

ANIMAL SPECIES DETECTION USING DEEP LEARNING

**IMPROVING ANIMAL SPECIES
DETECTION USING DEEP LEARNING**

TEAM OPENCV

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PRESENTERS



Eke Mong Eke



Surbhi Jain

PROJECT LEAD

Olamide Oladipo

ASSISTANT PROJECT LEAD

Emmanuel Omatozaye Aiyede

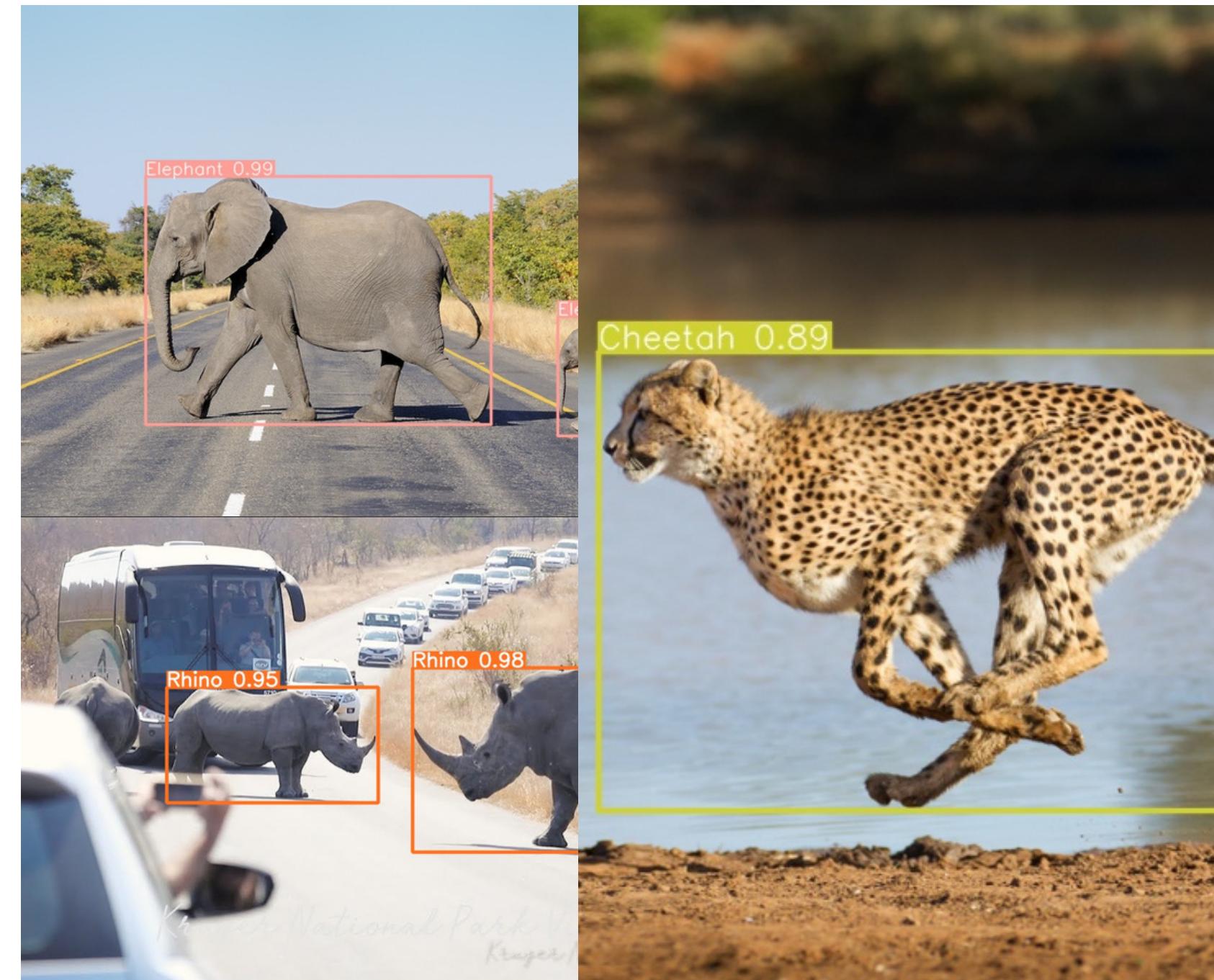
QUERY ANALYST

Surbhi Jain

PROBLEM STATEMENT

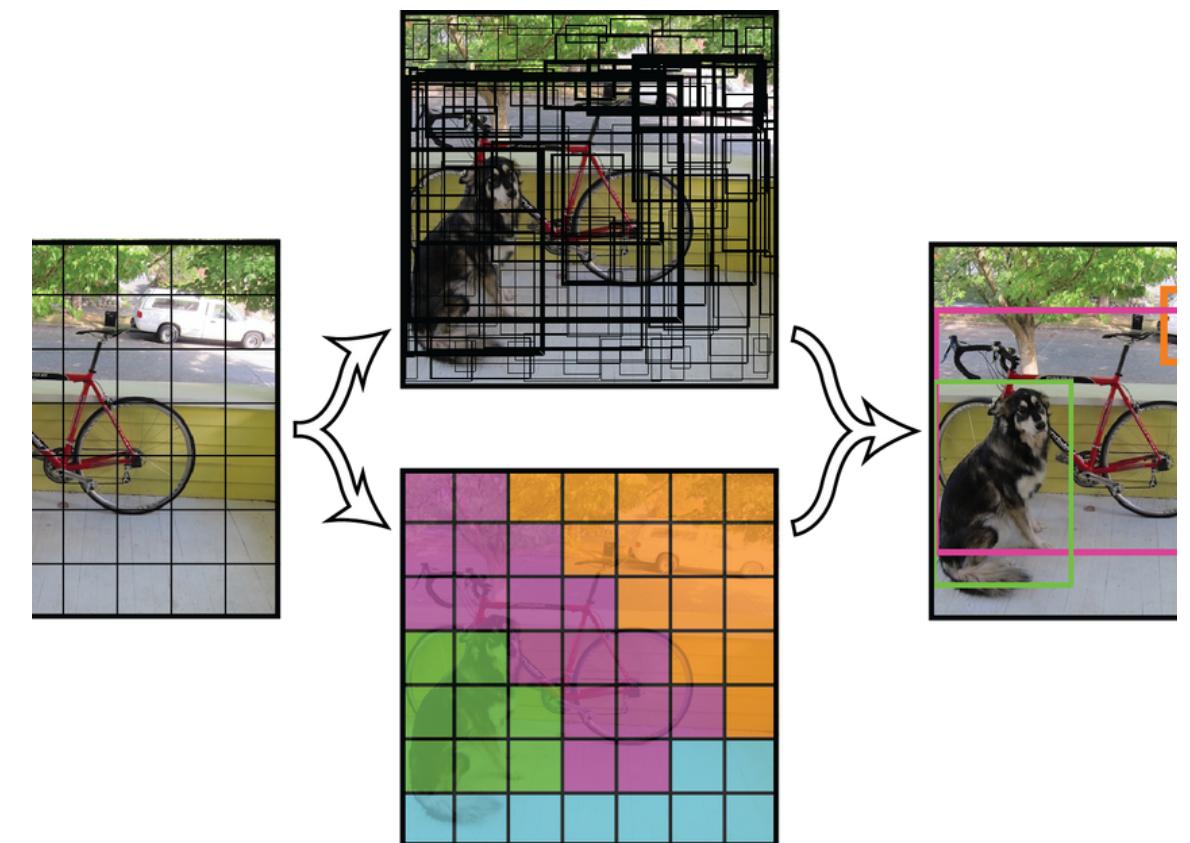
ANIMAL SPECIES DETECTION USING DEEP LEARNING

This project seeks to develop effective computer vision model using Deep Learning algorithm that can be deployed as part of detection systems to detect wildlife in urban environments, on highways using real time visuals to warn humans of potential collision with wildlife.

