Using deep learning to recognize individual animals in images

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in cooperation with

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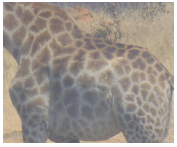
Animal re-identification

- **Objective:** Determine the identity of an animal from an image.

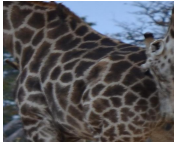
?



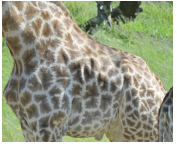
Peter

Fred

Vojta



George



Lukas

Abby

Challenges

- Research in animal re-identification lacks a standardization.

stripespotter

File	Summary + Labels	Uploaded	Size
StripeSpotter.zip	StripeSpotter v2.1 MacOS 10.8 OpSys-OSX	Mar 4, 2013	17.51MB
data-20110718.zip	dataset ZIP archive (3 of 3) Type-Archive	Jul 18, 2011	68.35MB
data-20110718.z02	dataset ZIP archive (2 of 3) Type-Archive	Jul 18, 2011	75MB
data-20110718.z01	dataset ZIP archive (1 of 3) Type-Archive	Jul 18, 2011	75MB
StripeSpotter-v2.1-mac.zip	StripeSpotter for Mac OS 10.5-10.6 Featured OpSys-OSX Type-Archive	May 15, 2011	234.54KB
data-20110513.z02	dataset ZIP archive (3 of 3) Type-Archive Deprecated	May 13, 2011	75MB
data-20110513.z01	dataset ZIP archive (2 of 3) Type-Archive Deprecated	May 13, 2011	75MB
data-20110513.zip	dataset ZIP archive (1 of 3) Type-Archive Deprecated	May 13, 2011	67.38MB
StripeSpotter-v2.0-mac.zip	StripeSpotter for Mac Deprecated	Feb 24, 2011	234.52KB
wxMSW-2.8.11-Setup.exe	wxWidget 2.8.1	Feb 17, 2011	11.22MB
vcredist_x86.exe	Visual C++ 2008 Redistributable Featured Type-Installer OpSys-Windows	Feb 16, 2011	1.74MB
StripeSpotter-v2.0.zip	StripeSpotter (Windows, ZIP file) Type-Archive OpSys-Windows Featured	Feb 15, 2011	1.2MB
data.z02	dataset ZIP archive (3 of 3) Deprecated	Feb 15, 2011	95MB
data.z01	dataset ZIP archive (2 of 3) Deprecated	Feb 15, 2011	95MB
data.zip	dataset ZIP archive (1 of 3) Featured Type-Archive Deprecated	Feb 15, 2011	27.34MB
StripeSpotter-v2.0.zip.zip	StripeSpotter (Windows, ZIP file) Featured Type-Archive OpSys-Windows Deprecated	Feb 12, 2011	1.2MB

iPanda-50

The iPanda-50 dataset consists of 6,874 images of 50 giant panda individuals with 49 ~ 292 images per panda. The iPanda-50 dataset is used for fine-grained panda identification and it was proposed in Le Wang, Rizhi Ding, Yuanhao Zhai, Qilin Zhang, Wei Tang, Nanning Zheng, and Gang Hua, "Giant Panda Identification", IEEE Transactions on Image Processing, 2021. In case you do not have convenient access to IEEE Xplore, the preprint PDF can be accessed here from Github.io or here from xjtu.edu.cn. If you find this dataset helpful in your research, please consider citing this publication.

```
@ARTICLE{Wang21Giant,
author={Le Wang and Rizhi Ding and Yuanhao Zhai and Qilin Zhang and Wei Tang and Nanning Zher
journal={IEEE Transactions on Image Processing},
title={Giant Panda Identification},
year={2021},
volume={30},
pages={2837-2849},
doi={10.1109/TIP.2021.3055627}}
```

This dataset can be downloaded as ZIP files from the following URLs. Some filenames of the JPG images contain UTF-8 characters, please enable proper encoding while reading these files.

- (***Not recommended***: single zip file, requiring client software) Baidu NetDisk/Wangpan 百度网盘 Extraction code 提取码: `ohln` File Size: 885.8M
  The 'iPanda-50.zip' file contains three folders, i.e., "iPanda50-images", "iPanda50-split", "iPanda-50-eyes-labels".
  Note: Baidu NetDisk/Wangpan service may require a client software (Baidu Netdisk) installed on your machine before allowing you to download. If you prefer not to install any software, please try the alternative download links as follows.
- (***Recommended***: 3 Zip files, direct download links) Please download all three ZIP files for the images, train/test split settings and the additional eye annotations, respectively.

Files	File Size	MD5 checksum	Download Servers
iPanda50-images.zip	883M	`46727b709139ad3306491f9c11eaefba`	[Google Drive], [Dropbox], [MS OneDrive]
iPanda50-split.zip	137K	[illegible]	[Google Drive], [Dropbox], [MS

Goal of our work

Enhance ecological and machine learning research with:

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Enhance ecological and machine learning research with:

- **Unified and easily accessible datasets.**

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Enhance ecological and machine learning research with:

- **Unified and easily accessible datasets.**
- **Simple interface for state-of-the-art methods.**
- **Baseline approach for general animal re-identification.**

WildlifeDatasets + WildlifeTools + MegaDescriptor = ♥

Animal re-identification datasets at hand.

Tools for inference and fine-tuning.

One model to suit them all.

WildlifeDatasets – Easy access to animal re-id datasets

- **Core feature:** Access to 33 datasets (and growing) in a standardized form.

