

End-to-End Pipeline for an App-Based Machine Learning Tool to Identify Illegal Wildlife Products derived from Ivory, Pangolin Scales and Tiger parts

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Kone Foundation

The web of Illegal wildlife trade...

\$23B

The global illegal wildlife trade generates between \$7 billion and \$23 billion in illicit revenue annually.* The trade can involve a range of criminal activities, from trafficking and forgery to bribes and use of shell companies.¹

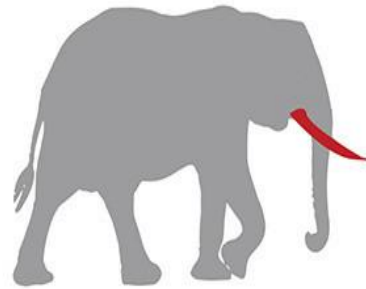
9,246%

In 2007, South Africa lost 13 rhinos.
In 2014, it lost 1,215—an increase of more than 9,000%.²



\$60,000

Increasing demand for rhino horn in Asia has fueled black market prices. Rhino horn is said to go for \$60,000 per kg (\$132,000/lb).³

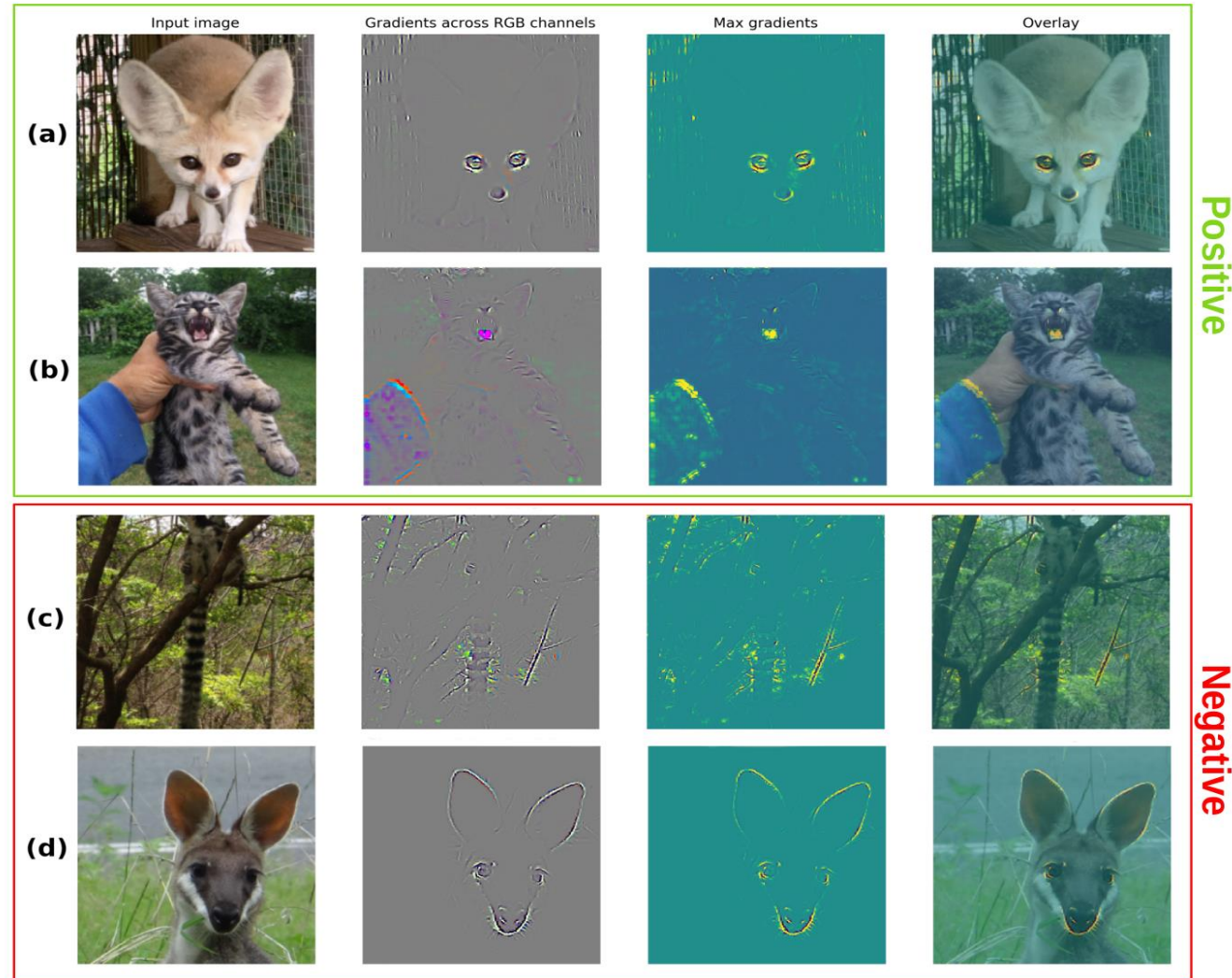


100,000

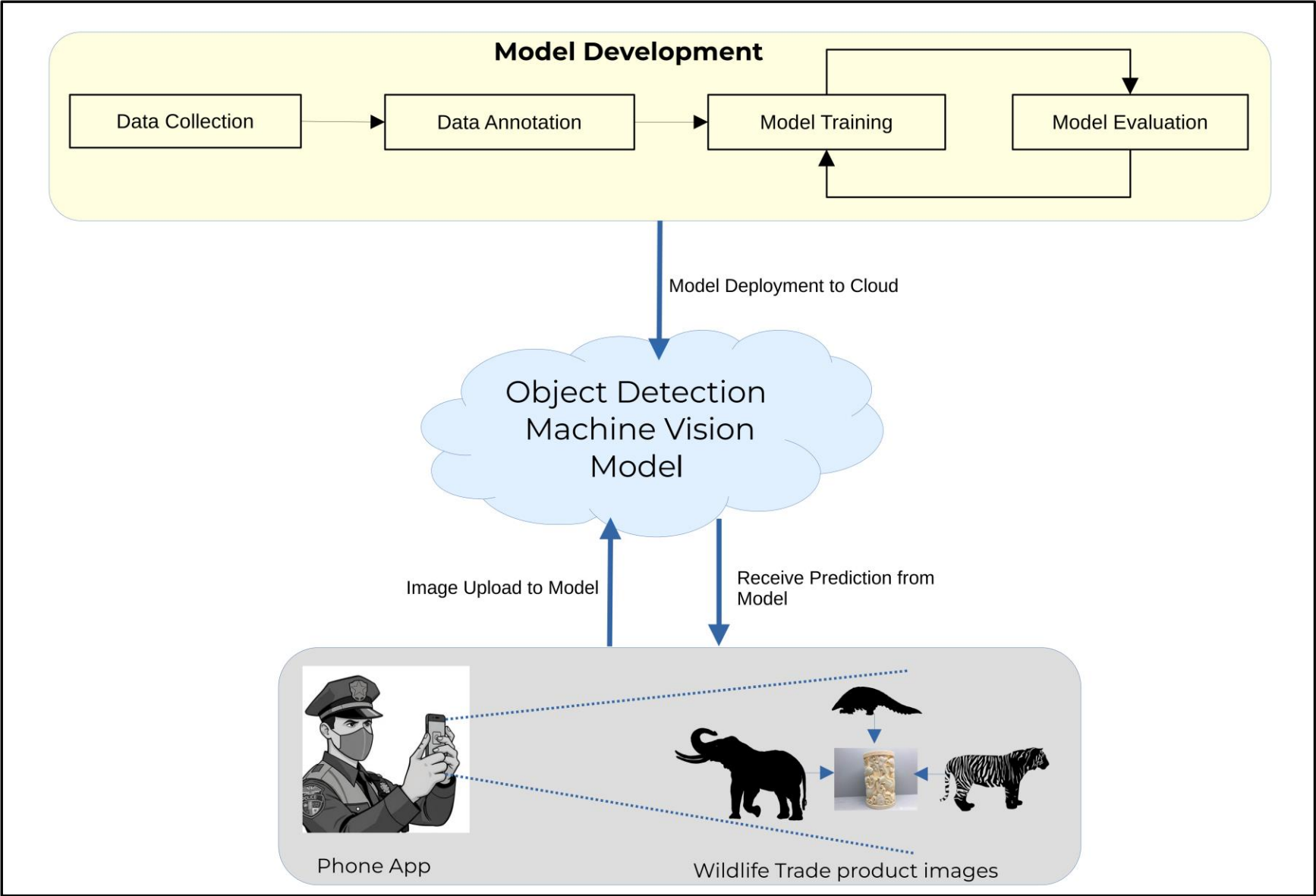
As many as 100,000 African elephants—33,000 per year—were killed between the years 2010 and 2012. More than 65% of Central Africa's forest elephant population has been wiped out in the last decade.⁵

- **Economic Impact**
- **Some Recent Data on illegal trade:**
 - Operation Thunder :confiscations of 12,427 birds, 5,877 turtles, and 1,731 other reptiles
 - Operation Pulka, an international initiative targeting organized wildlife crime
- **Emerging Technological Threats**
 - Traffickers using sites like **Facebook** and **WhatsApp** to advertise and sell endangered species and products

Previously on "AI in wildlife trade"...



