

Graphical Interactive Systems
Technische Universität Darmstadt



Animal Biometrics

Visual Computing Praktikum – SS 2018

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1. Introduction and Motivation
2. Problem 1: Classification of Species
 - Data Set
 - Architecture
 - Results
3. Problem 2: Classification of Individuals
 - Data Set
 - Architecture
 - Results
 - Alternative Approach
 - Finetuning for Individuals



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Introduction and Motivation



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Figure 1: Animal Biometrics Example

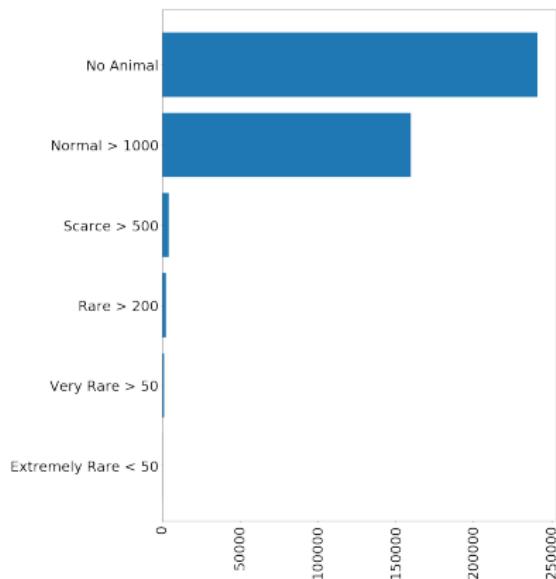
Outline



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Data Set



- ▶ Unbalanced data distribution (3 to 190k images per class)
- ▶ 87 classes/individuals
- ▶ Low quality images from camera traps

Figure 2: Reduced data distribution of species data set



Good Example Images



Figure 3: Marbled Cat



Figure 4: Mouse Deer



Bad Example Images

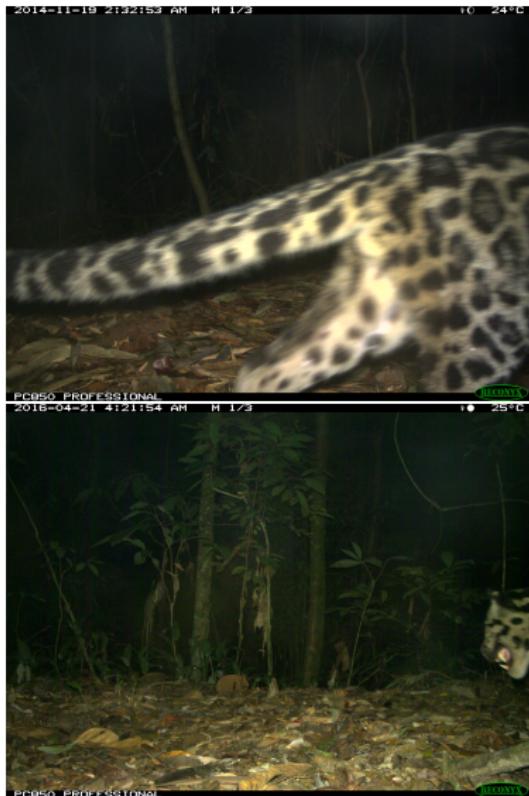


Figure 5: Bad quality training images

Architecture

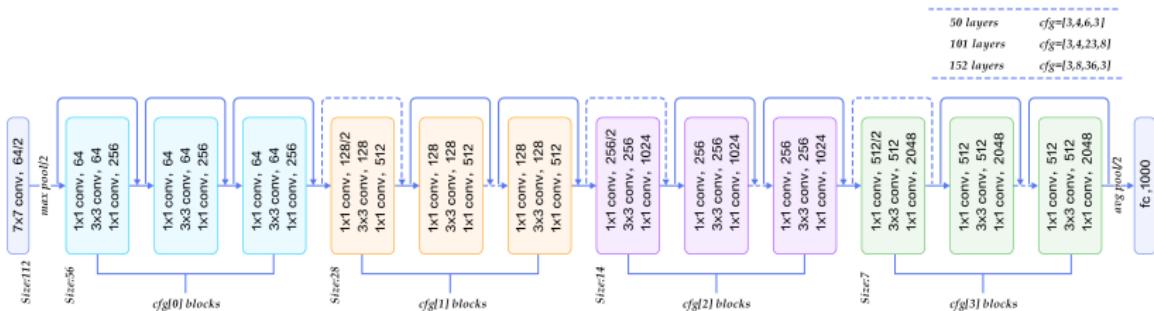


Figure 6: ResNet Architecture

[<https://www.codeproject.com/Articles/1248963/>]