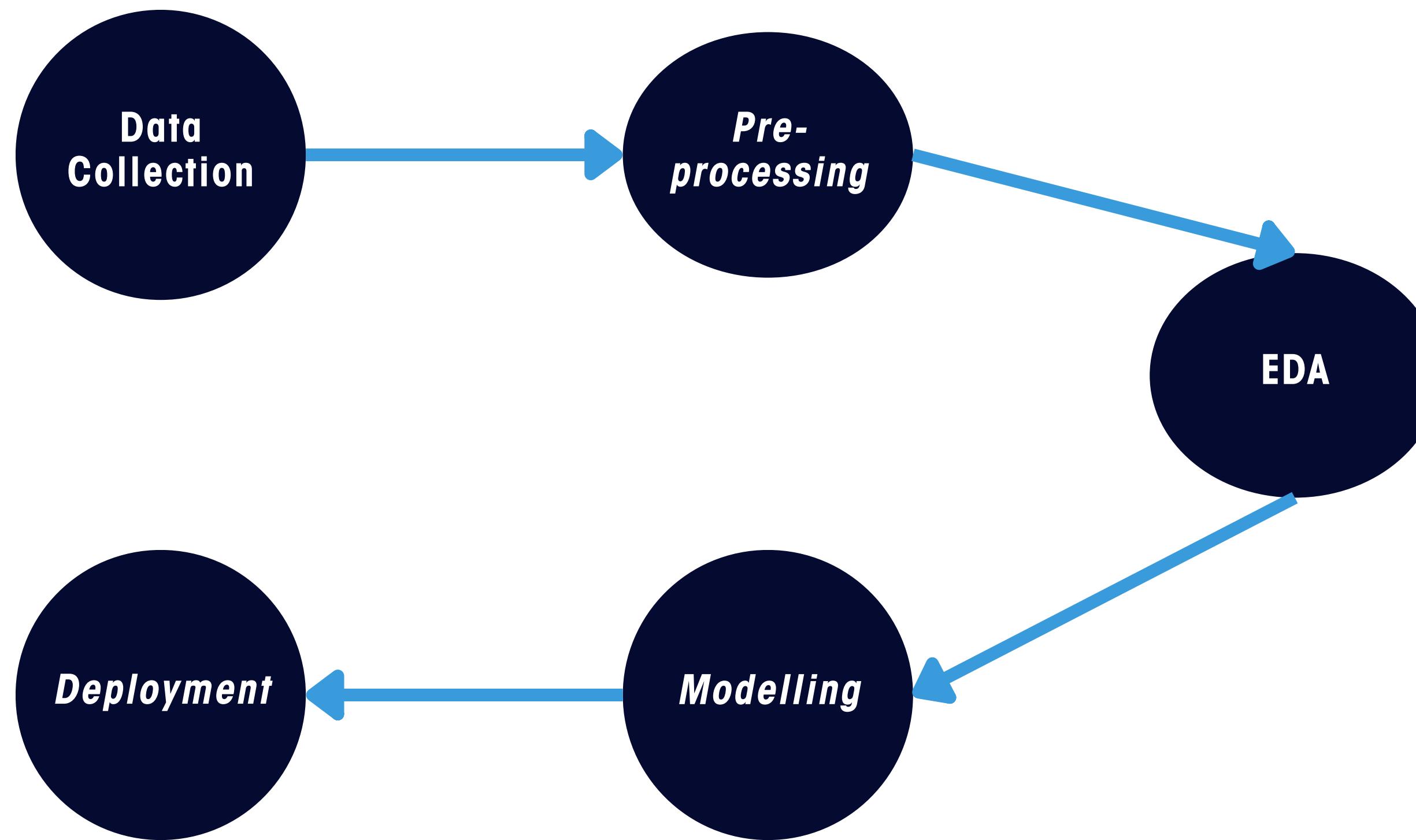


SOLUTION

- Our solution aims to design an inclusive and flexible deep-learning approach for animal species detection that suits various contexts.
- This initiative intends to primarily enhance road safety by detecting animals early and also boost wildlife preservation, refine animal population research, optimize agricultural methods.
- To achieve this, we employed a YOLOv8 model for animal detection and classification.



MODEL PIPELINE



DATASET DESCRIPTION

Previous dataset

- It contains 4 classes.
- All are annotated
