The Cornell Lab of Ornithology

Detecting calls of North Atlantic right whales using deep CNNs

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Why be concerned about right whales?

- Critically endangered
- Suffer ship strikes & fishing gear entanglements



Overview



Not just a right whale detector!



Understand effects of variations

> datapreparation> modelcomplexity



Goals

> achieve higher operational efficiency

> offer guidelines

Data

- NARW "upcall"
 - Bandwidth: 50 440 Hz
 - Duration: ~2 s
- DCLDE 2013 challenge[‡]
 - Training set:
 - 4 days × 24 hours
 6914 annotated upcalls
 - Testing set:
 - 3 days × 24 hours
 2767 annotated upcalls



Baseline



Yu Shiu et al., (2019, In Press). Deep neural networks for automated detection of marine mammal species.





DenseNet









- 16 pre-conv filters ۲
- 3 dense blocks
- Same growth rate & layers per block

Customizations

- Implicit pooling: strided convolution
- Trailing FC/dense layer



Images describing CNN architectures in this slide were obtained from https://towardsdatascience.com/review-densenet-image-classification-b6631a8ef803





11 clip sizes x 4 overlap thresholds

X666



If you torture the data long enough, it will confess to anything.













1x4_1x4_1x4_16





Summary

DenseNet works!

- Well-suited for spectrotemporal data
- Offers low-cost alternative (trained model size: 180 kB - 1 MB)
- Observations
 - Data sufficiency
 - Model complexity limits
- Trade-off considerations
 - Data preparation: clip size vs. annotation coverage
 - Temporal context vs. processing (train/inference) time
 - Training set size vs. model complexity



Thank you

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