Graphical Interactive Systems
Technische Universität Darmstadt

Animal Biometrics

Visual Computing Praktikum – SS 2018

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Outline

1. Introduction and Motivation

2. Problem 1: Classification of Individuals
   - Data Set
   - Architecture
   - Results
   - Alternative Approach

3. Problem 2: Classification of Species
   - Data Set
   - Results
   - Finetuning for Individuals

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Introduction and Motivation

Figure 1: Animal Biometrics Example

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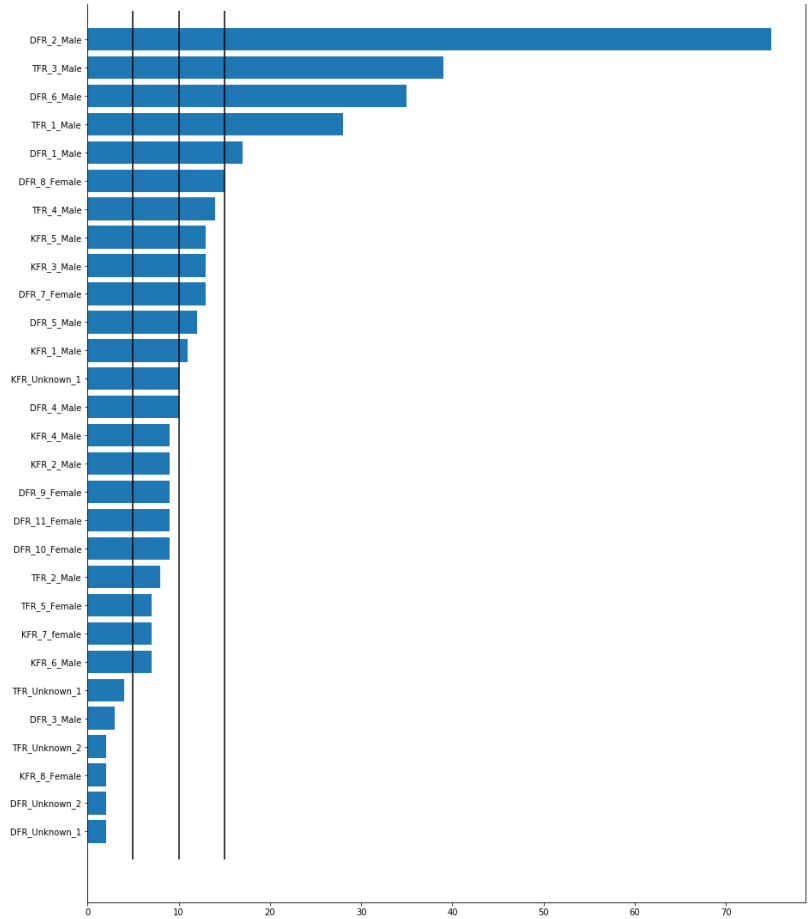
Data Set



- Unbalanced data distribution (3 to 99 images per class)
- 29 Classes/Individuals
- Low quality images from camera traps