- High image resolution.

Current dataset

- It contains 10 classes.
- None annotated
- Most images have low resolution.
- Annotated the high-resolution images using the Make Sense tool

Additional dataset

- It contains 80 classes.
- All are annotated.
- High image resolution
- The selection was limited to the classes that exist in the current dataset.

Combined dataset

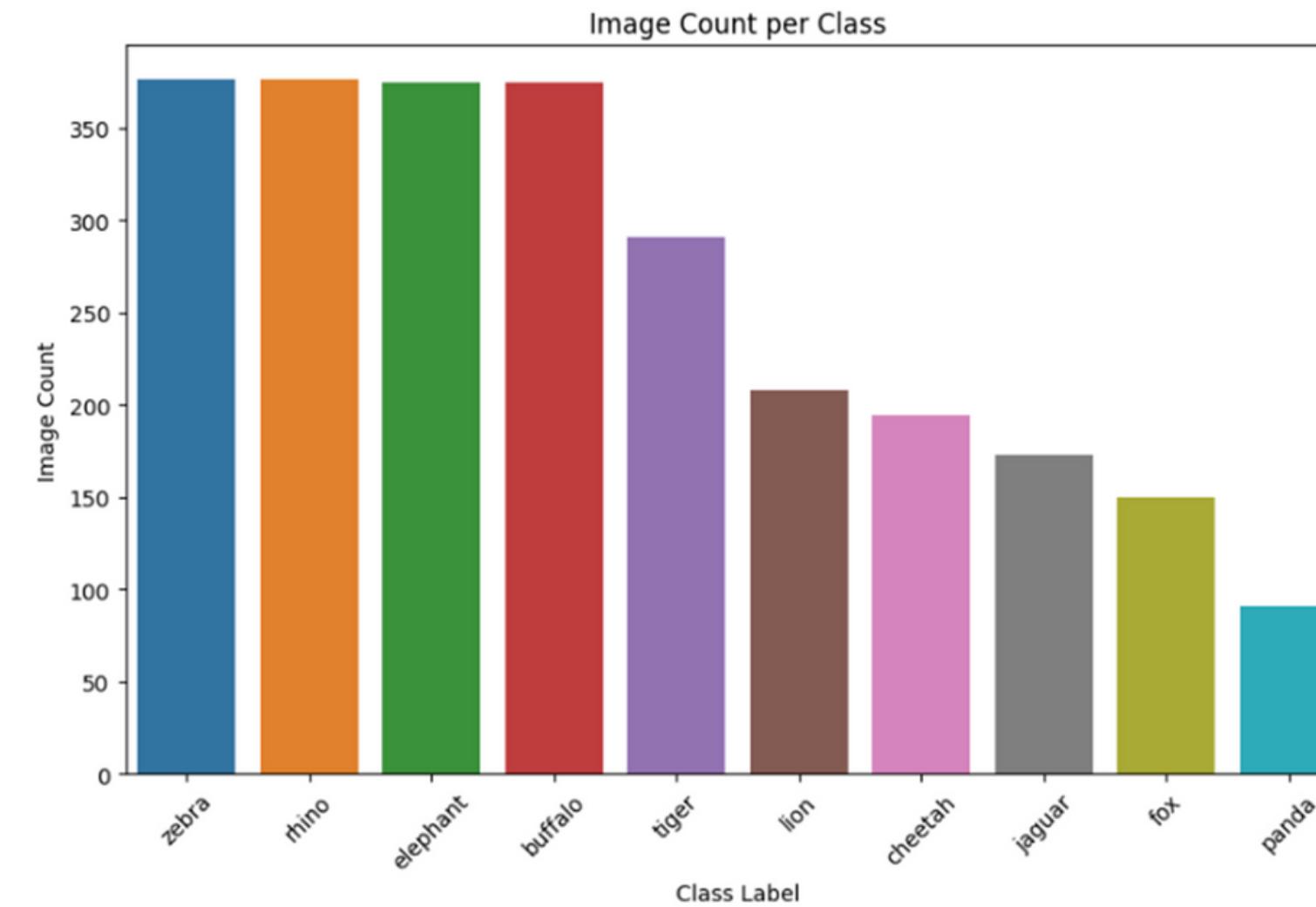
- It contains 10 classes, 4 from the previous and 6 from the current and additional datasets
- 2609 image files
- All are annotated
- High image resolution

