

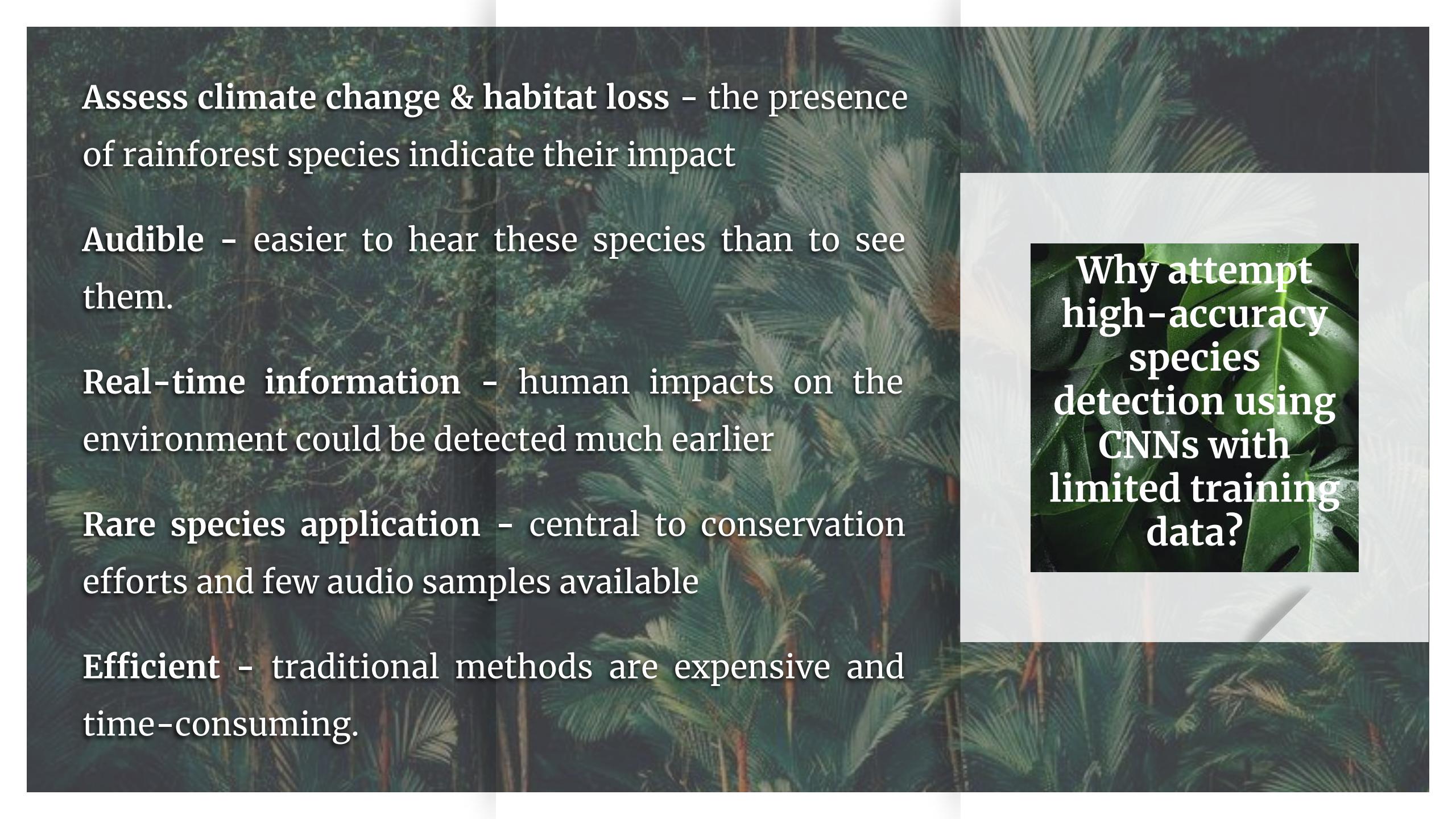


Developing an Automated Eco-Acoustic Monitoring System

Detecting Bird and Frog Species in
Tropical Soundscape Recordings

kaggle





Assess climate change & habitat loss - the presence of rainforest species indicate their impact

Audible - easier to hear these species than to see them.