Deep-Learning-using-Python-plus-Keras-Chapter-Re]

- ResNet-50 finetuning and from scratch

Scores

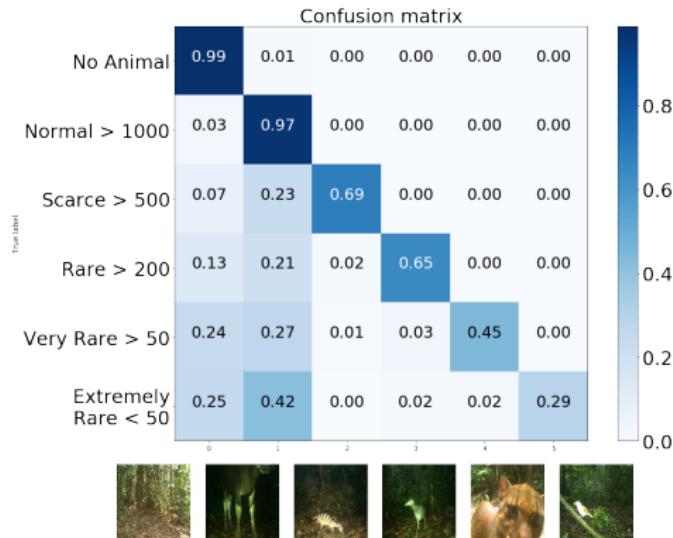


Figure 7: Reduced confusion matrix for finetuned ResNet-50

Training Process



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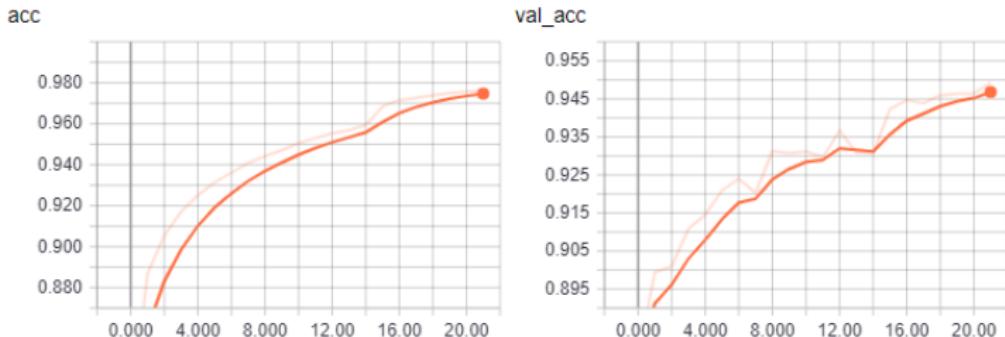


Figure 8: Accuracy during Training



Positive Examples



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Figure 9: Correct attention and classification