Figure 2: Data distribution of individuals data set

Good Example Images

Figure 3: DFR 2 Male

Figure 4: DFR 5 male

Bad Example Images

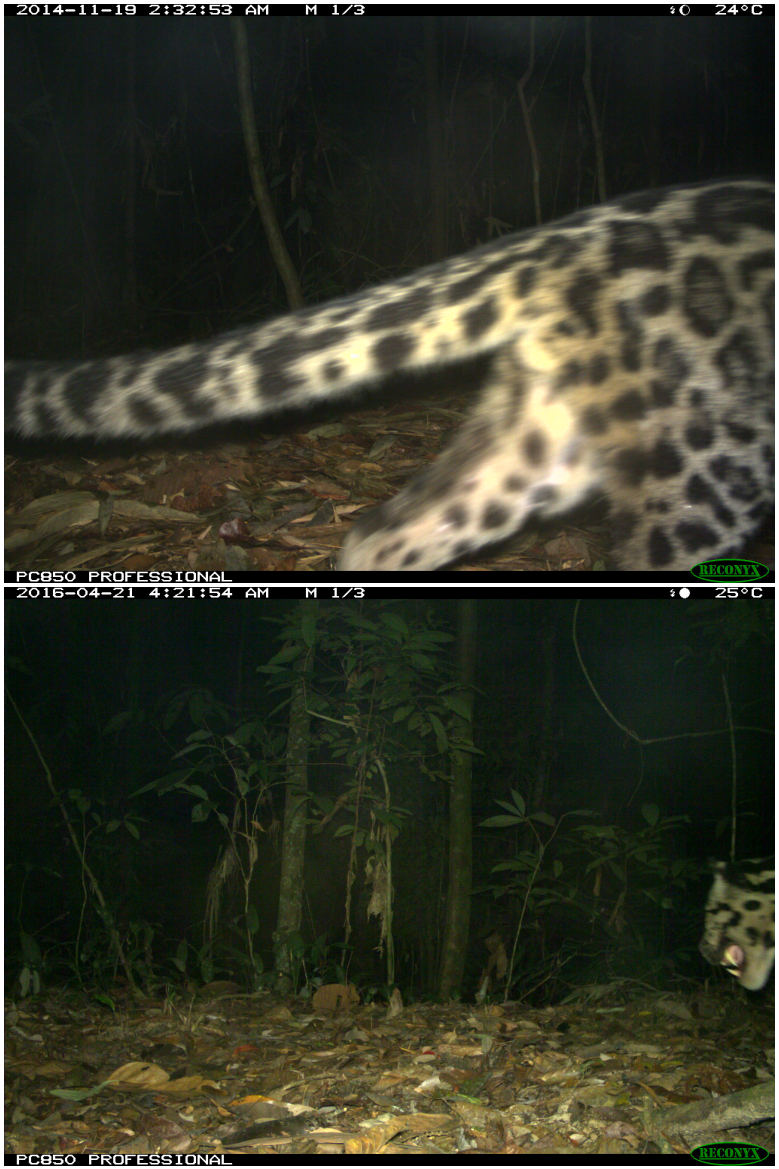


Figure 5: Bad quality training images

Architecture

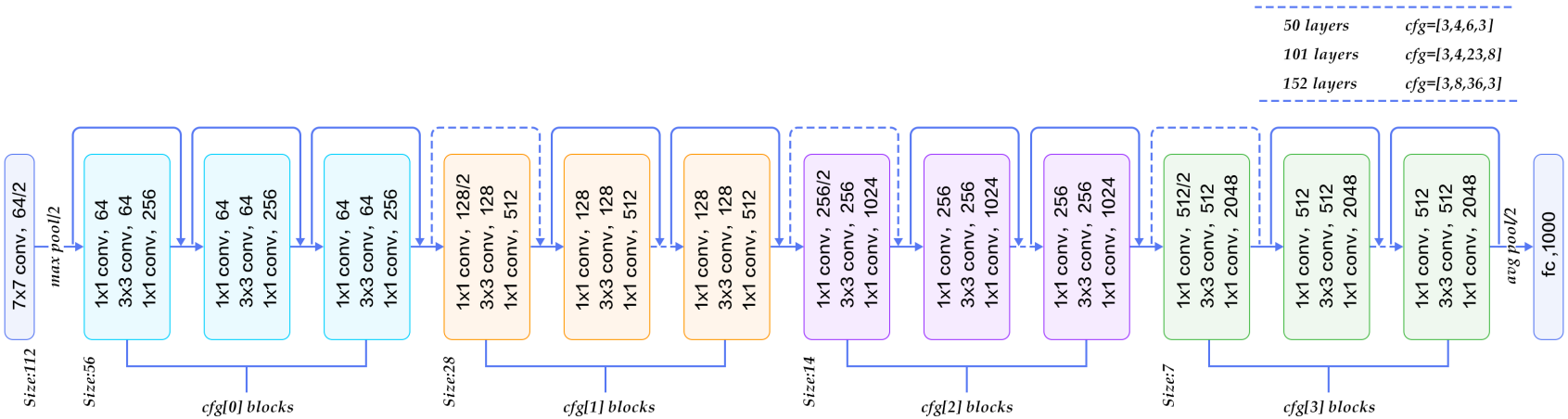
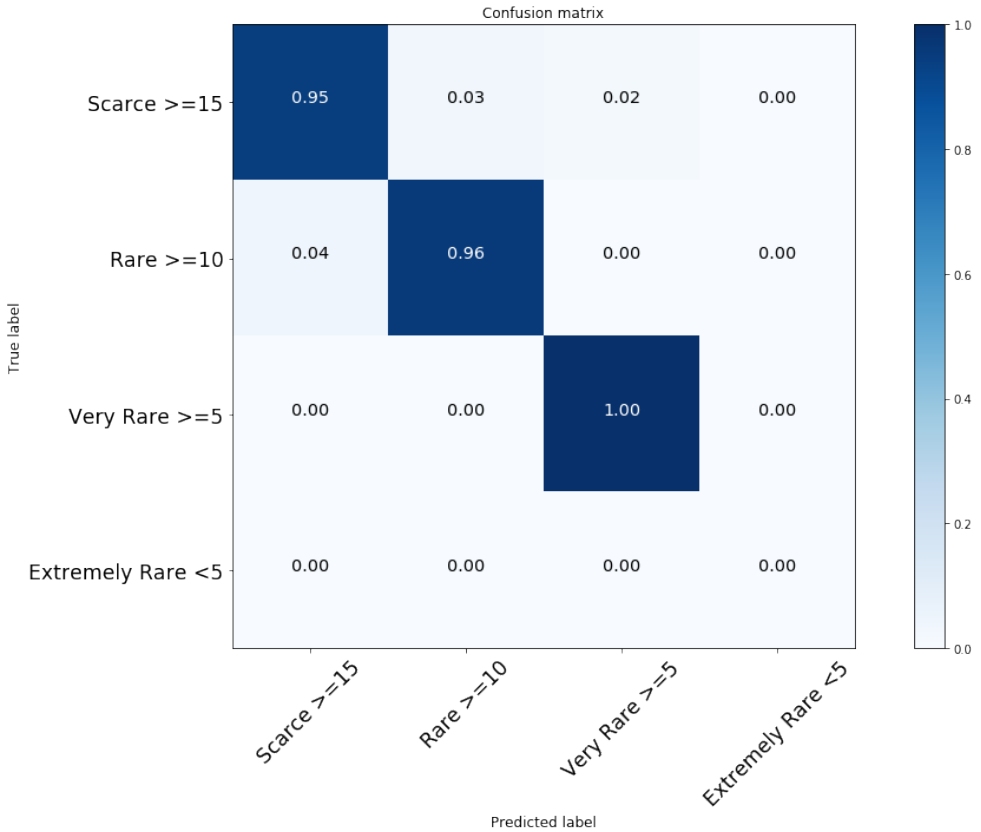


Figure 6: ResNet Architecure

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

Scores



- Test Accuracy: 0.91
- Avg. Precision: 0.91
- Avg. Recall: 0.91
- Avg. F1-Score: 0.90