And now...



Data : Collection



Quick Filter



Quick Filter

claw 2 none 3 crafted_scale 4 other 5 parched_pangolin_scales 6 raw_scale 7 pangolin_wrong 8















@文玩买卖吧


Data : Annotation

Label Studio Projects / IWT Elephant / Labeling

#2691 ritwik.kulkarni #41UD6 3 minutes ago

image img text str

<input type="checkbox"/>	0		ambiguous_mammoth
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ambiguous_mammoth 1 antique_ivory 2 elephant_skin 3 ivory 4 elephant_wrong 5 none 6

Info History

Selection Details

ambiguous_mammoth ID aRKVVUC-Jr

X 0.345117261 Y 27.3081924 W 83.9179076 H 68.01040312

Regions Relations

Manual By Time

ambiguous_mammoth

Submit

Data : Distribution

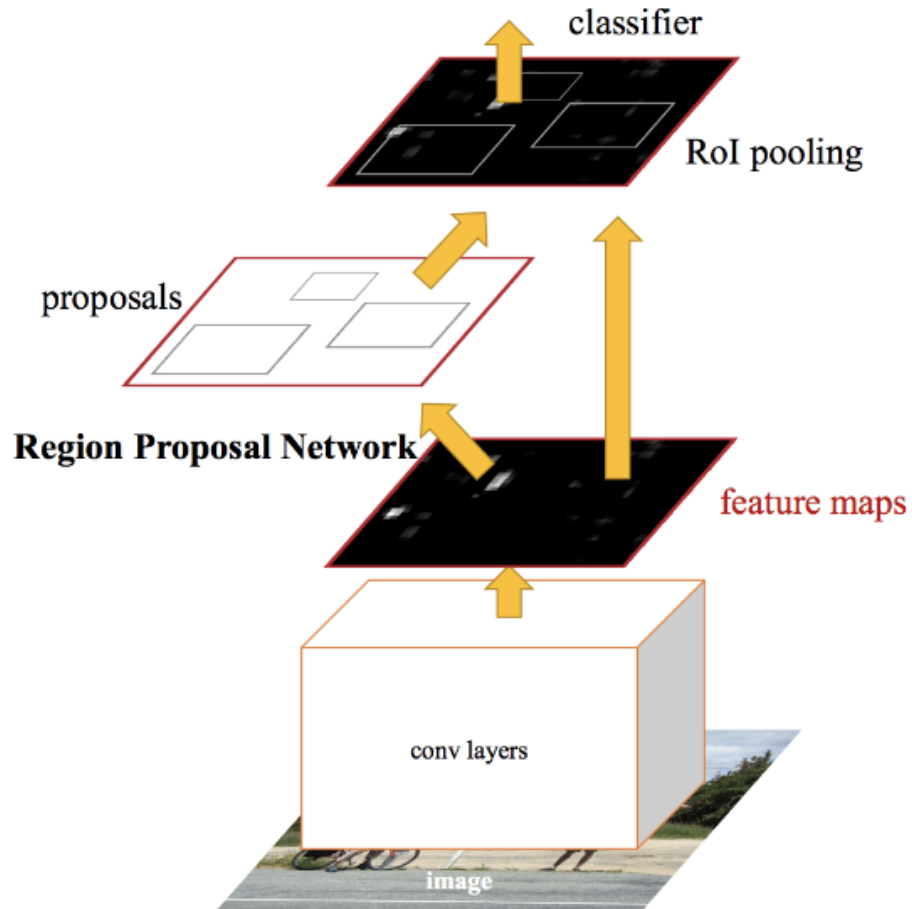
elephant	
ambiguous mammoth	5409
antique ivory	414
elephant skin	22
ivory	6893
non-wildlife	12890

pangolin	
claw	226
crafted scale	283
parched scale	65
raw scale	427
non-wildlife	1661

tiger	
bone ambiguous	399
claw	538
fang ambiguous	1993
other	72
non-wildlife	8649