Positive Examples



12

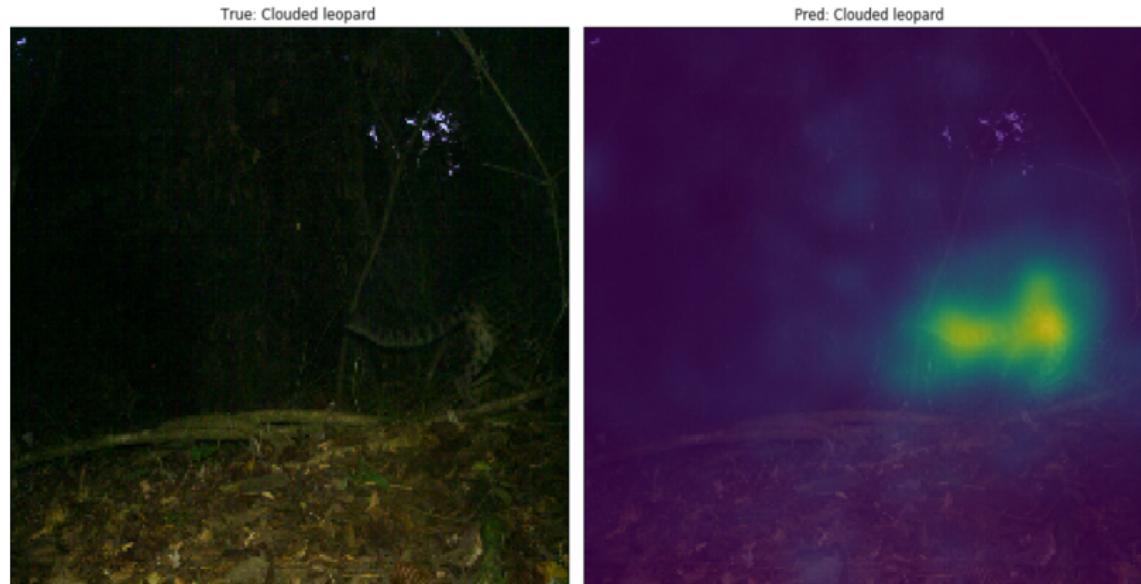


Figure 10: Correct attention and classification



Negative Examples



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True: Crested fireback



Pred: Mousedeer



Figure 11: Noisy labels



Negative Examples



14

True: Common palm civet



Pred: Long-tailed porcupine



Figure 12: Correct Attention, wrong label

Negative Examples



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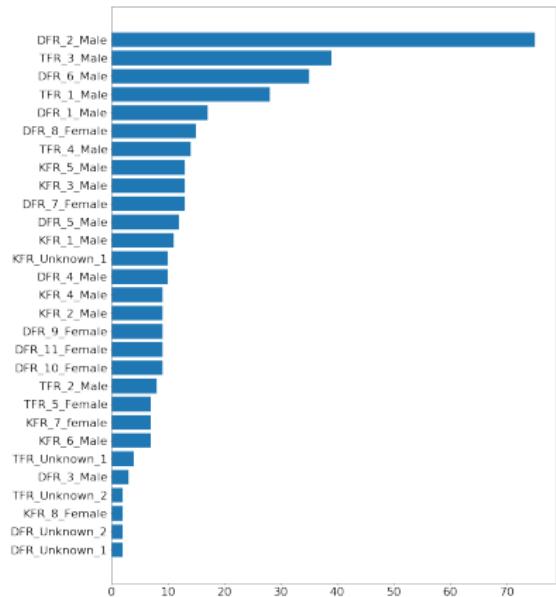
Figure 13: Mismatch because of class similarity



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Data Set



- ▶ Unbalanced data distribution (3 to 99 images per class)
- ▶ 29 classes/individuals
- ▶ Low quality images from camera traps

Figure 14: Data distribution of individuals data set



Good Example Images



18



Figure 15: DFR 2 male



Figure 16: DFR 5 male



Architecture

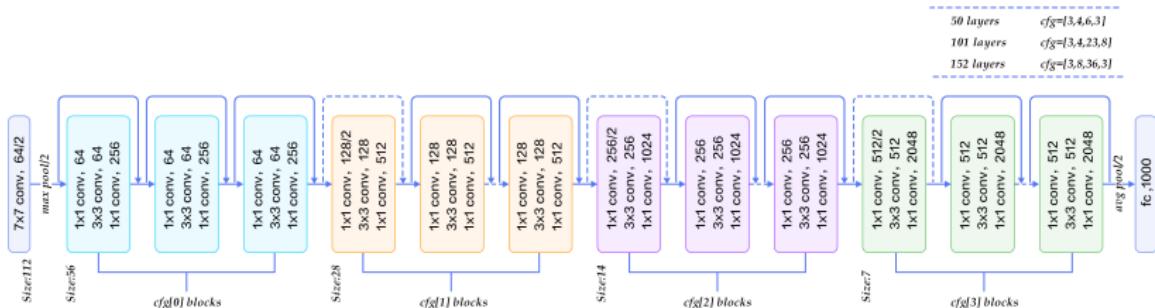


Figure 17: ResNet Architecture

[<https://www.codeproject.com/Articles/1248963/Deep-Learning-using-Python-plus-Keras-Chapter-Re>]

