Fish migration monitoring from audio detection with CNNs

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1 September 2021

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1. Introduction

- Preserve biological diversity
- Reduce human costs
- Enlarge the study area

On spring nights, migratory fish produce splashes in rivers during spawning.

VIDEO FANNY ALIX

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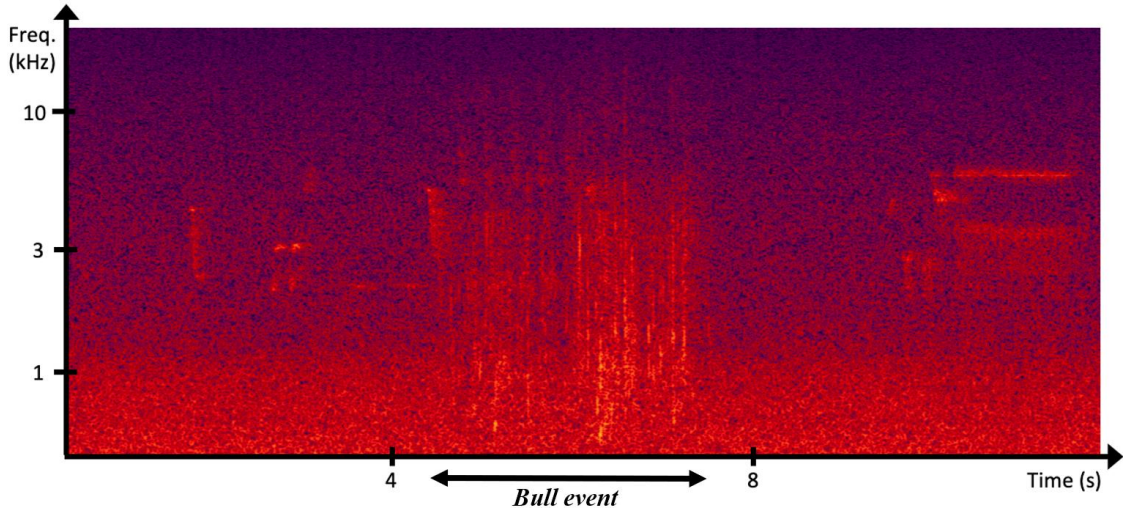
2. Data

- 20 recordings on several sites manually labelled → 68 hours
- 47.567 segments of 15 seconds, including 2160 labelled as bulls (4.5 %)
- 709 bull events in total

Year	River / site	# Rec.	Duration	# Bulls
2009	Charente	2	46m	94
2012	Loire	6	30h59	73
2013	Charente	3	2h	251
2014	Ceze	2	3h54	208
2016	Vidourle	1	1h11	6
2017	Ceze & Vidourle	5	24h06	60
2018	Ceze	1	5h38	3

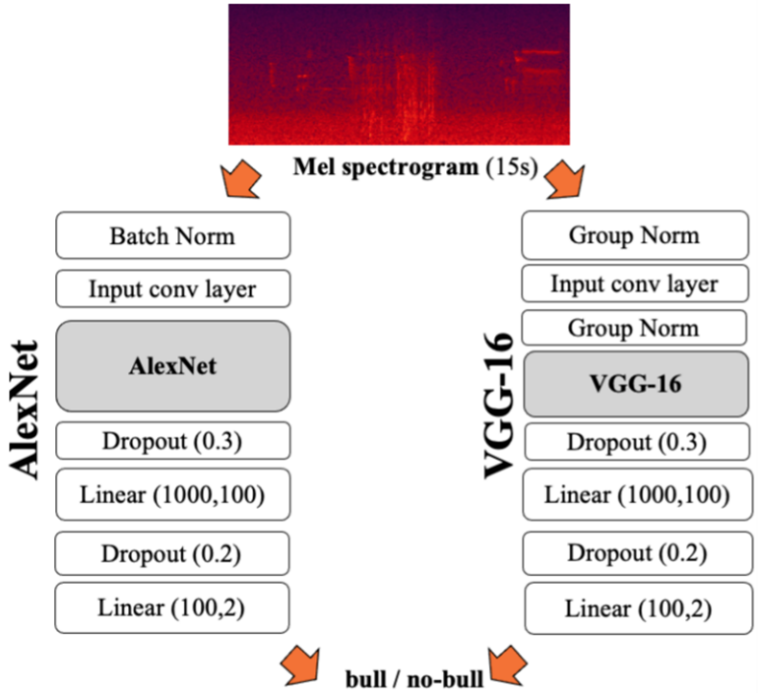
Sites, number of recordings, total durations, and number of annotated bulls for each year.



Spectrogram of a bull audio event.

3. Methods

- **Pre-processing:** data cutting and overlapping
- **Models:** adaptations of AlexNet and VGG-16
- **Metric:** average recall



Models.

Audio segmentation with overlapping.

4. Experiments and results

- **Hyper-parameters testing:** batch size, audio segments duration, learning rate, …
- **Memory optimization strategies:** gradient accumulation, data generation on-the-fly, …
- **Results:** best score = 89.7 %

	AlexNet	VGG-16
Precision	41.4	21.3
Recall	81.4	93.2
Average recall	88.4	**89.7**

Results of the bull detection on the test set.

	Bull predicted	No-bull predicted
Bull segment	**330**	24
No-bull segment	1220	**7592**

Confusion matrix on the test set with the VGG-16 model.

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5. Conclusion

- Small number of missed bulls
- Number of segments to be listened by humans divided by almost 6
- Improvements :
  - use of Recurrent/Attention layers
  - collection of additional data
  - set up of other data augmentation technics
  - use of strong labels

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