

AI-DRIVEN ACCELEROMETER-BASED BIRD ACTIVITY RECOGNITION

CONTEXT

- Track activities of migrating birds
 - Study activity patterns
 - Sensor on bird
- Problem
 - Little available energy
 - Little storage
 - Compromise between uploading and collecting data



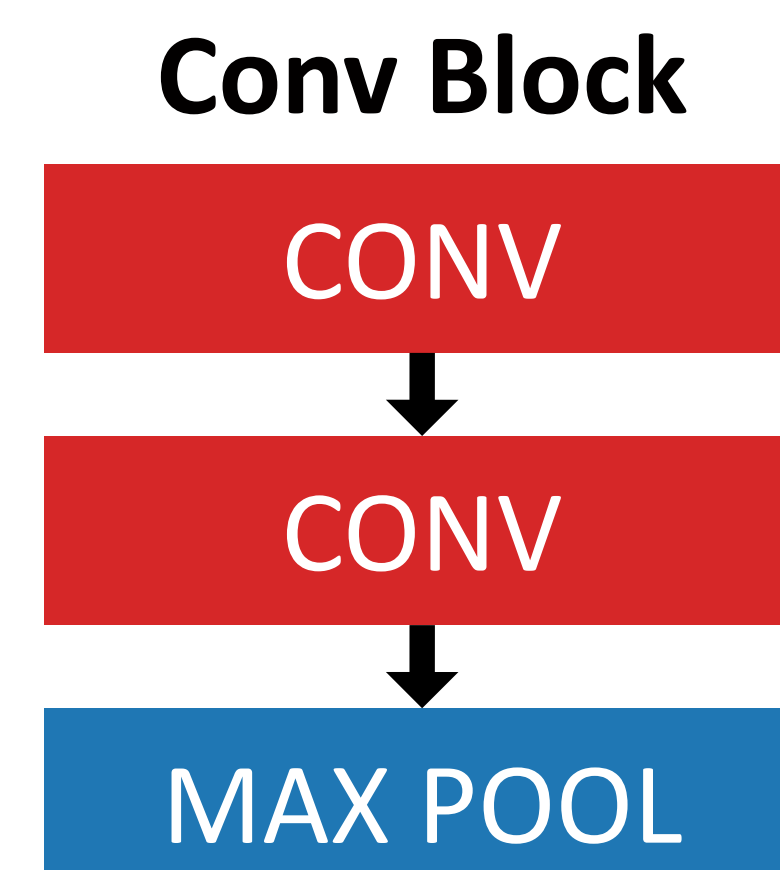
GOAL

- Classify activities on bird
 - Easily usable data/insights for biologists
 - Reduces communication amount
- Distinguish 4 activity classes using accelerometer data
 - Swimming
 - Distance flight
 - On ground (not moving)
 - Foraging



SETUP

- Data
 - 60 accelerometer readings within 3 seconds every 5 minutes
 - 10% of data labeled
- Use labeled data for training (supervised learning)
- Baselines
 - Decision Tree (max. depth 10)
 - Random Forest (50 decision trees)