- ▶ ResNet-18, ResNet-34 from scratch
- ▶ ResNet-50 finetuning

Scores



20

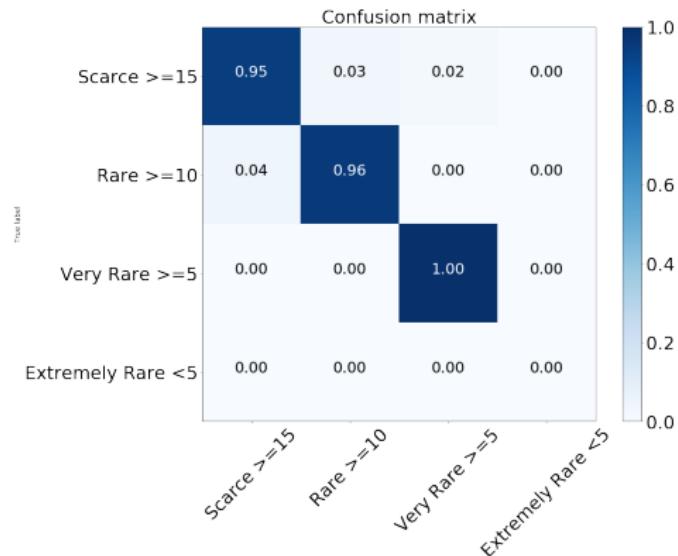


Figure 18: Confusion matrix for finetuned Resnet-50

Results



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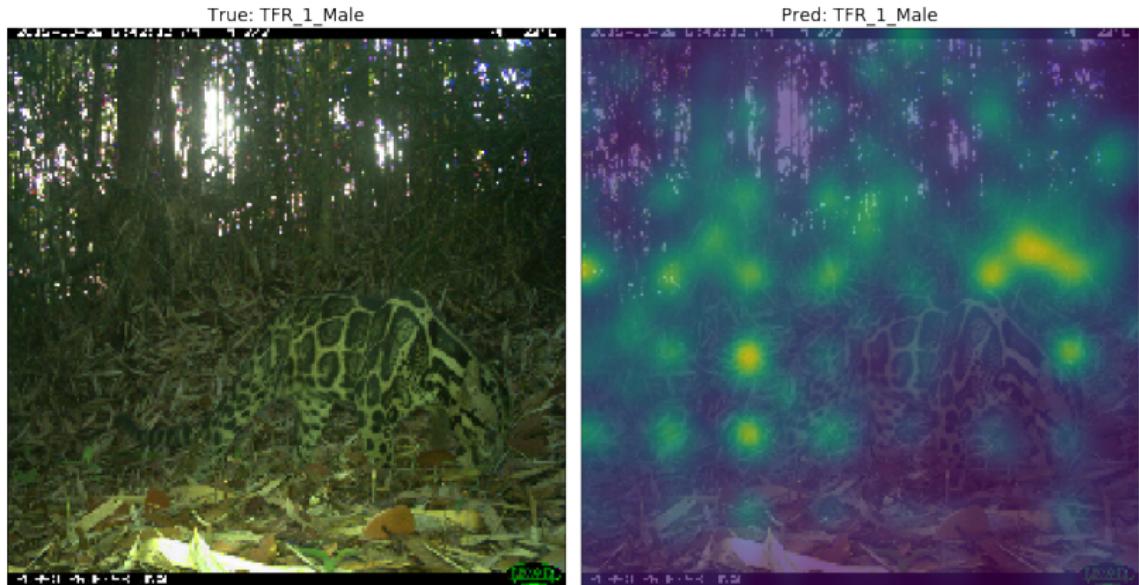


Figure 19: Network attention on background

Results



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Figure 20: Network Attention on background