Figure 7: Network Attention

Results

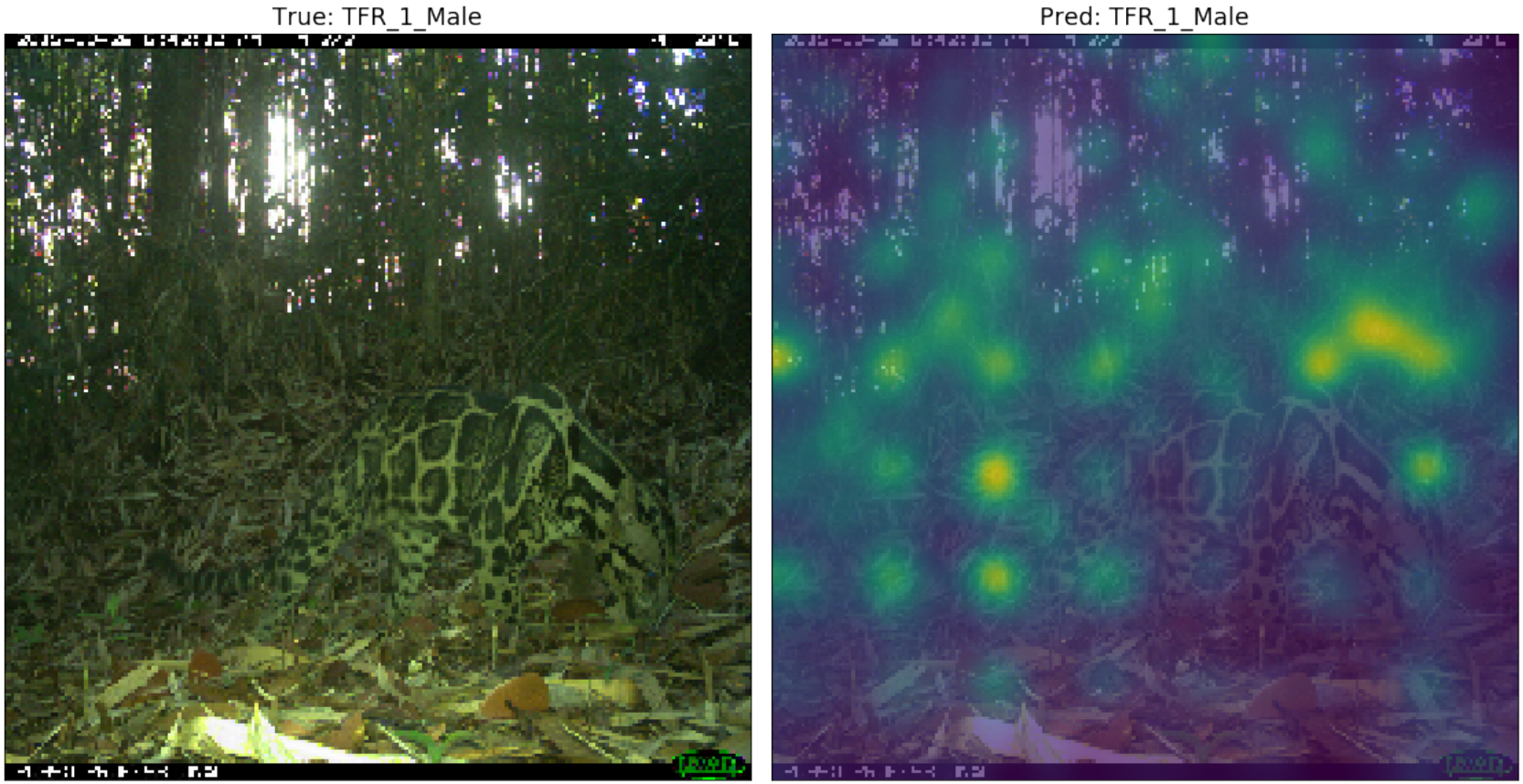


Figure 8: Network Attention

Results

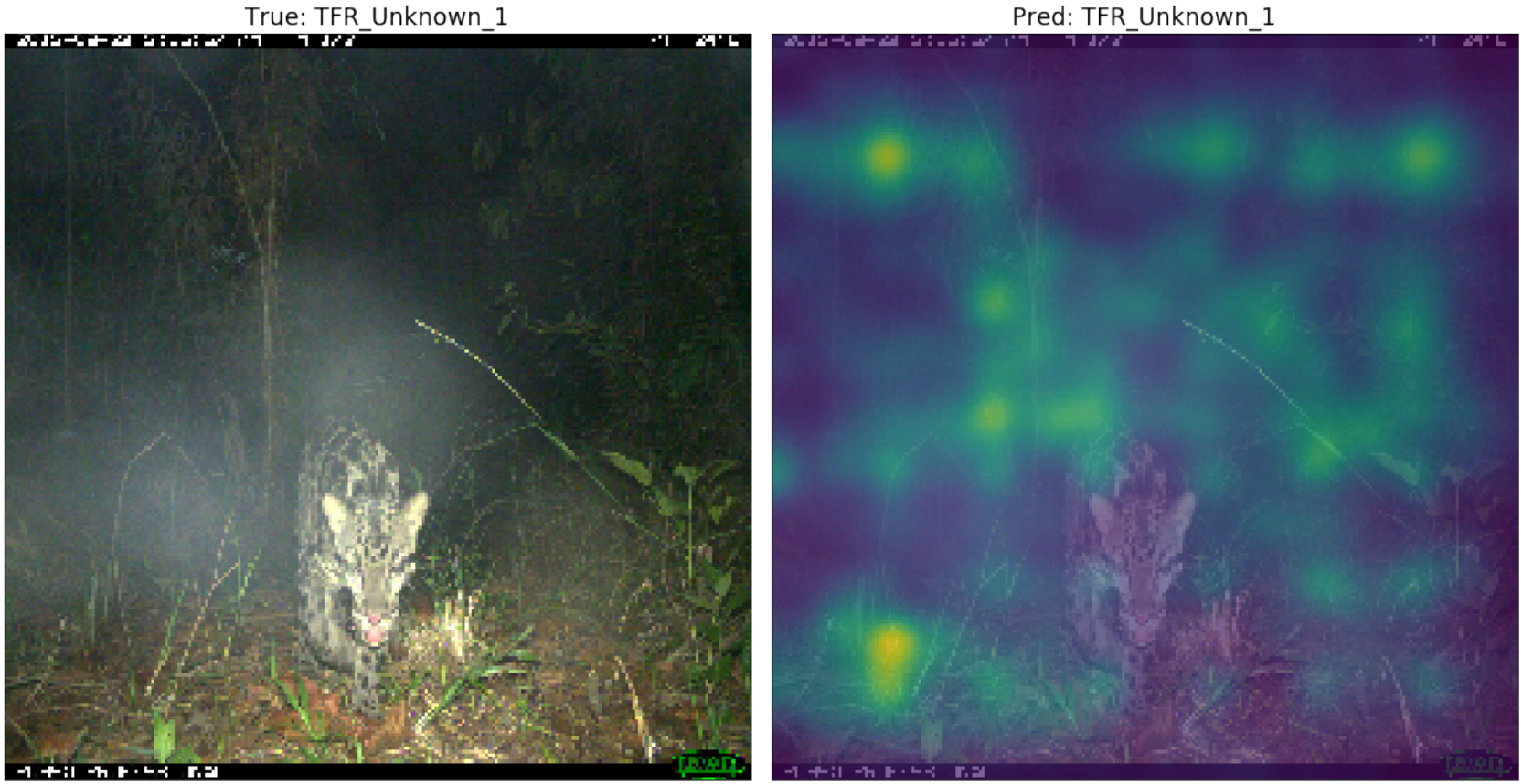


Figure 9: Network Attention

Training Process

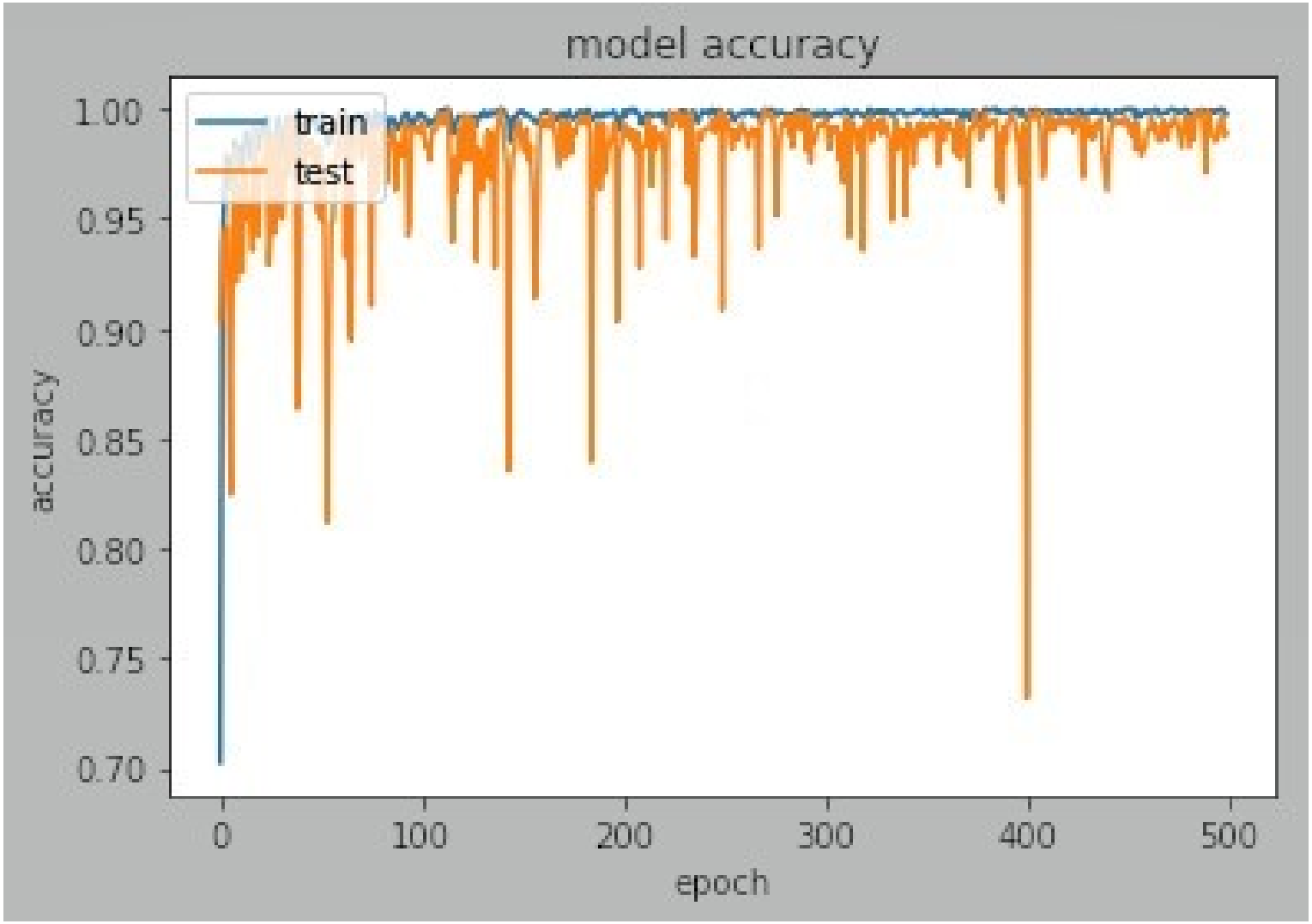


Figure 10: Accuracy development

Results

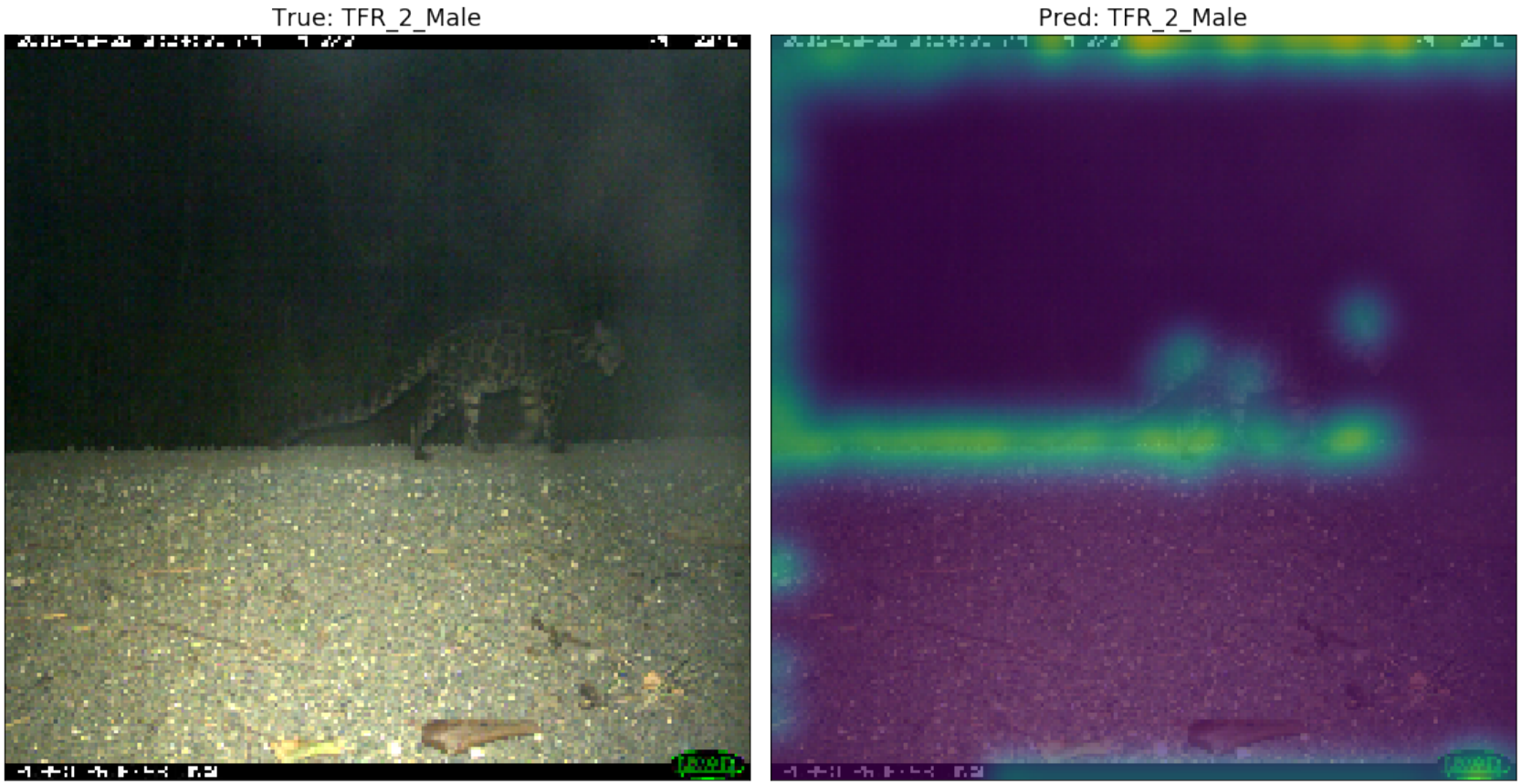


Figure 11: Network attention on logo and time stamp