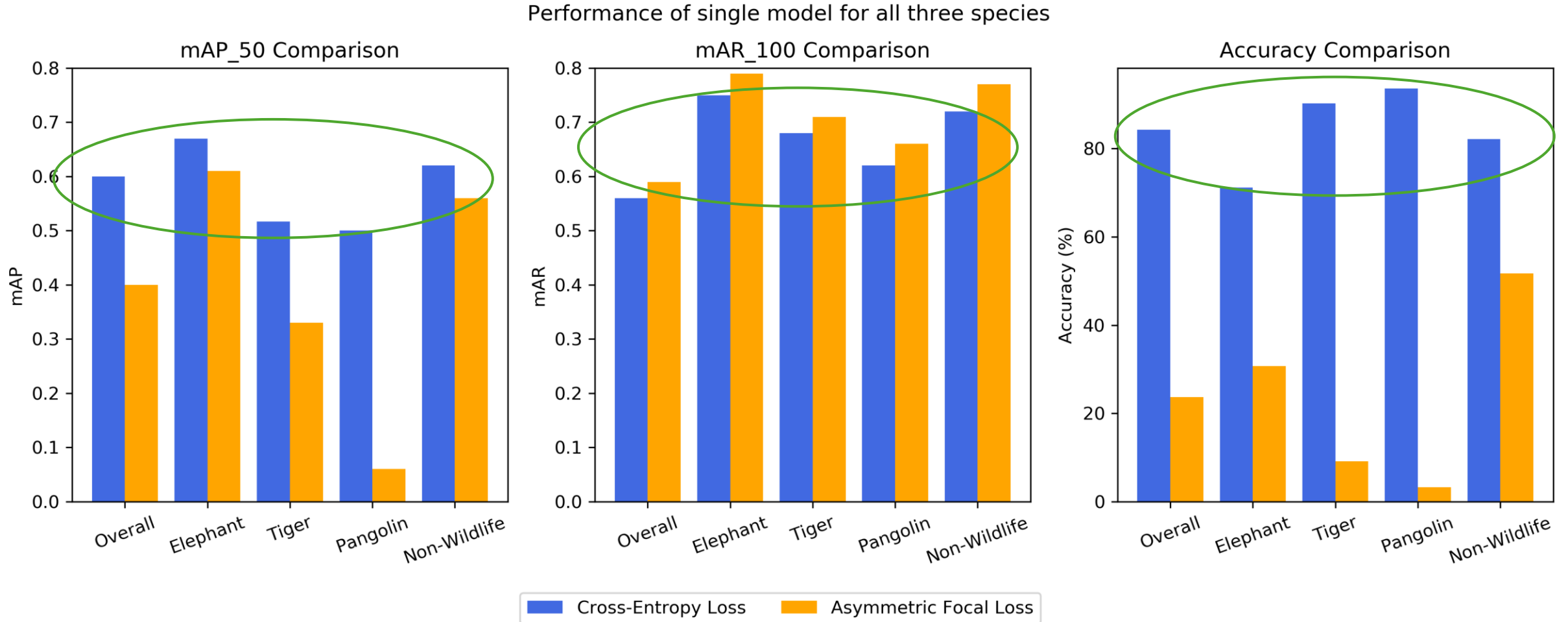
Table 1: Counts of various categories for elephant, pangolin, and tiger