Training Process



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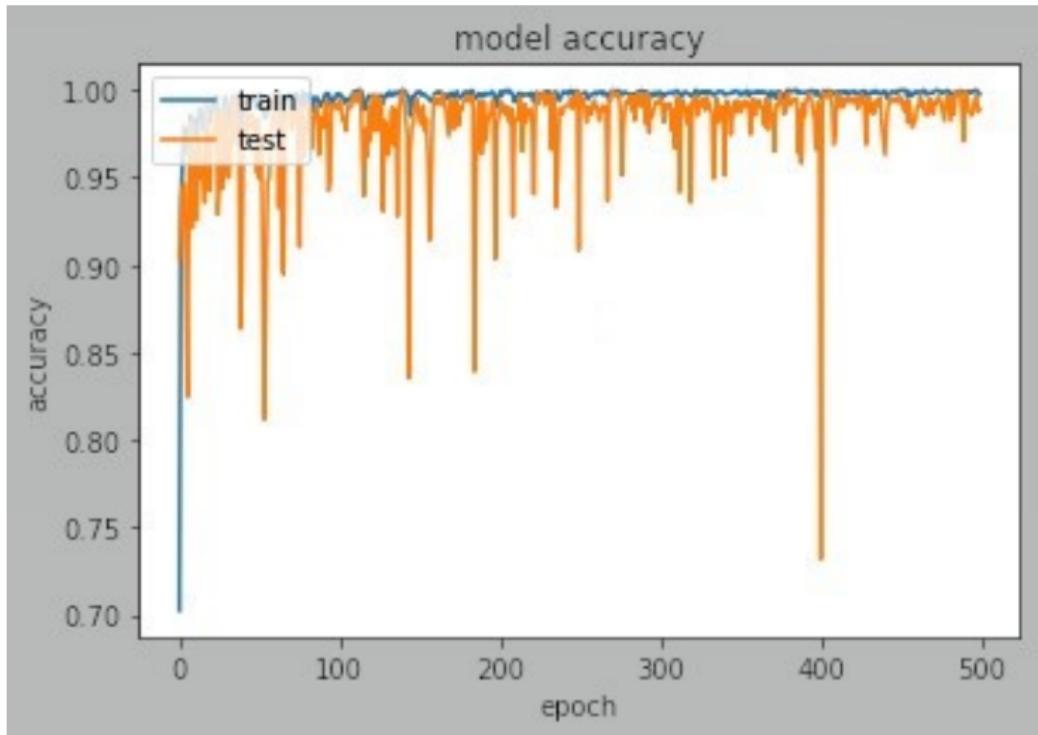