Using Bounding Boxes

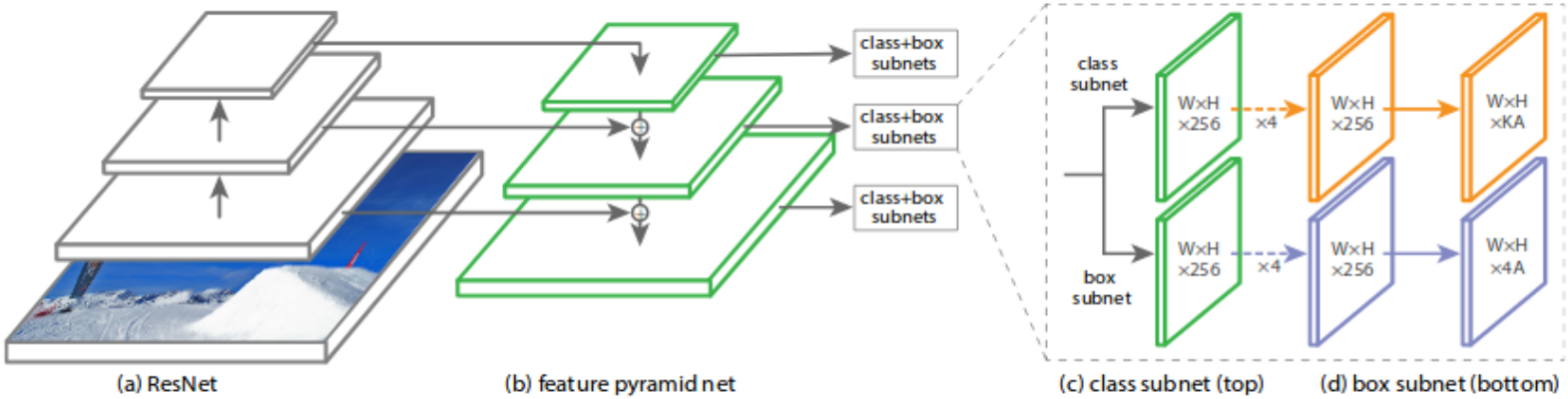
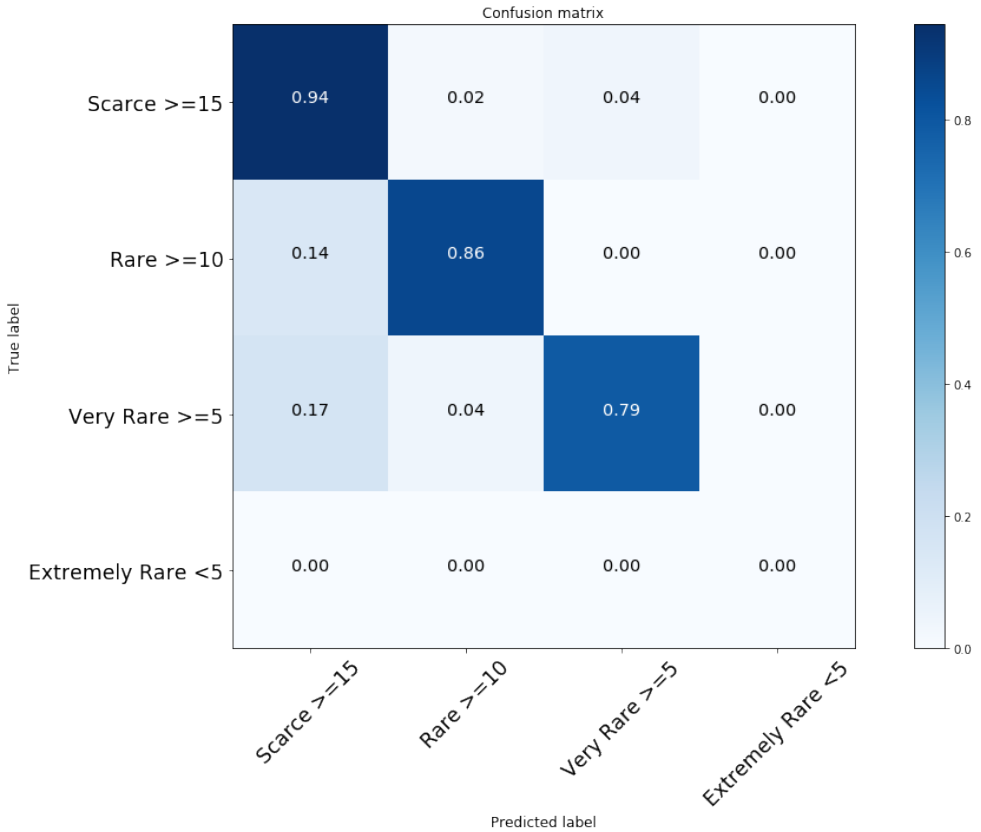


Figure 12: ResNet Architecure

- losses semantic information an detect small objects RPN
- used preferred backbone
- extract after each pooling layer feature maps – Feature pyramid network based on resnet
- Manual annotation of images