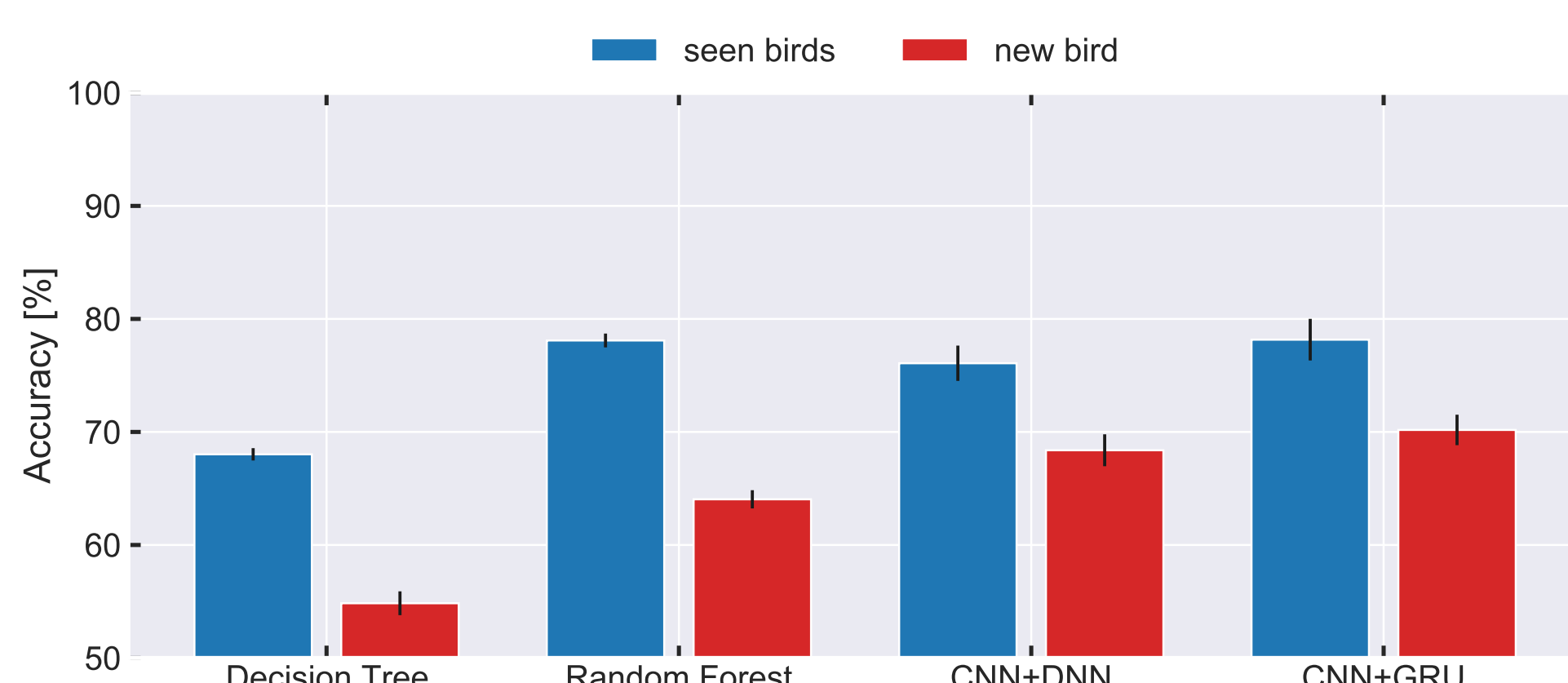


MODELS

- Combination of Convolutional Neural Network (CNN) and Dense Neural Network (DNN)
 - 4 Convolutional blocks (two convolutions per block with 32+128, 32+32, 32+32, and 32+32 filters)
 - 4 Dense layers (32 neurons each)
- Combination of Convolutional Neural Network (CNN) and Recurrent Neural Network (RNN)
 - 2 Convolutional blocks (filters: 32+32) each followed by a dropout layer
 - 2 Gated Recurrent Unit (GRU) layers (64 outputs)

INITIAL RESULTS

- 10 training runs
 - Decision Tree: 235 parameters
 - Random Forest: 11,813 parameters
 - CNN + DNN: 44,939 parameters (*model used for confusion matrices*)
 - CNN + RNN: 41,387 parameters



		Seen birds			
True Class	Predicted Class	swimming	flight	on ground	foraging
		swimming	77.6	4.1	14.3
flight	7.2	88.4	0.0	4.3	
on ground	5.6	1.1	76.7	16.7	
foraging	2.9	7.1	32.9	57.1	

		New bird			
True Class	Predicted Class	swimming	flight	on ground	foraging
		swimming	73.5	0.9	0.9
flight	1.6	92.9	3.2	2.4	
on ground	4.0	0.6	64.9	40.5	
foraging	2.7	2.7	24.5	70.0	

FUTURE WORK

- Explore more approaches using unlabeled data
 - Semi-supervised learning
 - Unsupervised learning
- Split classes into subclasses
 - foraging* and *on ground* are currently hardly distinguishable
 - Foraging is a combination of *flight* and *on ground*
- Collect data for longer periods of time
- Include previous activities
 - Get more context from available data
 - Learn how likely activities change