Figure 21: Accuracy during Training

Results



24

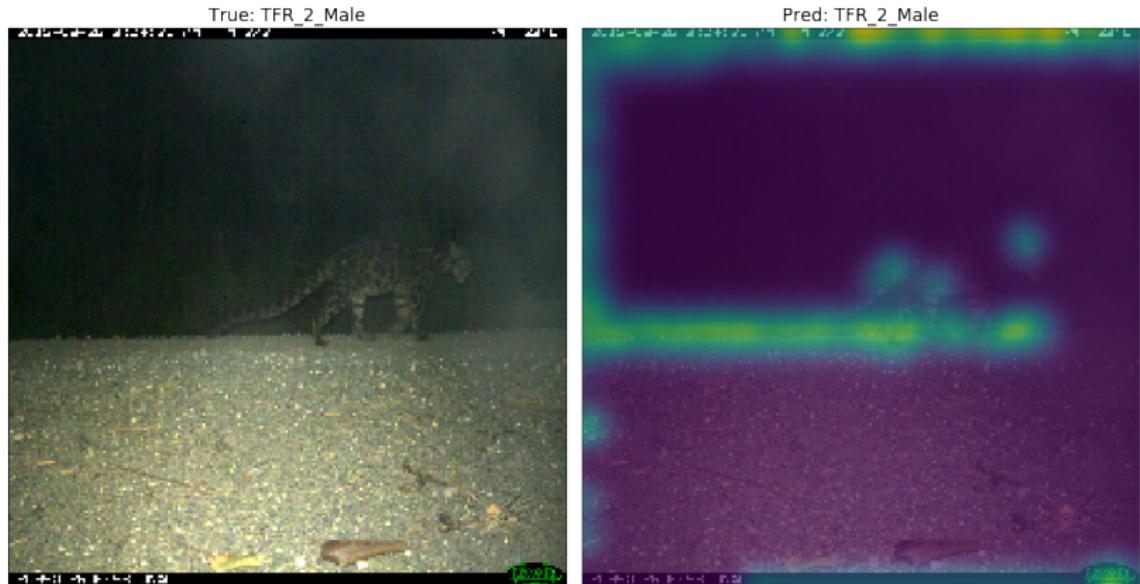


Figure 22: Network attention on logo and time stamp



Using Bounding Boxes

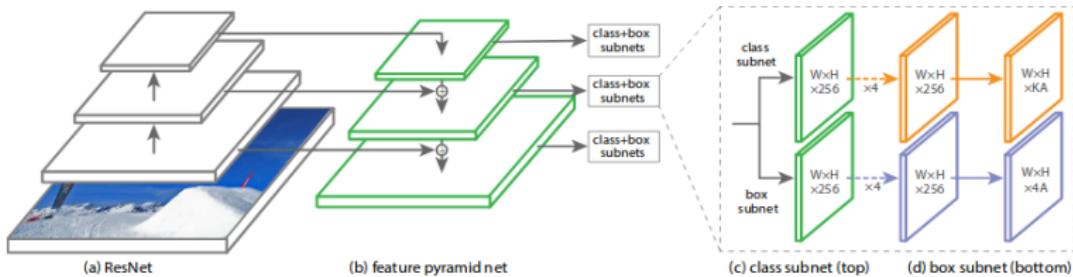
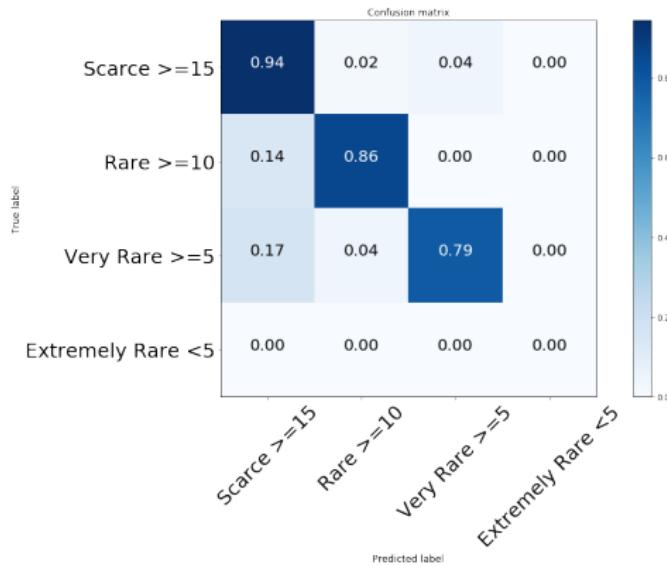


Figure 23: RetinaNet Architecture [<https://medium.com/@14prakash/the-intuition-behind-retinanet-eb636755607d>]

- ▶ One stage detector with similar performance as Faster R-CNN
- ▶ Main improvement: Focal Loss
- ▶ Manual annotation of bounding boxes required

Scores



Test set:

- ▶ Accuracy: 0.86
- ▶ Avg. Precision: 0.87
- ▶ Avg. Recall: 0.86
- ▶ Avg. F1-Score: 0.85

Figure 24: Confusion matrix for finetuned RetinaNet with ResNet-50 backbone



Positive Examples



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Figure 25: RentinaNet attention on animal

Negative Examples



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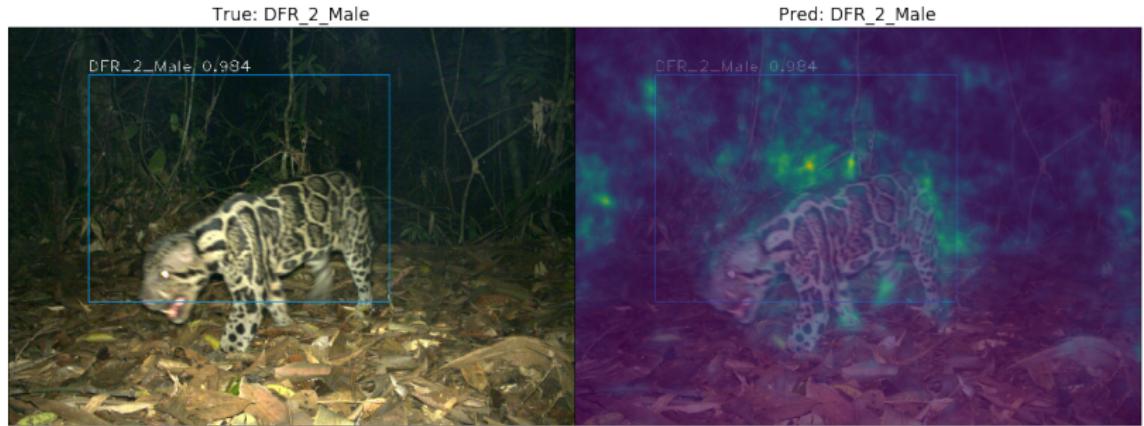