DATA PREPROCESSING



EXPLORATORY DATA ANALYSIS

	Class Label	Image Count
0	zebra	376
1	rhino	376
2	panda	91
3	lion	208
4	elephant	375
5	buffalo	375
6	fox	150
7	tiger	291
8	cheetah	194
9	jaguar	173



The dataset is well-balanced, with each animal species having a substantial representation. The zebras and rhinos have the highest count with 376 images each, while the panda class has the lowest count with 91 images.

EXPLORATORY DATA ANALYSIS

```
Number of objects  count
```

	Number of objects	count
0	2	466
1	3	135
2	1	1893
3	25	1
4	4	54
5	11	1
6	5	25
7	6	21
8	8	3
9	7	6
10	10	3
11	9	3
12	14	1

```
2 df_dimensions.describe()
```

	Height	Width	Aspect Ratio	Pixels
count	2609.000000	2609.000000	2609.000000	2.609000e+03
mean	680.756995	937.675738	1.416894	8.221119e+05
std	380.602572	545.998171	0.316714	1.466427e+06
min	86.000000	99.000000	0.560156	1.109400e+04
25%	435.000000	640.000000	1.333333	2.739200e+05
50%	678.000000	992.000000	1.498829	6.942720e+05
75%	768.000000	1024.000000	1.505882	7.864320e+05
max	3888.000000	5666.000000	3.341067	1.996186e+07

- Majority of images have one object.
- Aspect Ratio varies from 0.56 to 3.34.