Scores



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

Figure 13: Network Attention

Positive Examples

Figure 14: Network attention on logo and time stamp

Negative Examples

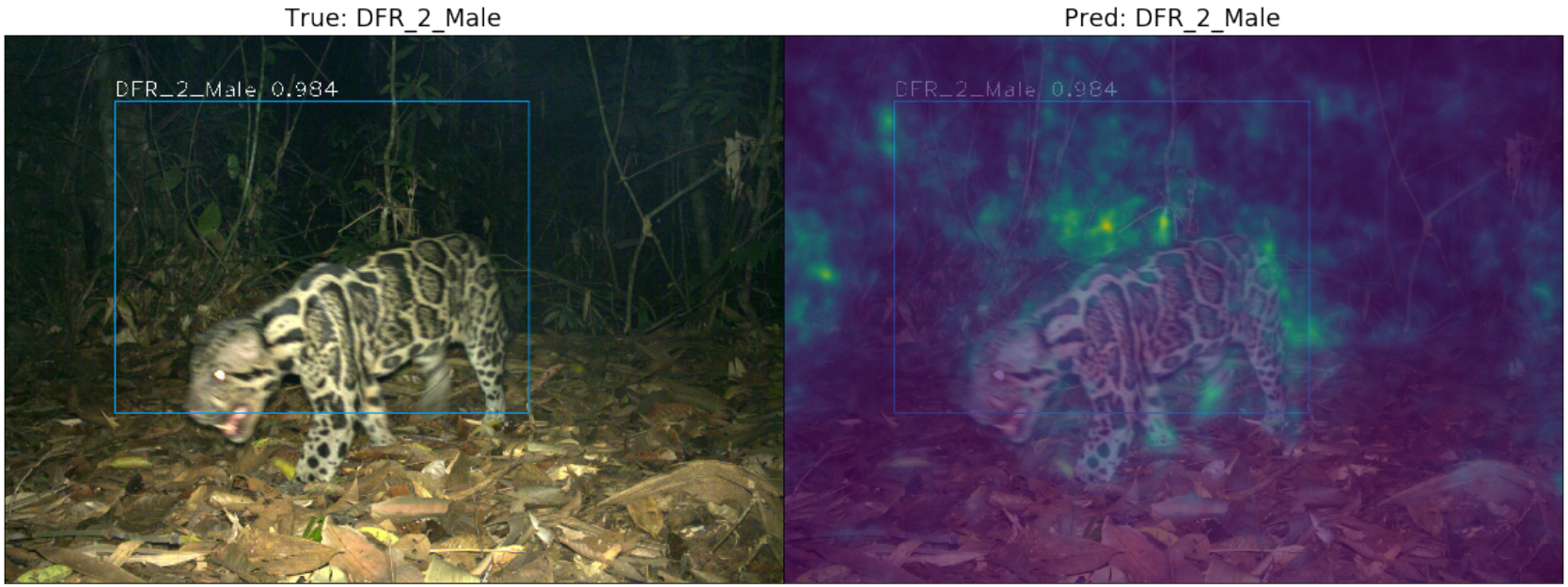


Figure 15: Network attention on logo and time stamp

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Data Set

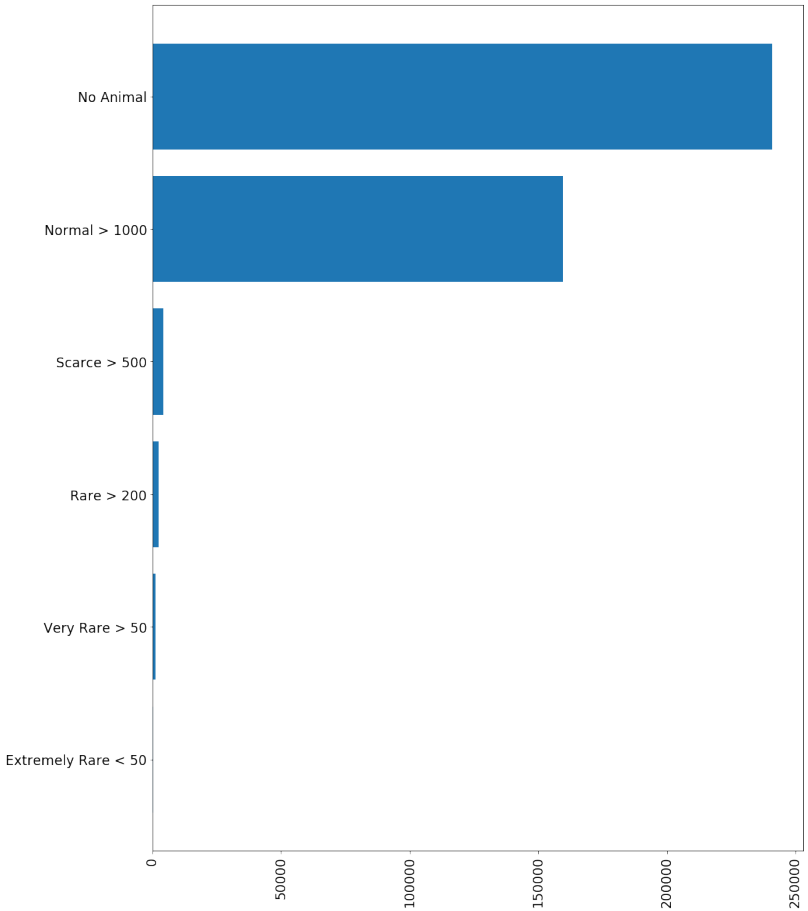


Figure 16: Reduced Data distribution of Species data set

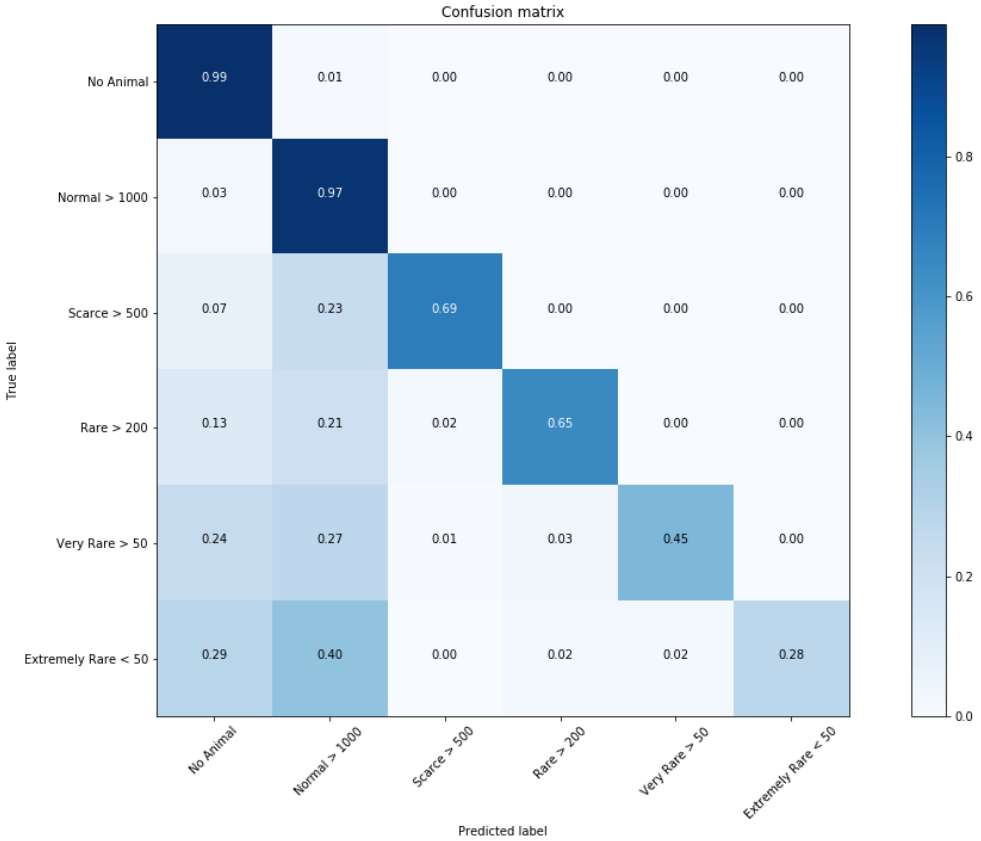
- Unbalanced data distribution (3 to 190k+ images per class)
- 87 Classes/Species

Some Example Images

Figure 17: Marbled Cat

Figure 18: Mouse Deer

Scores



- Test Accuracy: 0.95
- Avg. Precision: 0.95
- Avg. Recall: 0.95
- Avg. F1-Score: 0.95