Machine Vision Model



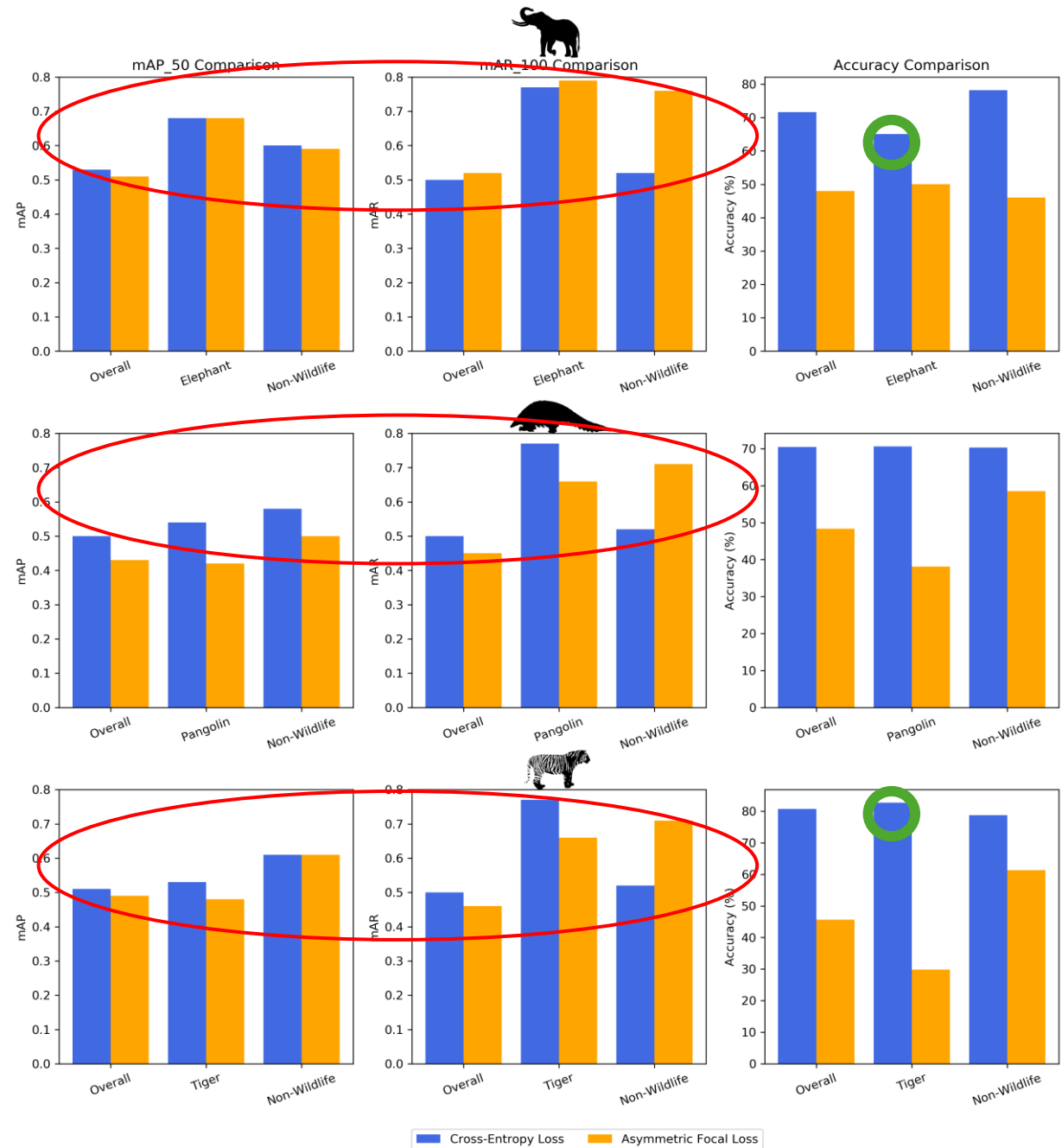
- Faster RCNN model
- Region Proposal + Classifier Modules
- 8 Models Experimented
- Cross-entropy Loss vs Asymmetric Focal loss

Results: One Model for all species



Results: Individual Models

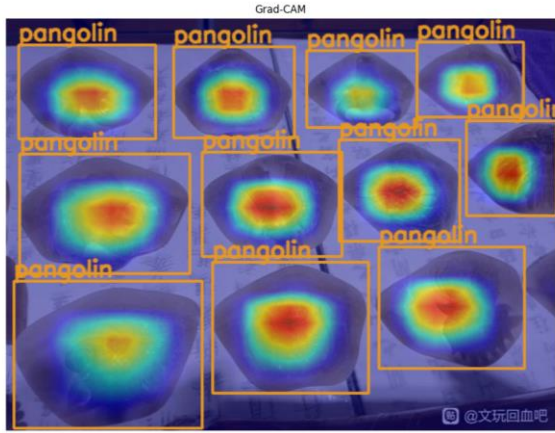
Single model generalises better and performs well overall



