Automatic Detection of Brown-headed Cowbird Song in Urban Environments
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Introduction
- 24/7 cameras and microphones let us study the group dynamics of an entire flock of cowbirds
- The end goal is to build a “smart aviary” which automatically processes raw video and audio into behavioral data

Question
- How to automatically identify when calls occur?
- Types of calls
- Complications:
  - Urban noise (trains and highway traffic)
  - Calls of other bird species
  - Overlapping calls

Methodology
- Example calls were manually annotated and then converted to “dictionary” vectors
- We build a sparse representation (SR) of each audio segment in terms of these vectors using a process called orthogonal matching pursuit
- The SR tells us the amount of signal in the audio sample, and what is left over is the noise—using this, we can calculate the signal-to-noise ratio (SINR)
- Samples with high SINR are detected as calls and samples with low SINR are ignored

Results
- We used an ROC curve in order to find an optimal value for the threshold
- Using this threshold, we were able to successfully identify 94% of the validation call dataset with only 5% error

Next Steps
- The end goal is to completely characterize the behavior of birds automatically and combine behavior with neural data
- Sound detection can be combined with sound localization and bird position information to auto-detect which birds are singing when...