Figure 19: Reduced confusion matrix

Training Process

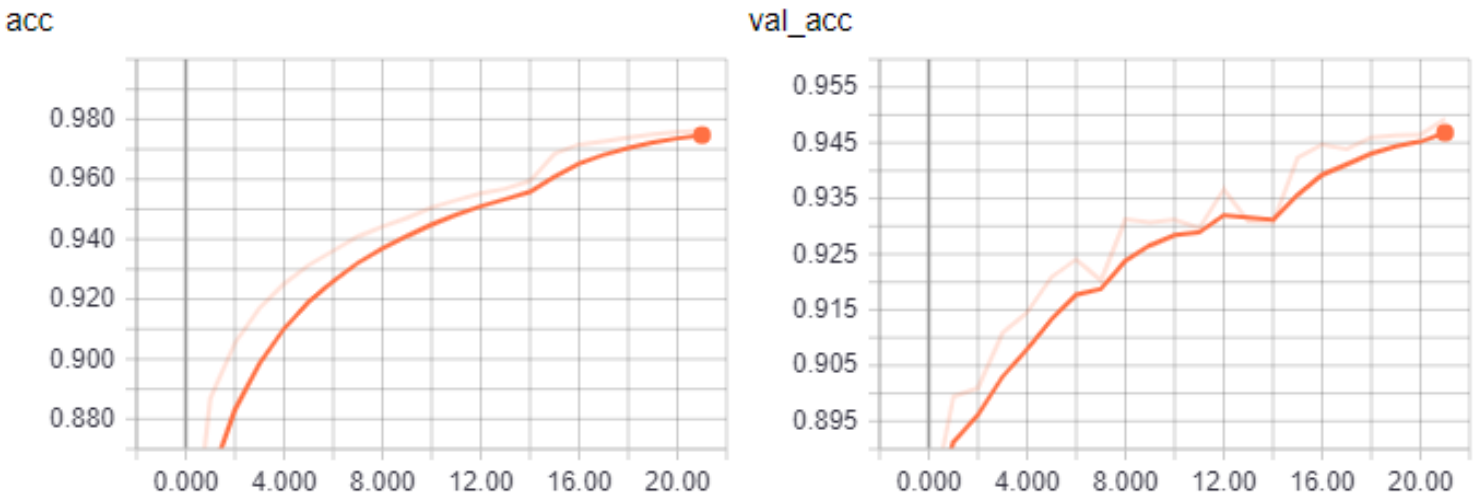


Figure 20: Accuracy development

Positive Examples

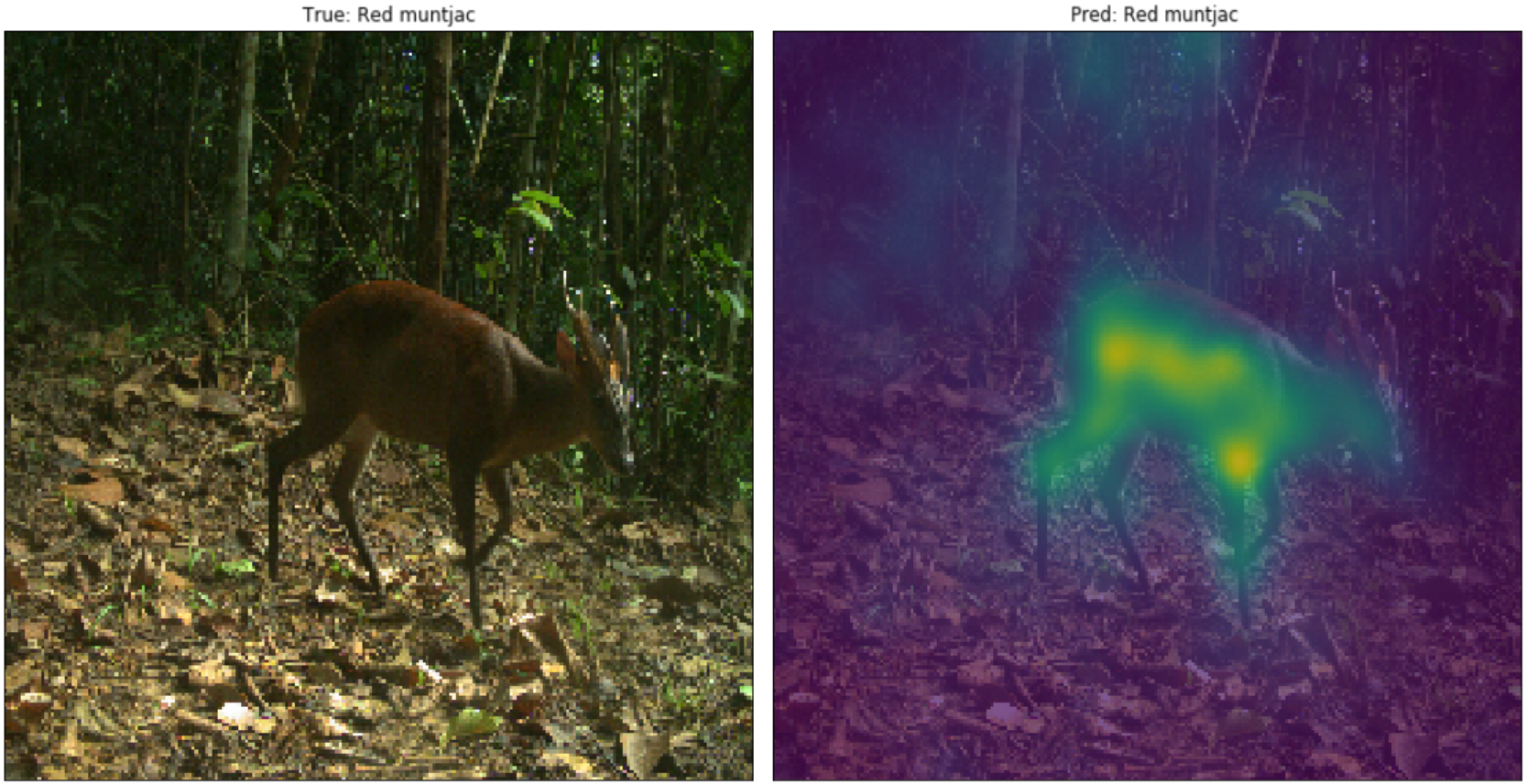


Figure 21: Correct attention and classification

Positive Examples

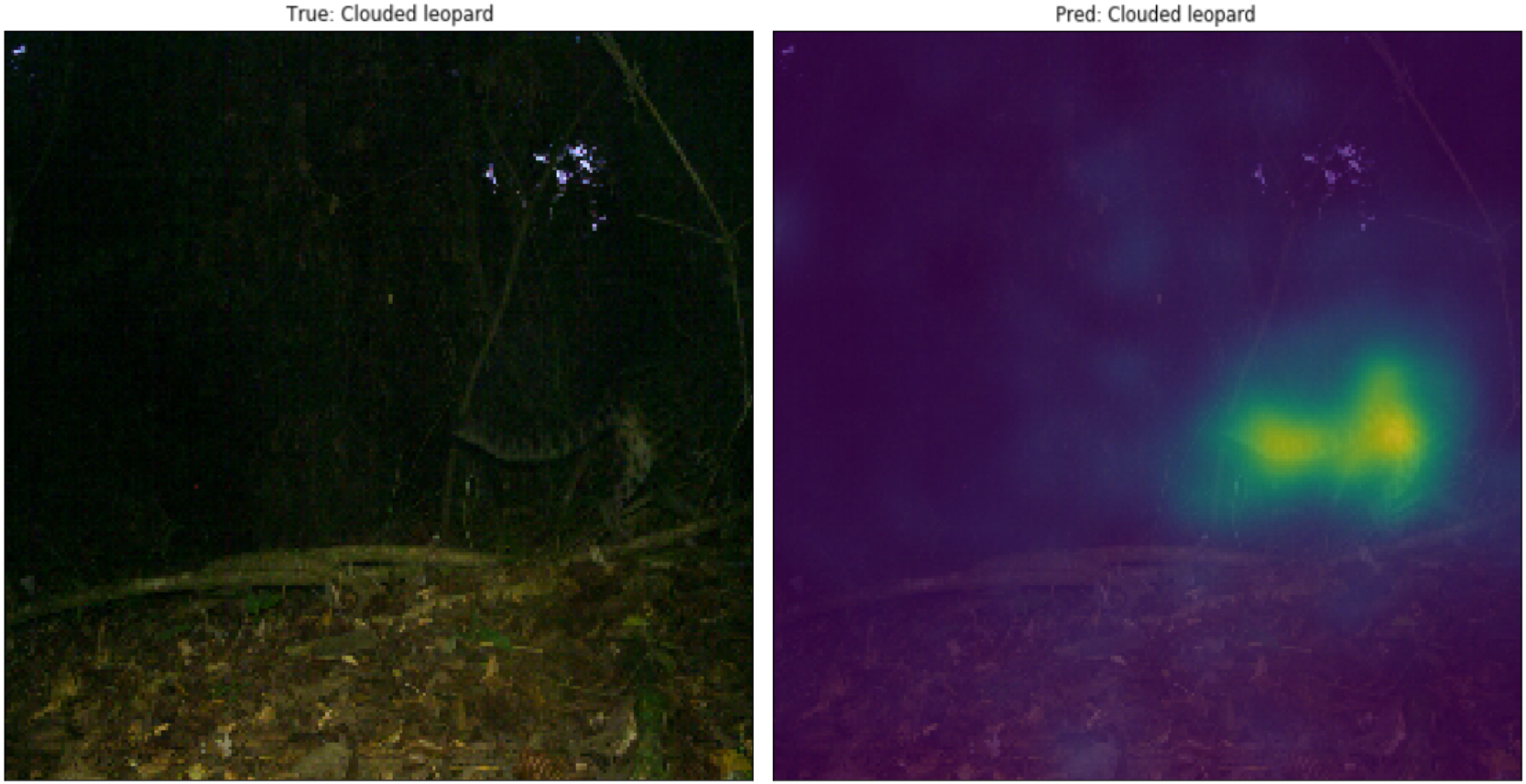


