Non-Invasive Fish Species Classification Using Deep Learning: A Hydroacoustic Approach for Sustainable Ecological Monitoring

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Problem:

- Invasive traditional methods harm ecosystems
- hydroacoustic data lacks species classification tools.

Target:

- LSTM model to classify Lake Trout v.s. Smallmouth Bass using frequency responses (45–260 Hz).

Key Steps:

- Preprocessing:
  - Cleaned 6,085 recordings (16 fish).
  - Explored PCA/RF (10 key features identified but not used in LSTM).
- Modeling:
  - Trained LSTM on raw 426-feature sequences (2-layer, masking, Adam).
  - Validated with Leave-One-Fish-Out and Stratified K-fold.
- Result:
  - 73.8% accuracy (vs. XGBoost's 72% with PCA features).
- Contribution:
  - Non-invasive framework for scalable ecological monitoring.

Future Work:

- Expand dataset.
- Test transformers.
- Field validation.