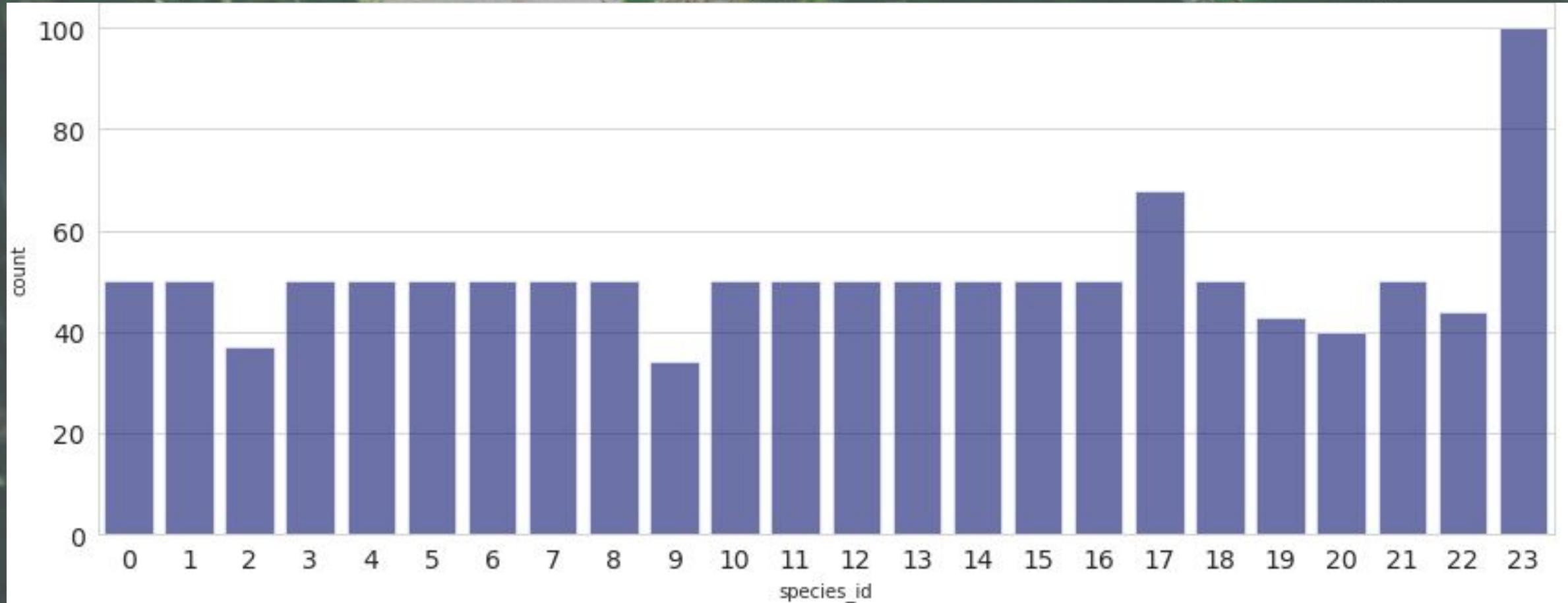
Real-time information - human impacts on the environment could be detected much earlier

Rare species application - central to conservation efforts and few audio samples available

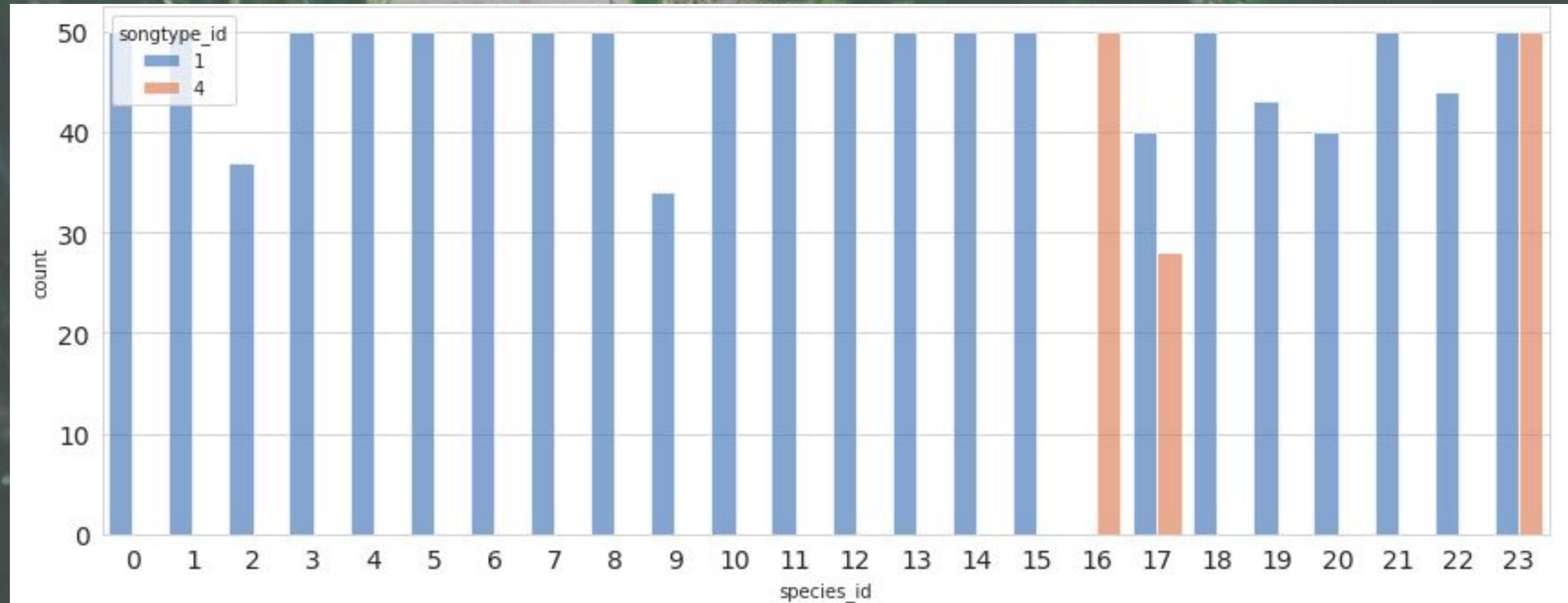
Efficient - traditional methods are expensive and time-consuming.

Why attempt
high-accuracy
species
detection using
CNNs with
limited training
data?