Figure 22: Correct attention and classification

Negative Examples

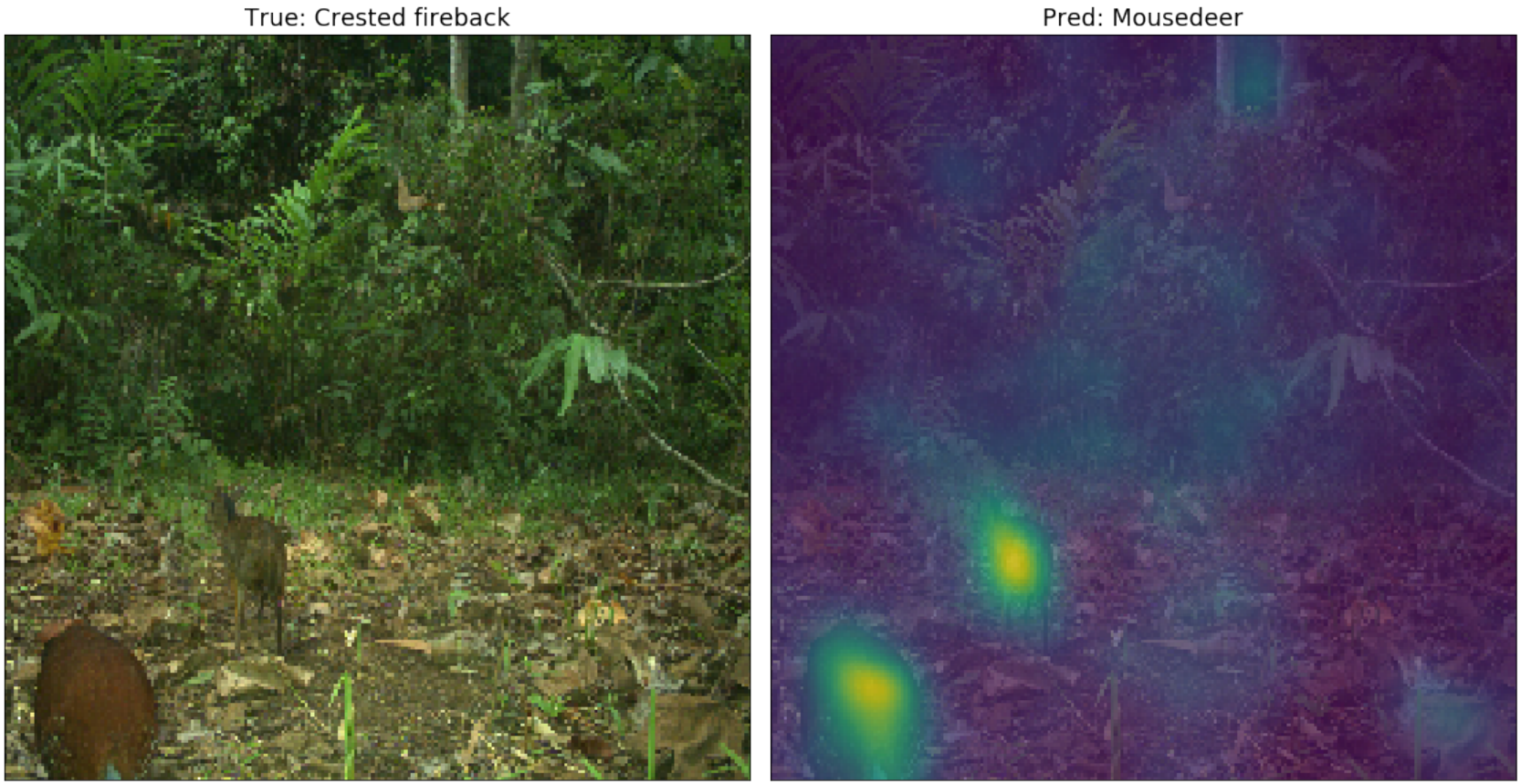


Figure 23: Noisy labels

Negative Examples

Figure 24: Correct Attention, wrong label

Negative Examples

Figure 25: Mismatch because of class similarity

Training Process