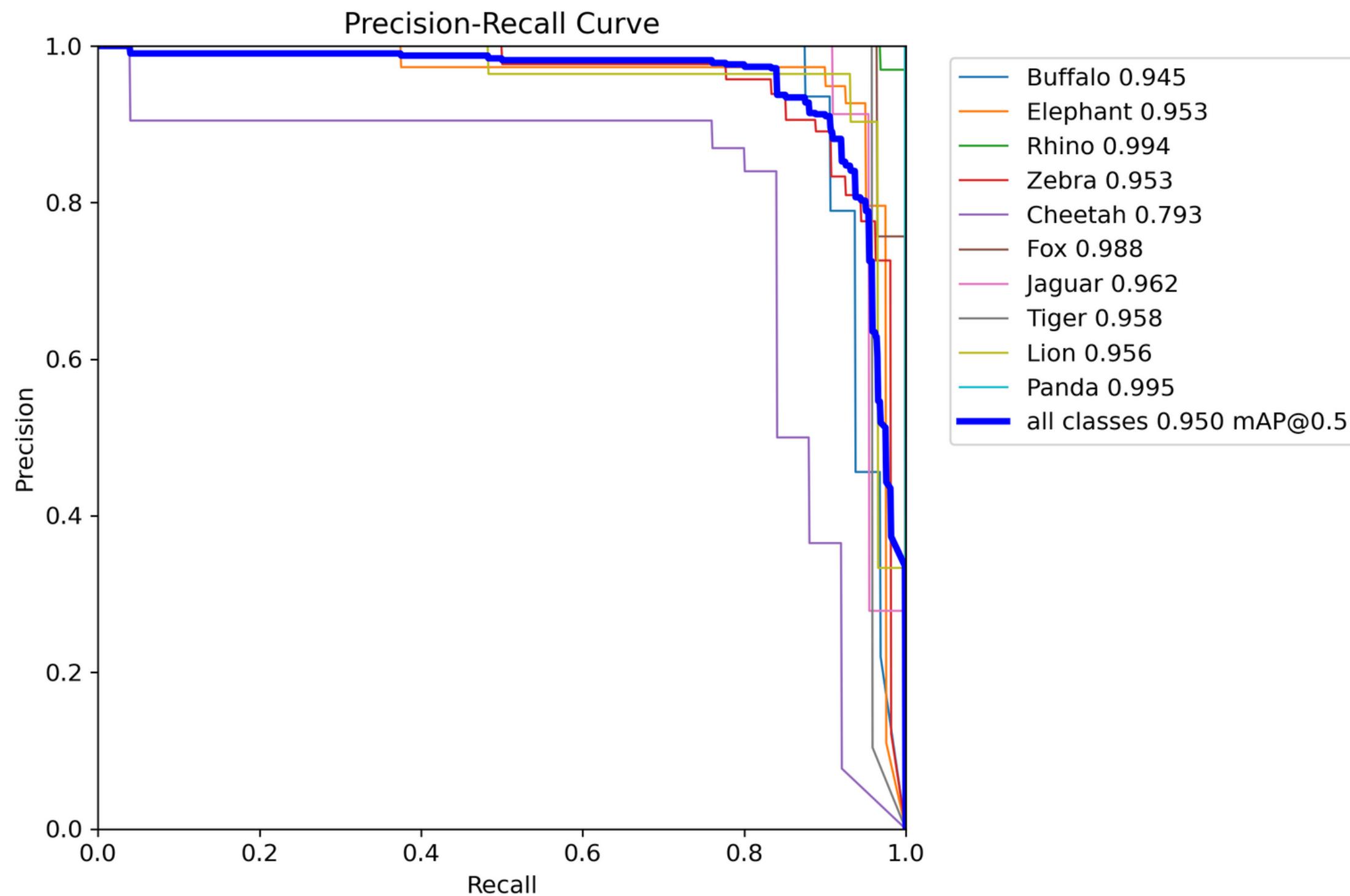
MODEL TRAINING

Model summary (fused): 168 layers, 3007598 parameters, 0 gradients

Class	Images	Instances	Box(P)	R	mAP50
all	243	329	0.907	0.938	0.965
Buffalo	243	40	0.947	0.95	0.985
Elephant	243	44	0.915	0.955	0.969
Rhino	243	38	0.927	0.974	0.993
Zebra	243	53	0.763	0.925	0.953
Cheetah	243	26	0.909	0.885	0.922
Fox	243	25	0.923	0.959	0.984
Jaguar	243	25	0.797	0.88	0.923
Tiger	243	33	0.937	0.899	0.94
Lion	243	26	1	0.959	0.988
Panda	243	19	0.95	0.996	0.99