Species Class Distribution



Species Class Distribution by Song Type





Eleutherodactylus gryllus,
cricket coqui



Eleutherodactylus brittoni,
grass coqui



Leptodactylus albilabris,
Caribbean white-lipped frog



Eleutherodactylus coqui,
common coqui



Eleutherodactylus hedricki,
Hedrick's coqui



Dendroica angelae, Elfin
woods warbler

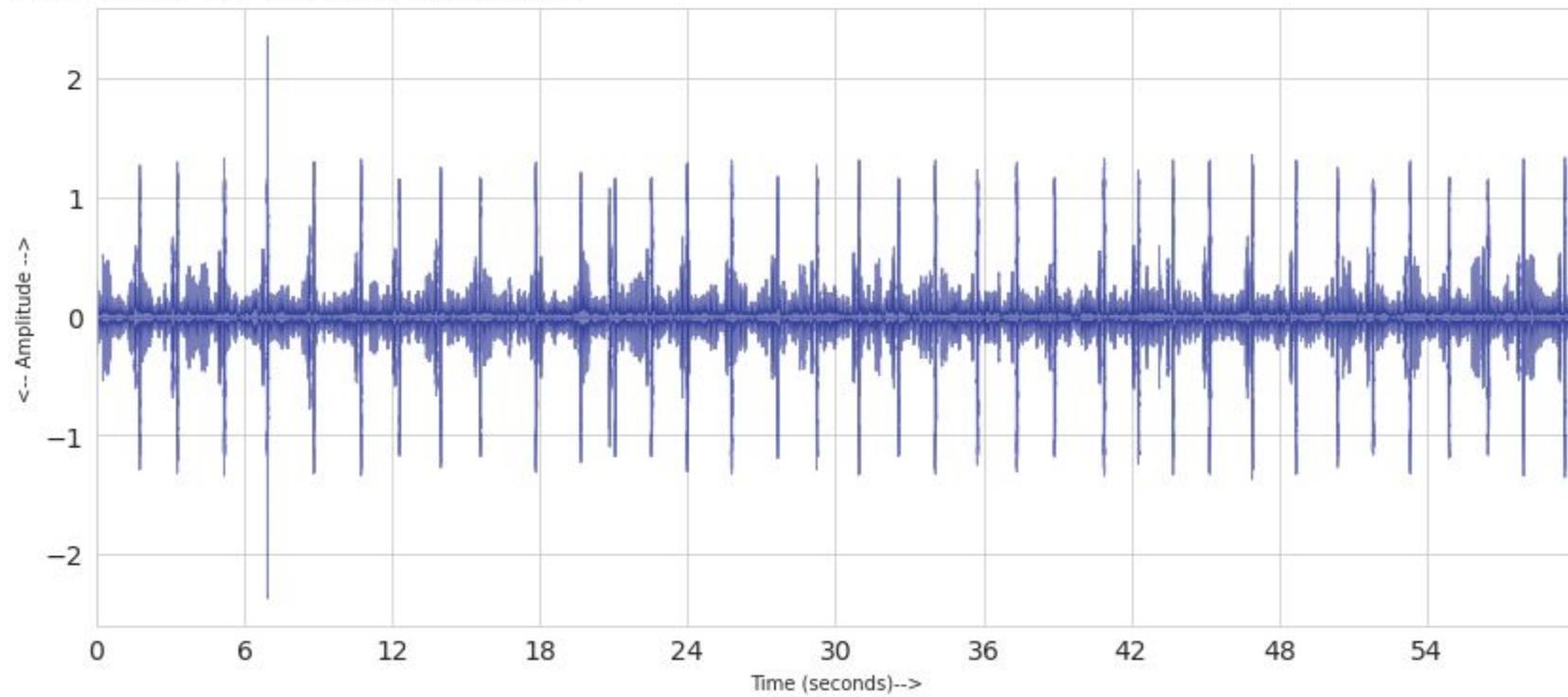


Melanerpes portoricensis,
Puerto Rican woodpecker



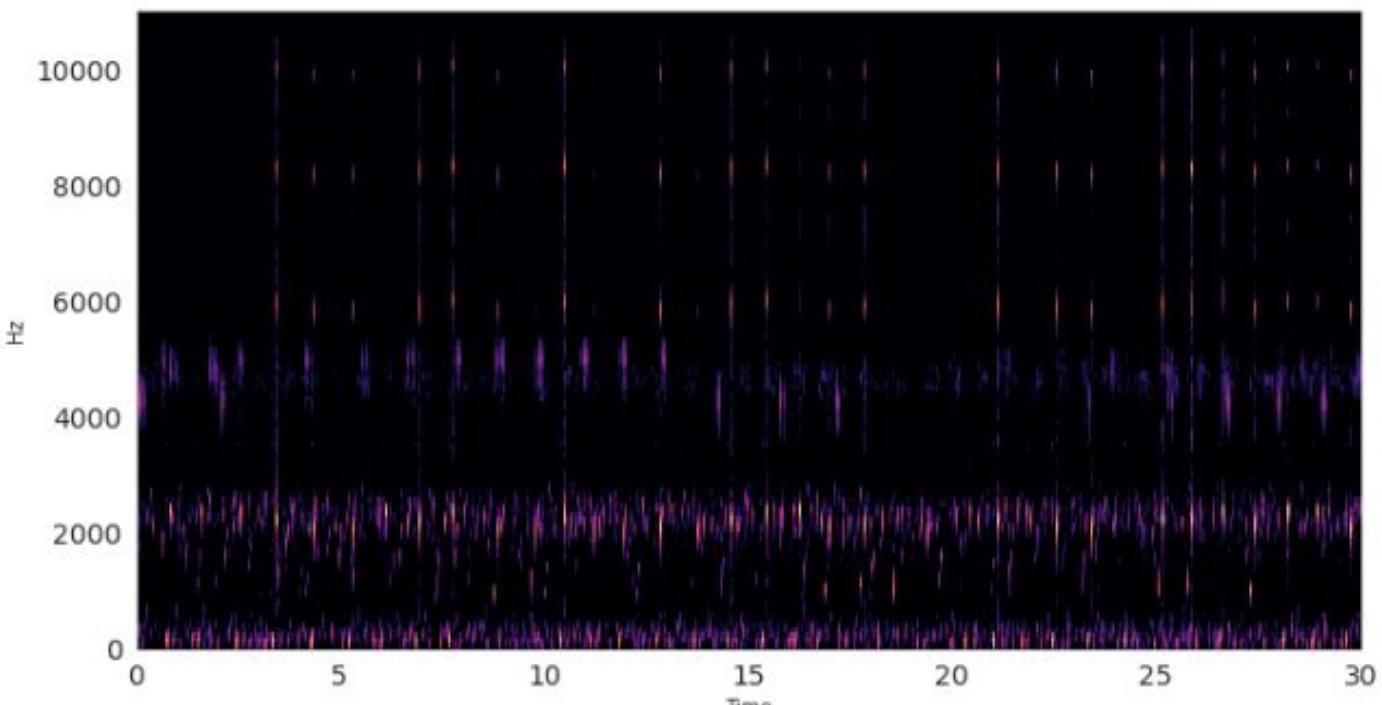
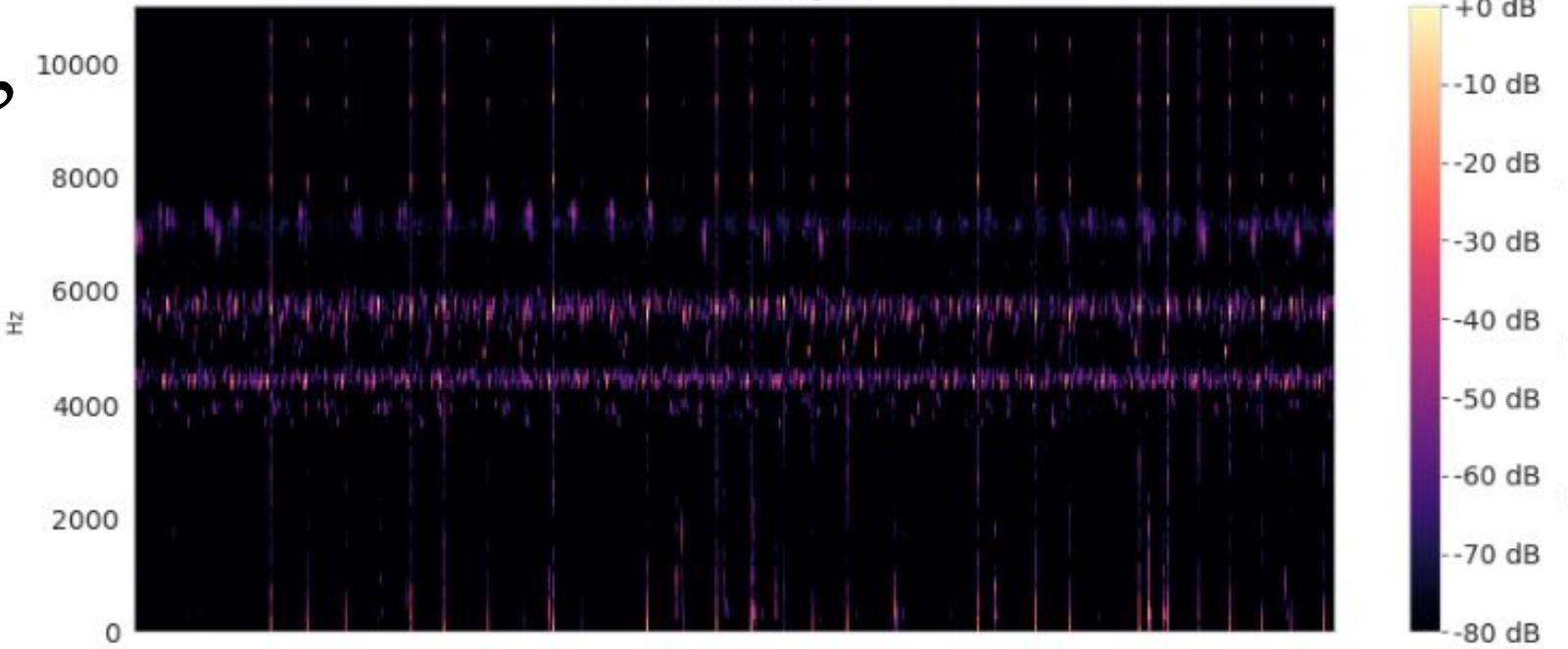
Coereba flaveola,
bananaquit

What Does Sound Look Like?



Spectrograms

Mel-scaled spectrogram



Preprocessing framework



Mel spectrograms -> Images

ImageDataGenerator:

- Image Augmentation
- Creates batches of the images for the model

Establish a NN Baseline

Stratified split
between train and
validation

Baseline:
Simple neural
network architecture
yielded 8% accuracy



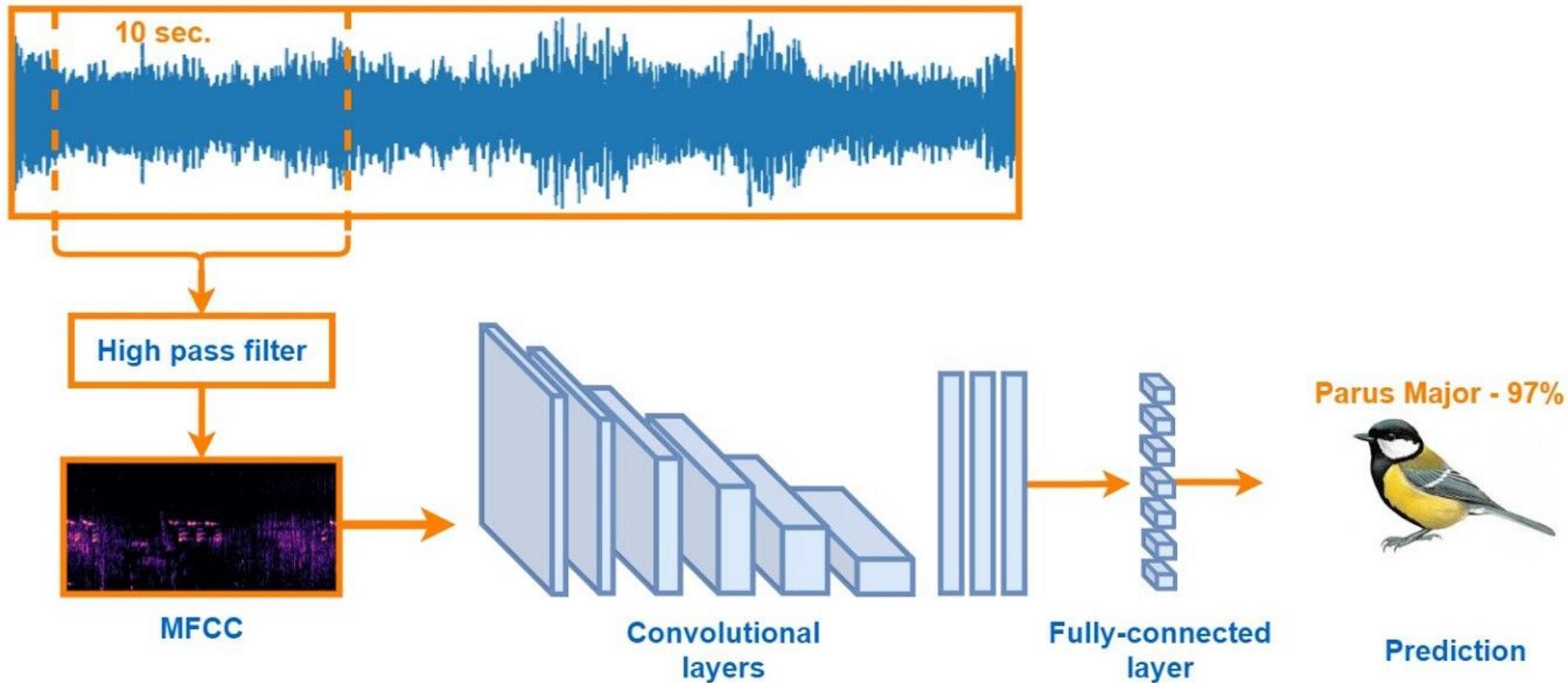
Expand & Refine Model



Transfer learning:
EfficientNetB3
architecture with
weights pre-trained on
ImageNet