A peek inside the model



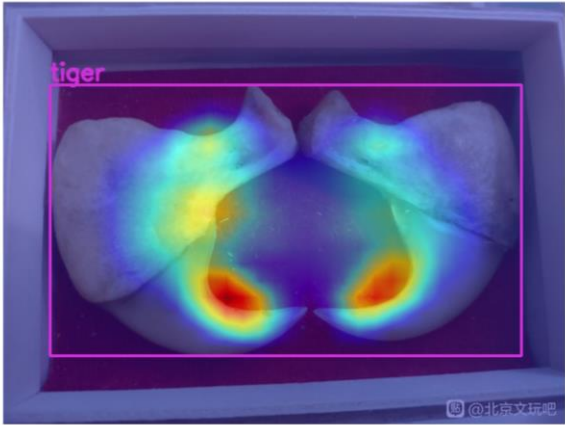
Original Image



Grad-CAM

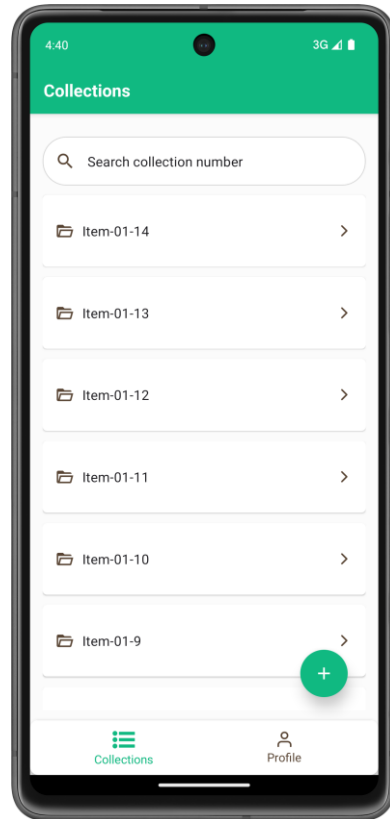


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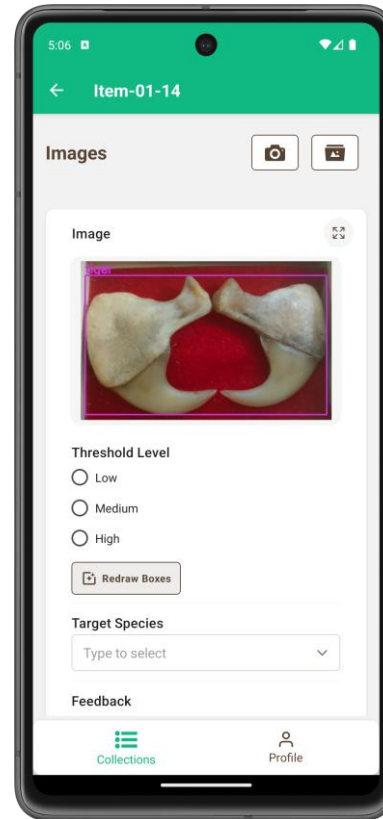


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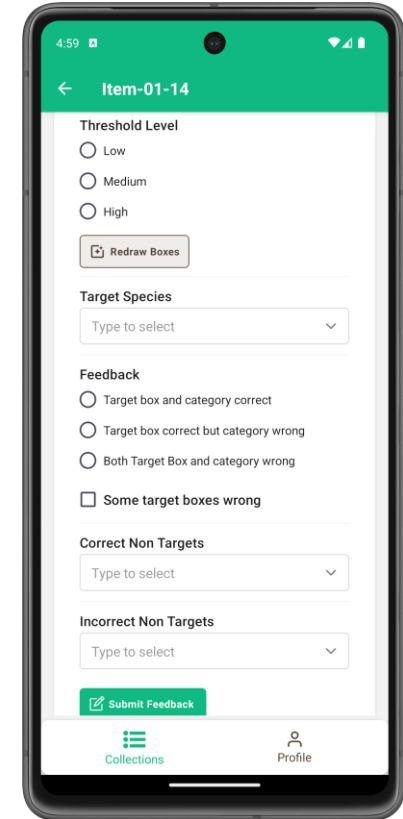
Phone Application



Suspected product
image upload



Classification result from ML



Feedback on performace

Highlights..

High-Accuracy Detection for Key Species: overall 84.2%, pangolin (90.2%) and tiger (93.5%) products,

Bridging Digital and Physical Markets

Real-Time, Accessible Enforcement Tool

Scalable Solution for Global Wildlife Protection

Advancing AI for Conservation

Things to Consider...

- **Expanding Species Coverage**
 - **Enhanced Multi-Modal Analysis**
 - **Requirement of resources**
-
- **Data Limitations and Bias**
 - **Evasion Tactics by Traffickers**
 - **Ethical and Legal Considerations**

Thank You...