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```python
from wildlife_datasets import datasets

datasets.StripeSpotter.get_data("data/StripeSpotter")
metadata = datasets.StripeSpotter("data/StripeSpotter")
```

WildlifeTools – Accessible feature extraction and matching

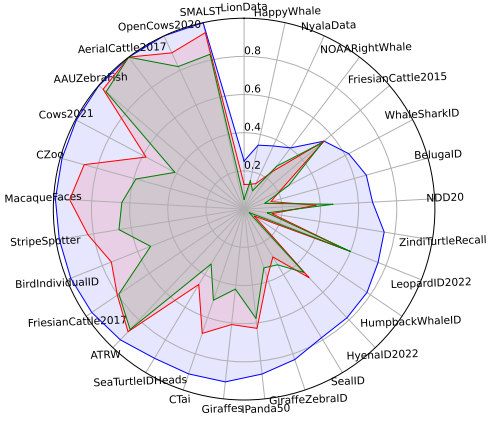
- **Core feature**: User-friendly API for animal re-identification.
  - Fine-tuning, local descriptors, pre-trained deep models, matching, etc.

```
from wildlife_tools.data import FeatureDatabase
from wildlife_tools.inference import KnnMatcher

model = timm.create_model("model_path", pretrained=True).eval()
database = FeatureDatabase.from_file("database_file")
query = model(transforms(Image.open("./query_img.png")).unsqueeze(0))
KnnMatcher(database)([query])
>>> ["id_george"]
```

MegaDescriptor - One model to suit them "all"

- *"Foundational"* model for animal re-identification.
- *Decent* performance across a wide range of species.
- *Good* model for fine-tuning on any species.



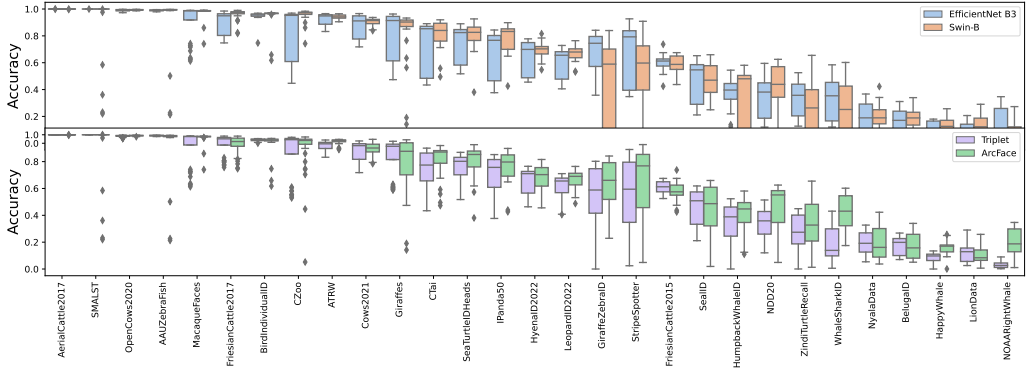
MegaDescriptor-L – Swin-L/p4-w12-384

DINOv2 – ViT-L/p14-518

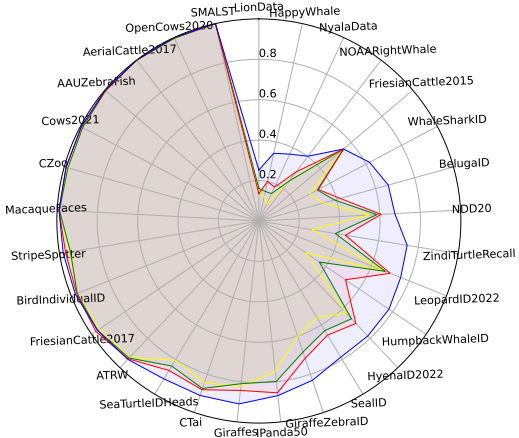
CLIP – ViT-L/p14-336

MegaDescriptor – Model selection and methodology

- Trained on 253,811 images and 30,275 identities.
- Based on Swin transformer architecture.
- Optimized with ArcFace loss.



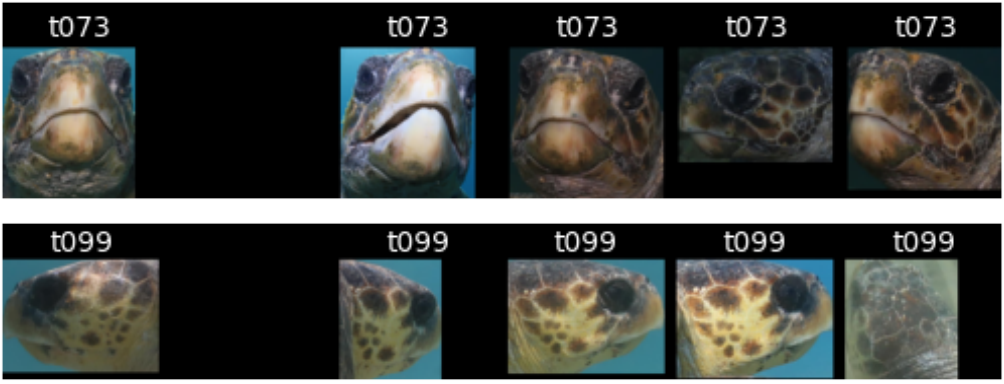
MegaDescriptor – Flavors



- MegaDescriptor-L – Swin-L/p4-w12-384
- MegaDescriptor-B – Swin-B/p4-w7-224
- MegaDescriptor-S – Swin-S/p4-w7-224
- MegaDescriptor-T – Swin-T/p4-w7-224

Future work

- Large datasets for animal re-identification
- Matching left and right sides of animals



Thank you for your attention

Questions?

WildlifeDatasets

WildlifeTools