Visualizing the Model

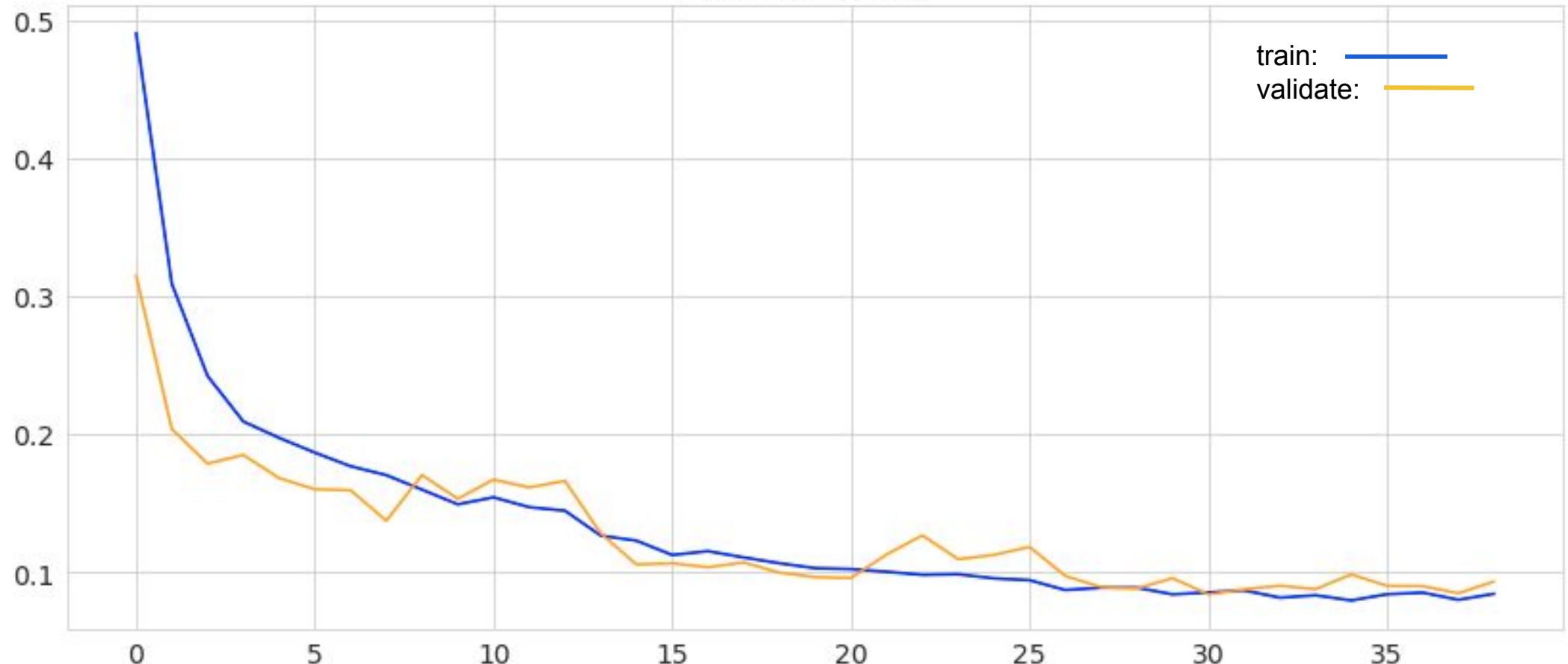




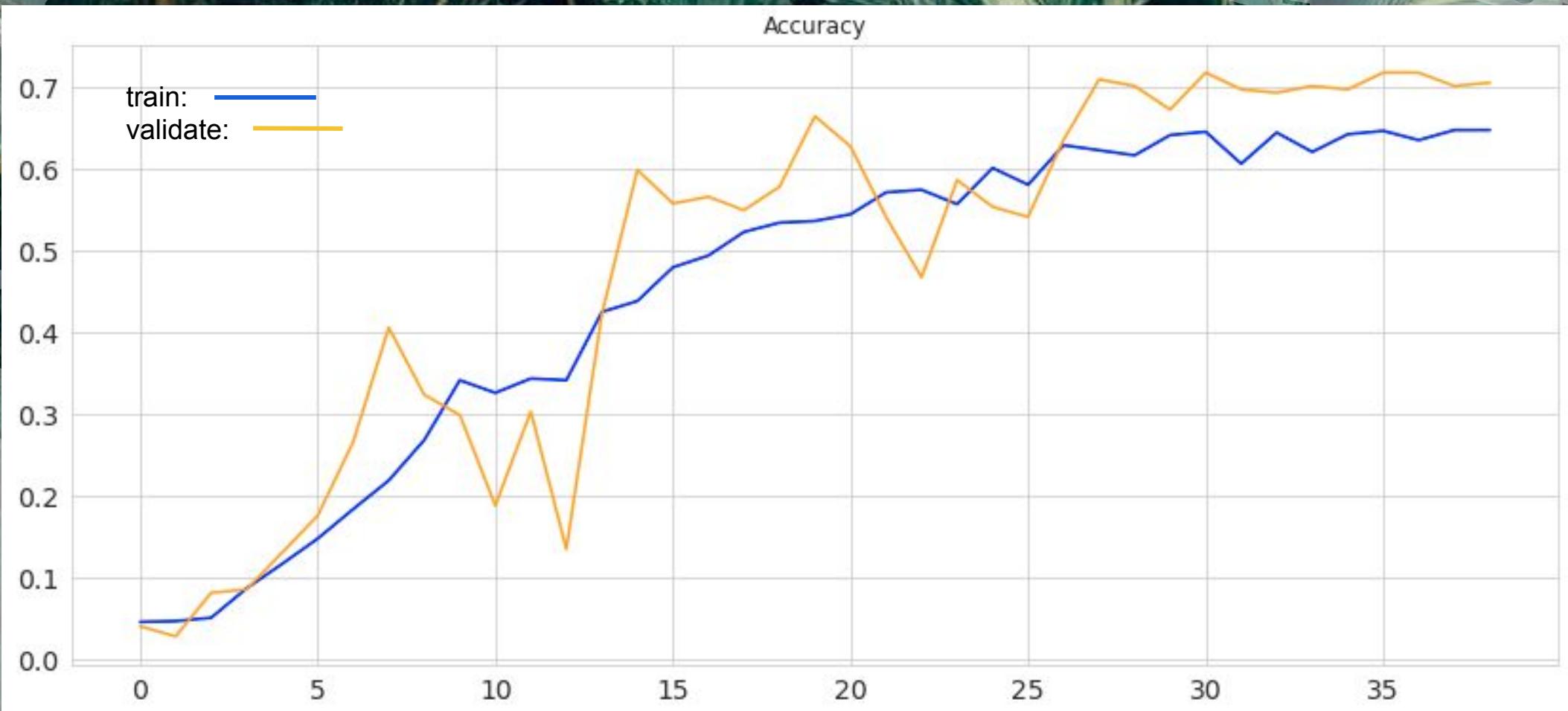
Log Loss

Cross Entropy Loss

train: 
validate: 



Accuracy



Performance Figures

Train/Val

95%/60%

64.7%/70.5%



Model Tuning:

Dropout
Weight regularization
Advanced optimizers
Callbacks
Layer Reduction



Performance Figures

	precision	recall	f1-score	support
0	0.67	0.80	0.73	10
1	0.82	0.90	0.86	10
2	0.67	0.80	0.73	10
3	0.67	0.80	0.73	10
4	0.42	0.80	0.55	10
5	0.62	0.50	0.56	10
6	0.62	0.80	0.70	10
7	0.75	0.60	0.67	10
8	0.75	0.90	0.82	10
9	0.57	0.93	0.70	14
10	0.60	0.30	0.40	10
11	1.00	0.89	0.94	9
12	1.00	0.88	0.93	8
13	0.83	0.62	0.71	8
14	0.67	0.60	0.63	10
15	0.78	0.78	0.78	9
16	0.74	0.85	0.79	20
17	0.00	0.00	0.00	10
18	0.89	0.80	0.84	10
19	0.55	0.60	0.57	10
20	0.89	0.80	0.84	10
21	0.50	0.40	0.44	10
22	1.00	0.60	0.75	10
23	0.00	0.00	0.00	6
accuracy			0.68	244
macro avg	0.67	0.66	0.65	244
weighted avg	0.67	0.68	0.67	244