Figure 26: RentinaNet attention on background

Finetuning for Individuals

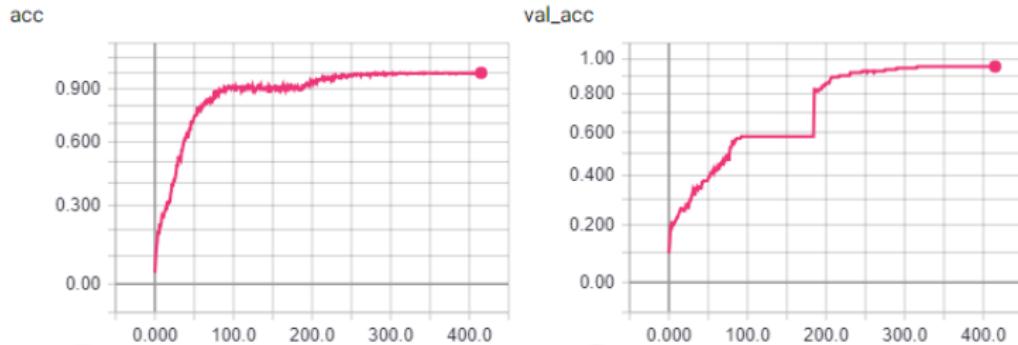


Figure 27: Accuracy during training

Network Attention



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Figure 28: Network attention after finetuning final dense layer

Network Attention



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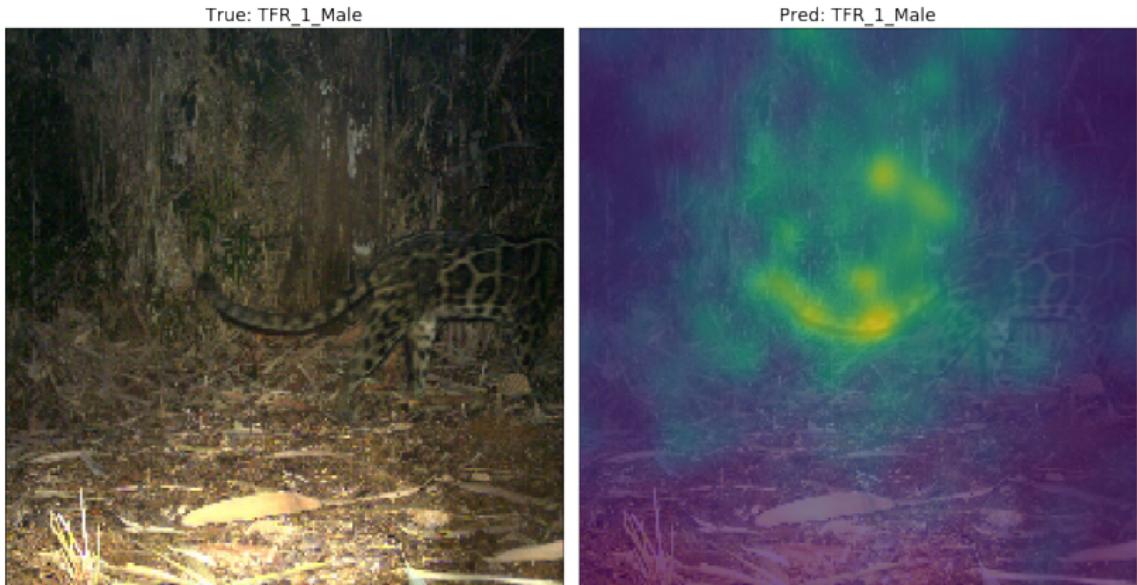


Figure 29: Network attention after finetuning complete ResNet-50



Thank you for listening



Questions?