 / 1.00

empty/dikdik / 14.08 / 0.99

topi/gazellethomsons / 13.89 / 1.00

wildebeest/empty / 13.86 / 1.00

empty/koribustard / 13.40 / 1.00

empty/otherbird / 12.94 / 1.00

empty/ostrich / 12.93 / 1.00

Fine-Tuned Loss Analysis

Future Improvements

- Addressing single labels for multi-species images
  - Create bounding boxes
    - Label individual boxes
    - Allows for collection of count data
- Addressing image mislabeling
  - Manual relabeling of high loss images
  - Concatenation of burst images into single image
- Improving App deployment
  - Explore different deployment options