Conclusion/Future Work

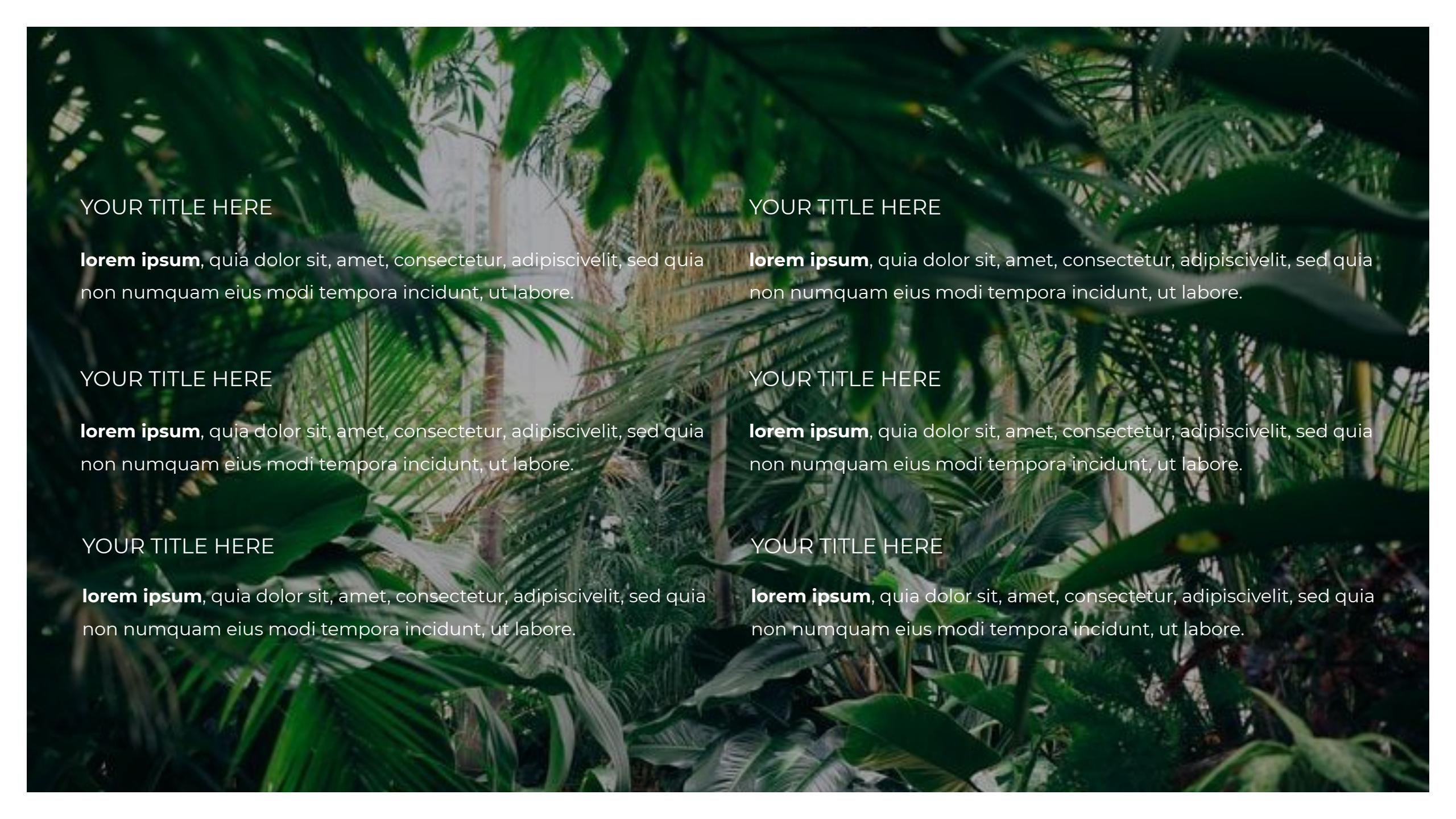
- Explore different models
- Look into 0% species
- Debug test submission
- Bring in more training data
- Use various audio filters instead of (or along with) the image augmentation
- Visit Puerto Rico...





lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.



YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incident, ut labore.



lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore.

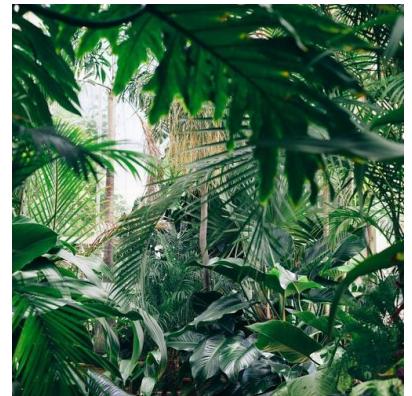
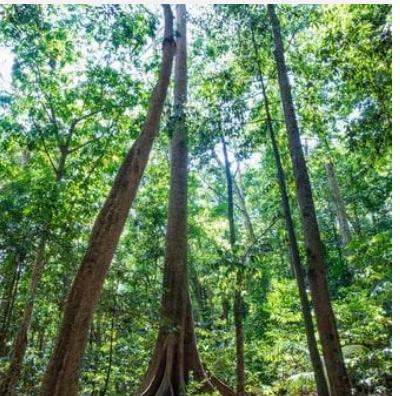
lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore.