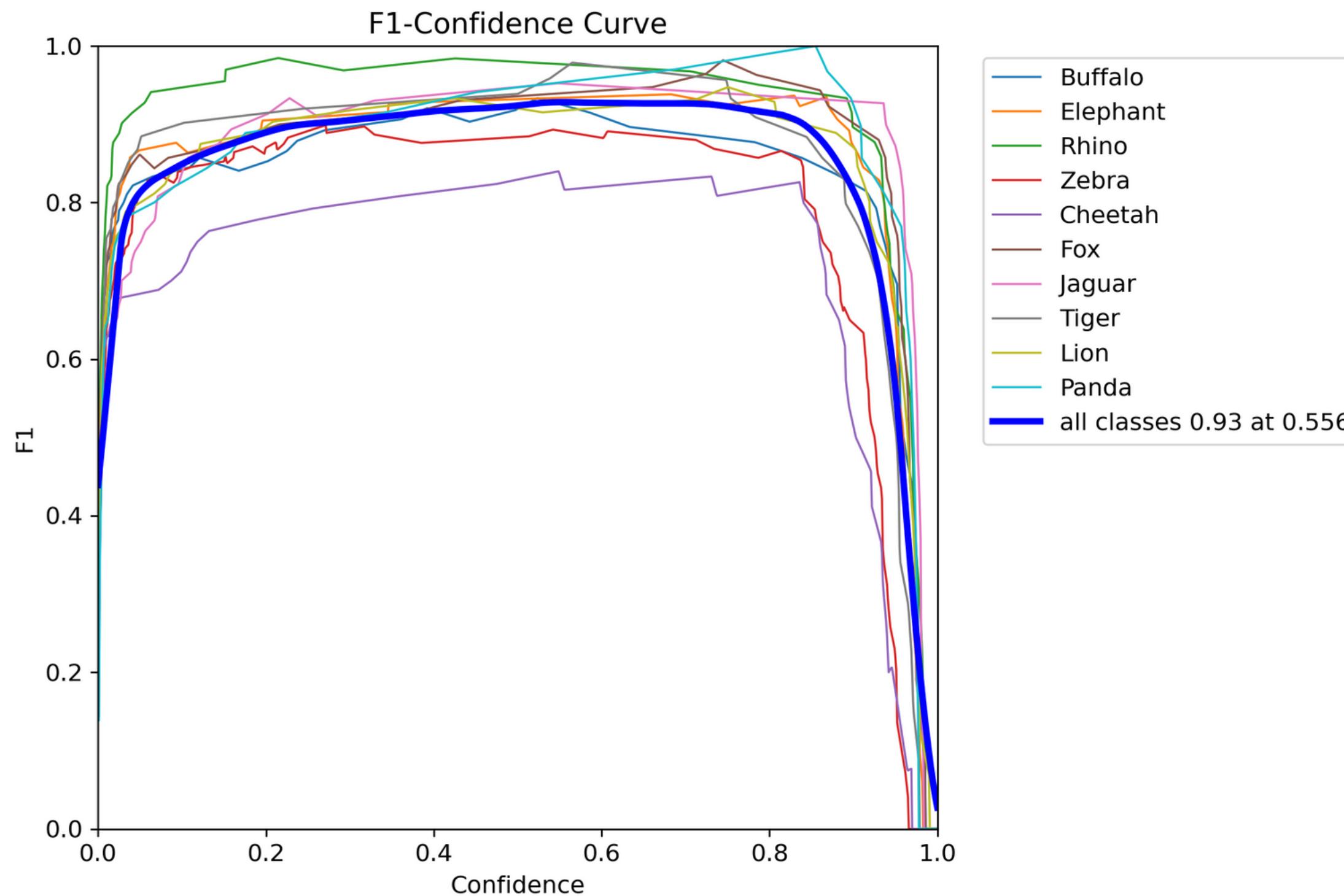
A summary of the model performance: The model has 168 layers and a total of 3,007,598 parameters, which are the values that the model learns during training to make predictions. The model was evaluated on a dataset of 243 images containing a total of 329 instances of animals. The evaluation metrics used were precision (P), recall (R), and mean average precision (mAP) at different thresholds (mAP50 and mAP50-95).

EVALUATION



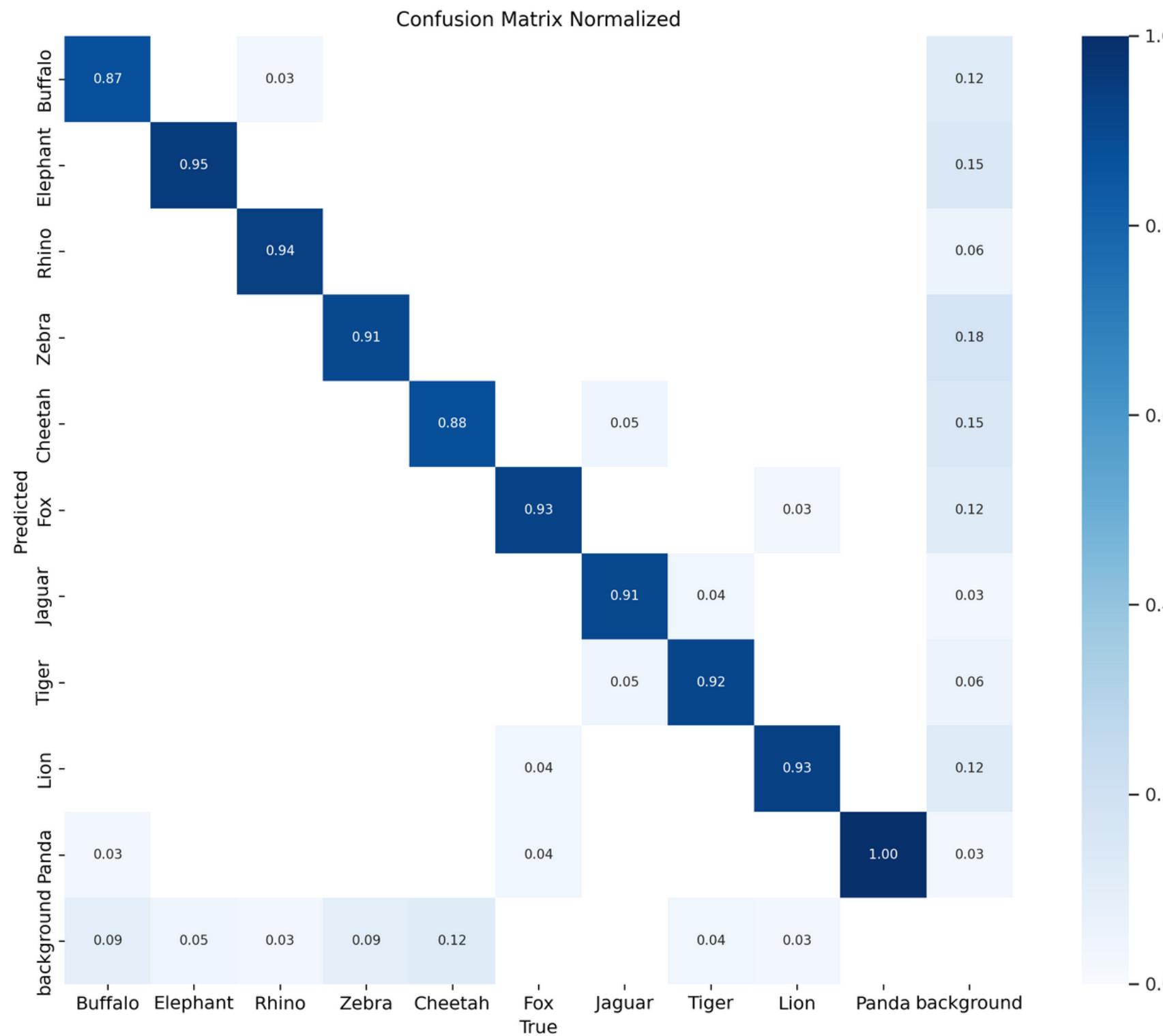
- Overall mAP50 score is 0.95
- Highest in Panda class - 0.995
- Lowest in Cheetah class - 0.793