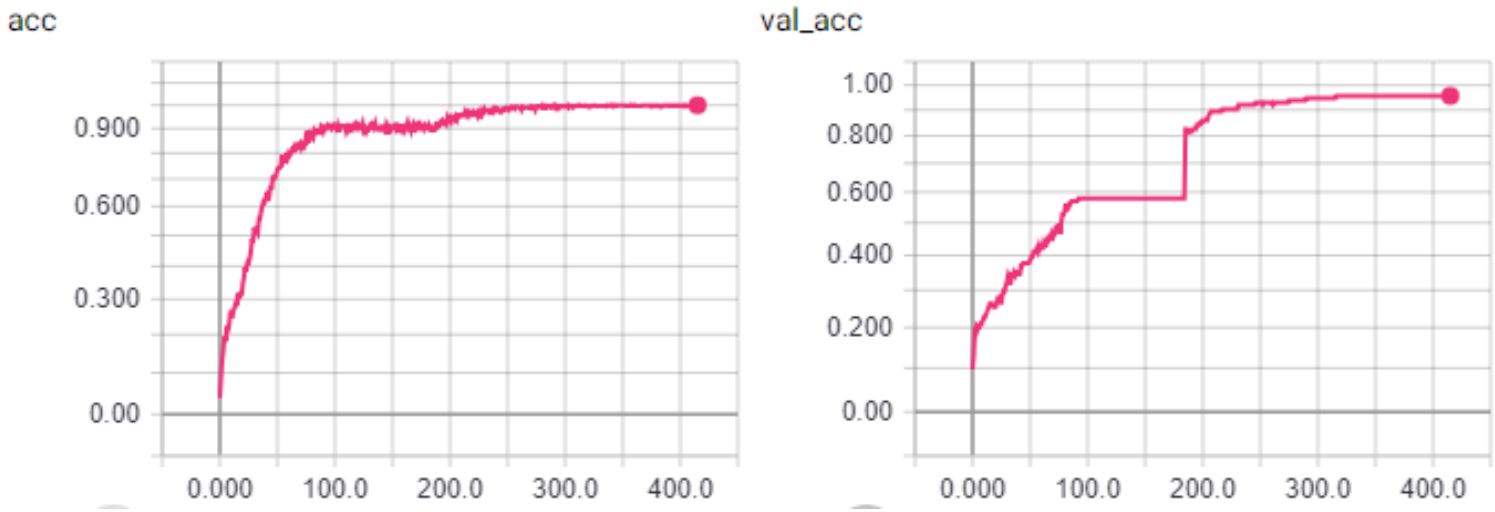


Figure 26: Accuracy development

Some Examples

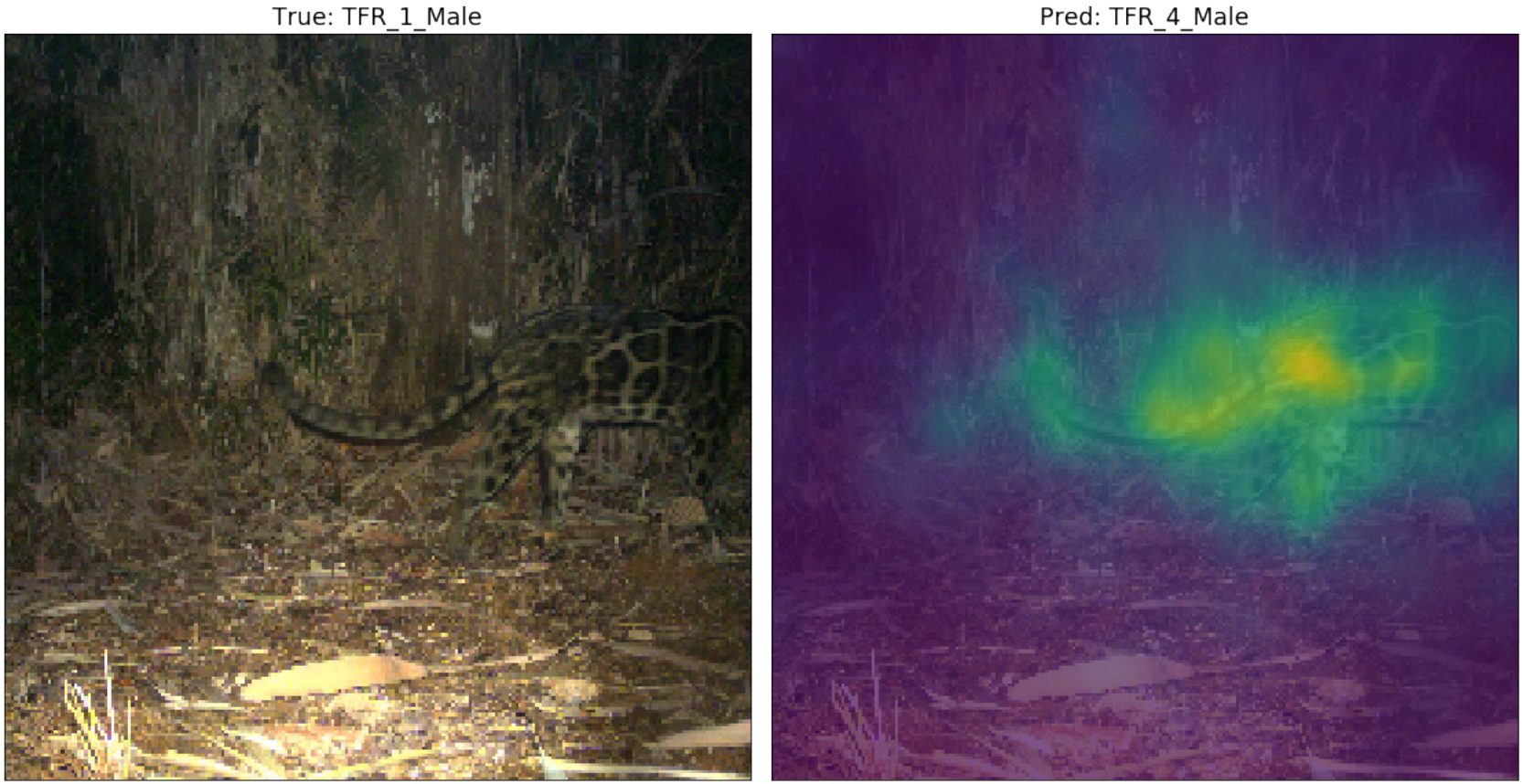


Figure 27: Mismatch because of class similarity

Some Examples

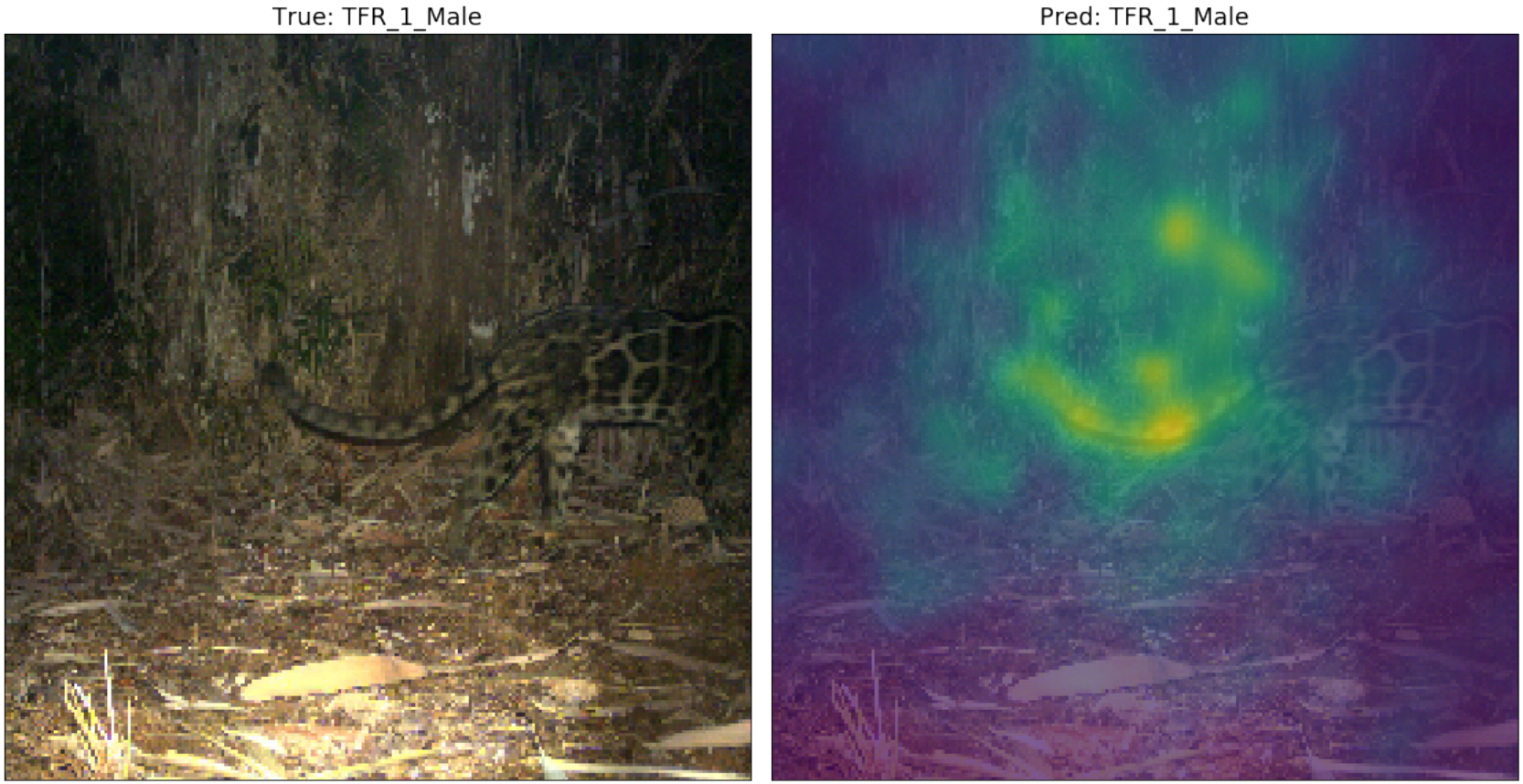


Figure 28: Mismatch because of class similarity

Thank you for listening

Questions?