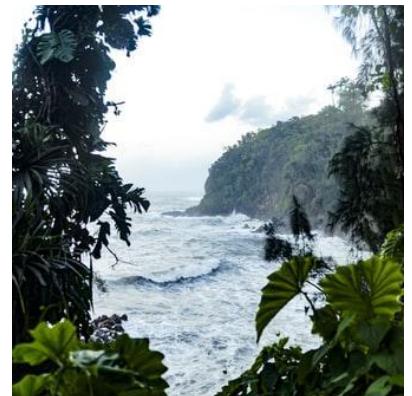
lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore.

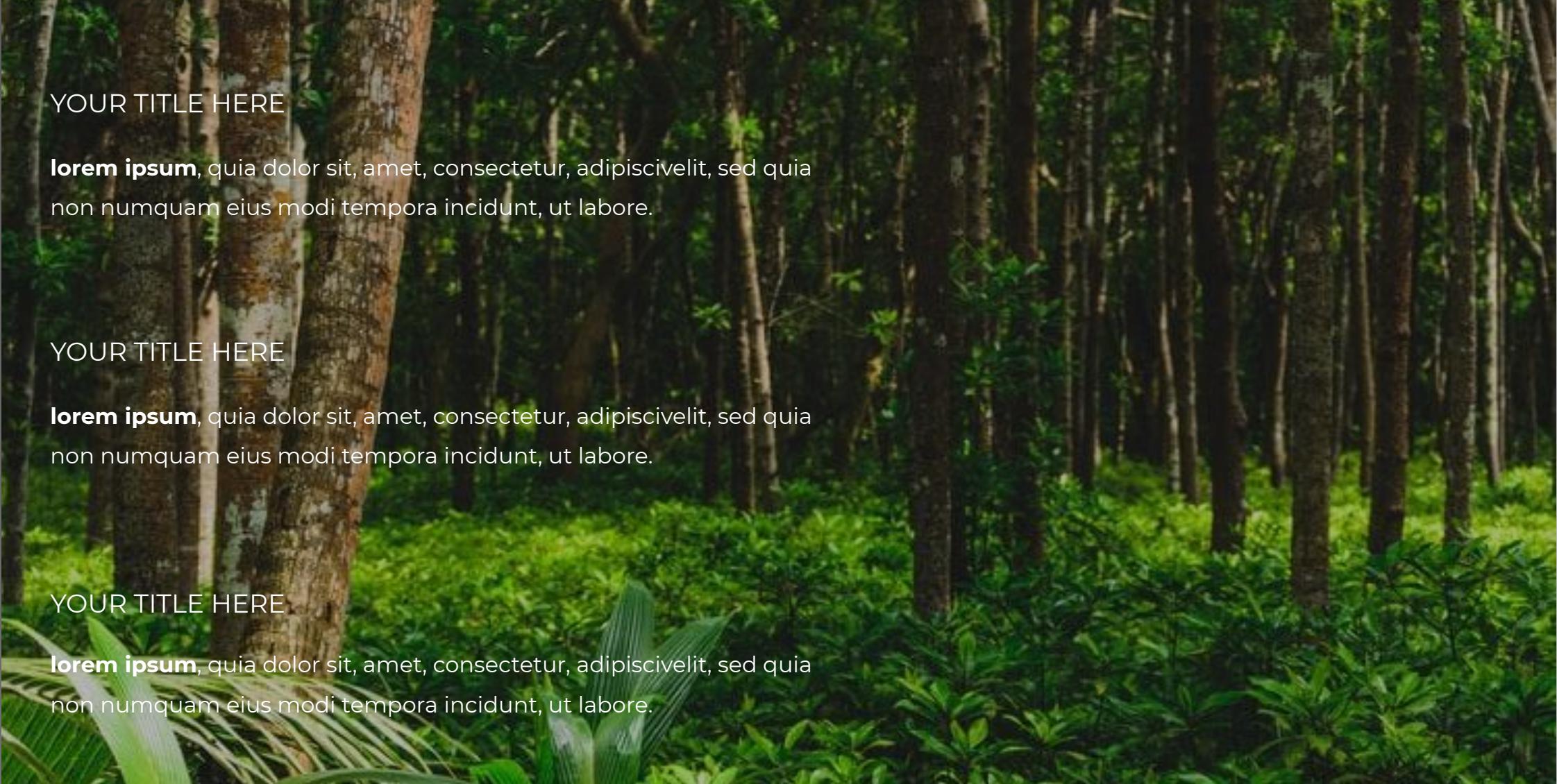
lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incidunt, ut labore.



lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.





YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia
non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia
non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia
non numquam eius modi tempora incident, ut labore.



lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incidunt, ut labore.

lorem ipsum, quia dolor sit, amet, consectetur, adipiscivelit, sed quia non numquam eius modi tempora incidunt, ut labore.

YOUR TITLE HERE



YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE HERE

lorem ipsum, quia dolor sit, amet, consectetur, adipisci velit, sed quia non numquam eius modi tempora incident, ut labore.

YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.



YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.



YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE
HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipisci velit,
sed quia non numquam eius
modi tempora incident, ut
labore.



YOUR TITLE

HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipiscivelit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE

HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipiscivelit,
sed quia non numquam eius
modi tempora incident, ut
labore.

YOUR TITLE

HERE

lorem ipsum, quia dolor sit,
amet, consectetur, adipiscivelit,
sed quia non numquam eius
modi tempora incident, ut
labore.





THANK YOU!