EVALUATION



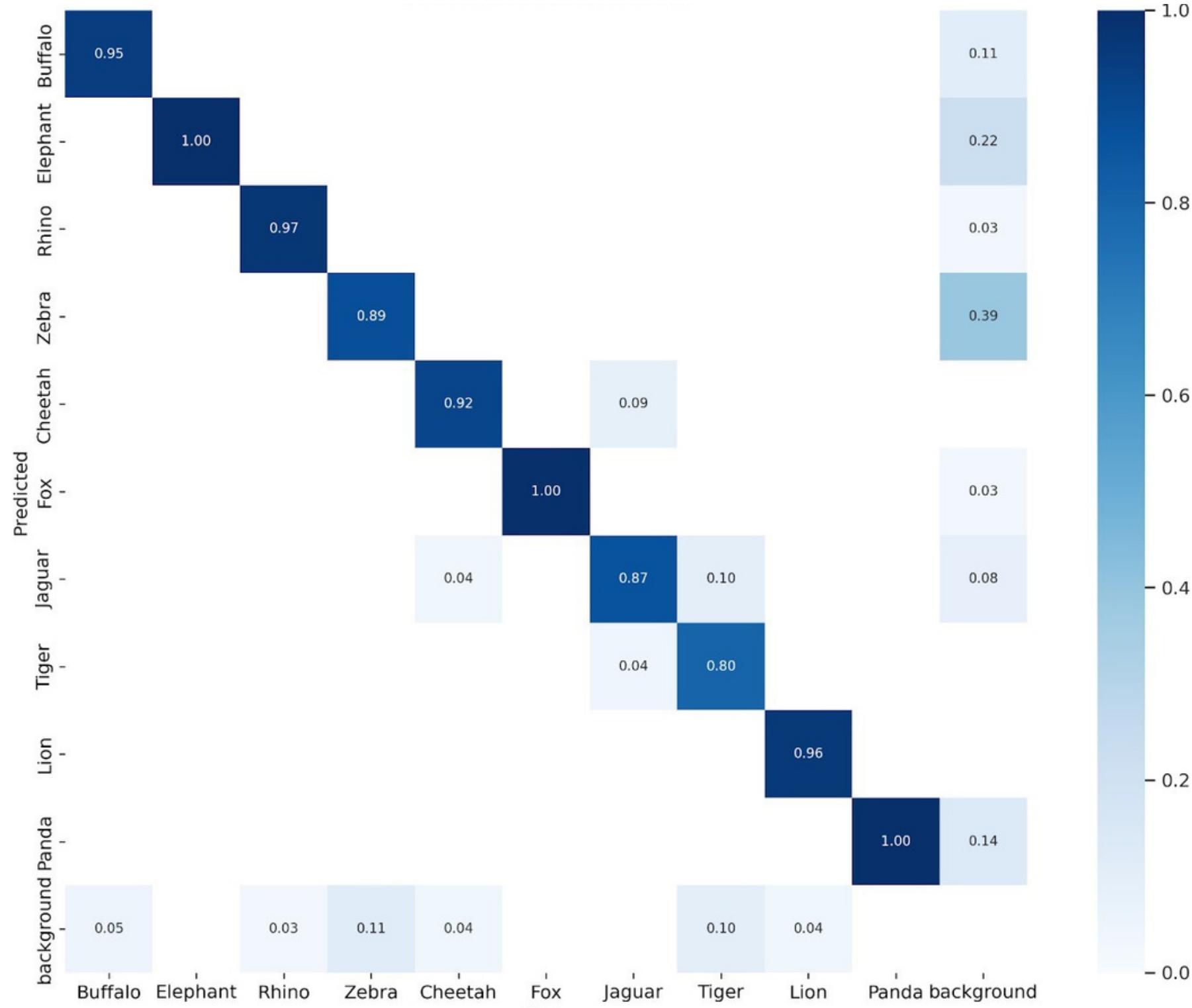
With recall 0.915 and precision 0.944, F1 score for Training is 0.93 at 0.556 confidence.

RESULTS FOR TRAINING



- High - Panda
- Low - Cheetah, Buffalo

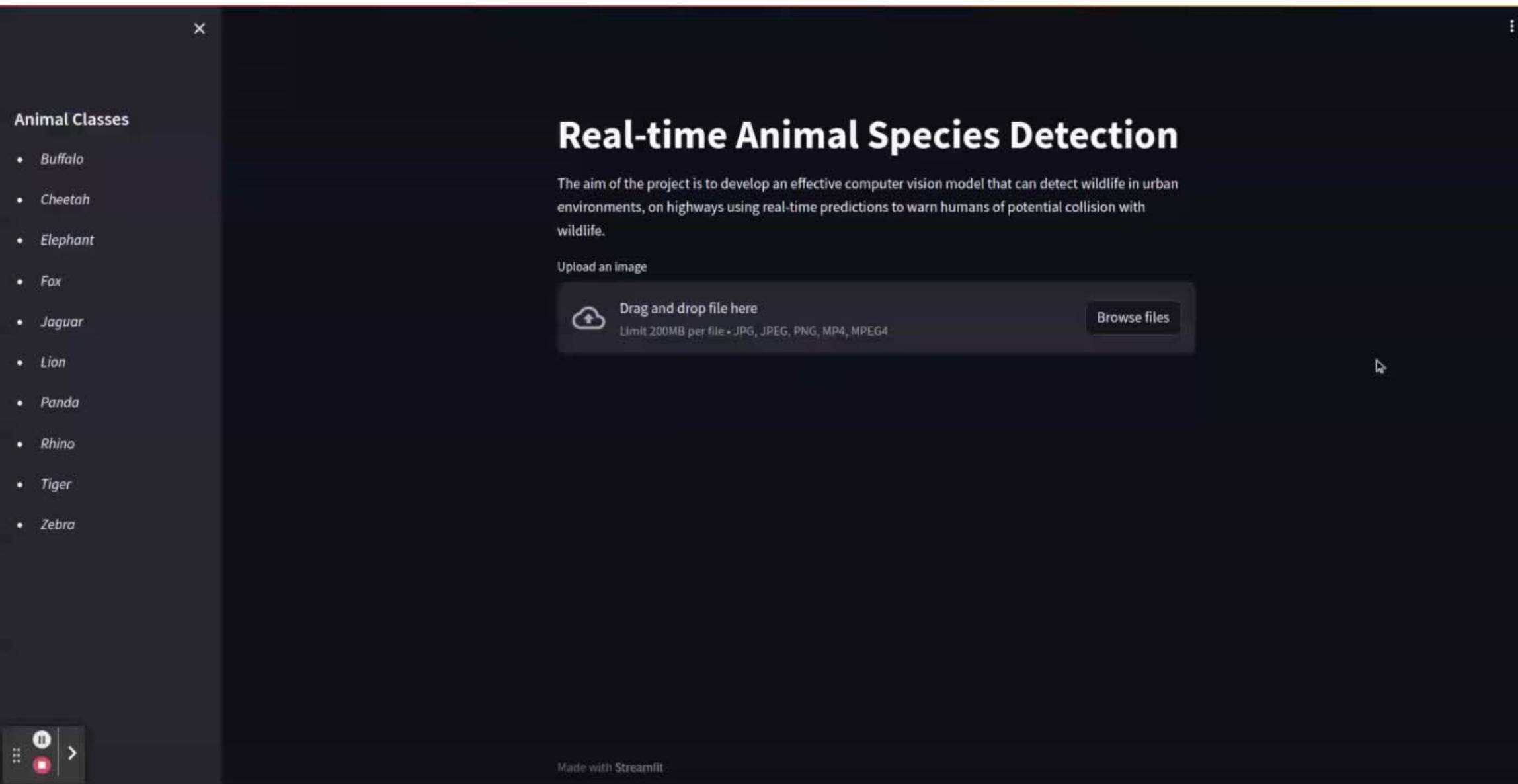
RESULTS FOR TEST



- High - Fox, Elephant, Panda
- Low - Tiger, Jaguar

DEPLOYMENT

The model was deployed using Streamlit on Hugging face. It can be accessed using this [link](#).



RECOMMENDATION

For future researchers and scientists venturing into the evolution of this model, an exciting pathway awaits.

- One of the primary areas of focus is extending the model's capabilities to adapt to new and previously unencountered animal species.
- This involves expanding the training dataset to encompass a broader range of species, thereby enhancing the model's ability to accurately detect and classify various animals.





Thank
You