

OSmOSE : groupement d'intérêt scientifique pour l'acoustique passive sous-marine

Workshop SERENADE 29 juin 2022

Equipe OSmOSE

<https://osmose.ifremer.fr/>

Speakers : Gabriel DUBUS, Dorian CAZAU

Plan

Part I : la communauté DCLDE du point de vue de l'IA

Part II : OSmOSE dans les grandes lignes

Part III : Etude de cas sur APLOSE et annotation collaborative

Avant de venir j'ai voulu ...

- choisir une **tâche de référence**
- récupérer une **base de données annotées ouverte**
 - évaluer mon modèle sur un **état de l'art**

Une palanquée de catalogues d'échantillons de sons

Best of Fraser's Dolphin (*Lagenodelphis hosei*) 87 sound cut files

See the 'About' section for [crediting](#) and [download](#) instructions.

Sound cut file	Location	Observation Date	Download link	Metadata
00:00 00:02	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00 00:01	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00 00:01	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00 00:02	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
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00:00	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00	SW of Scott Head, Dominica	26-Oct-1991	Download	Metadata
00:00	Prince Rupert Bluff, Dominica	26-Oct-1991	Download	Metadata
00:00	Prince Rupert Bluff, Dominica	26-Oct-1991	Download	Metadata
00:00	Prince Rupert Bluff, Dominica X	26-Oct-1991 X	Download	Metadata
00:00	Prince Rupert Bluff, Dominica	26-Oct-1991	Download	Metadata
00:00	Prince Rupert Bluff, Dominica O	26-Oct-1991 O	Download	Metadata
00:00	Prince Rupert Bluff, Dominica O	26-Oct-1991 O	Download	Metadata

Table of Contents

- **Mysticetes (Baleen Whales)**
- **Odontocetes (Toothed Whales)**
- **Pinnipeds (Seals, Sea Lions, and Walruses)**
- **Teleosts (Bony Fish)**
- **Human-made Sounds**

Blue Whale

(Low-frequency sound: played at 3x normal speed)



Fin Whale

(Low-frequency sound: played at 5x normal speed)



<https://www.fisheries.noaa.gov/national/science-data/sounds-ocean>

Une (petite) liste centralisée de ces catalogues

Fev 2022 : <https://www.eurekalert.org/news-releases/943736>

Et voici ce que j'ai trouvé :

Mots clés : *marine mammal + open source + sound database
+ machine learning + detection + classification + kaggle*

3 projets type *kaggle*

- **The Marinexplore and Cornell University Whale Detection Challenge** [1] / 2013 / North Atlantic Right whale call detection / Cornell University / 245 teams , 10,000 \$
- **The ICML 2013 Whale Challenge - Right Whale Redux** [3] / 2013 / North Atlantic Right whale call detection / Cornell University / workshop ICML / 139 teams , 500 \$
- **DOCC10 dataset** [4] in the **ENS data challenge** / 2020 / Click classification from 9 species , ~ 11300 samples per class

→ **codes pas dispo (à part [2]) , mais tâches et données ~ OK !**

Nombre de projets sur recherche par mots clés dans GitHub

Speech classification/recognition/detection → ~ 2000

Bird sound classification/recognition/detection → **max 35**

Whale sound classification/recognition/detection → **max 7**

[1] <https://www.kaggle.com/competitions/whale-detection-challenge/overview>

[2] <https://github.com/jaimeps/whale-sound-classification>

[3] <https://www.kaggle.com/competitions/the-icml-2013-whale-challenge-right-whale-redux/overview>

[4] <https://challengedata.ens.fr/participants/challenges/32/>

Et voici ce que j'ai trouvé :

Search				
Resource	Type	Last Modified	File Size	
energyDetection_Bp20/	Folder			
spectrogramCorr_annotation_Ant-ABZ/	Folder			
2 records				

Et quelques jeux de données plus volumineux

- **AcousticTrends_BlueFinLibrary** [1] / blue whales in

Antarctica from 2005-2017 / manual annotation with strong labels

→ tâches et données pas formatées IA , mais un embryon de benchmark!

- **Orcasound** [2] / Orcas in west coast of North

America / direct data access via AWS Command Line

Interface / ML formatted data

→ tâches et données pas formatées IA

Study	Detection method (software used)	Noise pre-processing	True positive rate	False positive rate	False positive removal	Characterisation/validation summary
Širović et al. 2004 ¹⁷	Spectrogram correlation (Ishmael) Energy sum (Ishmael)	Not reported	Not reported	< 1%	No	Threshold was iteratively adjusted until false positive rate was < 1%. Calls on days with fewer than 50 detections were inspected
Širović et al. 2009 ¹⁸	Spectrogram correlation (Ishmael)	Not reported	Not reported	Not reported	All	Visual inspection of all detections to remove false positives
Samaran et al. 2013 ²⁰	Spectrogram correlation (XBAT)	Not reported	Not reported	6%*	Some	Months with fewer than 50 detections: visual inspection of detections to remove all false positives. Otherwise 10% of randomly selected detections inspected
Trippovich et al. 2015 ²⁸	Energy detection (Ishmael)	Not reported	Not reported	14.6%	All	Visual inspection of all detections to remove false positives
Thomisch et al. 2016 ¹⁹	Spectrogram correlation (custom developed)	Not reported	Not reported	Nominally < 1%	No	False detection rates and thresholds determined via detection function quantiles from 100 randomly selected detections ²⁹
Leroy et al. 2016 ²⁴	Subspace projection detection ²⁵	Noise-adaptive threshold	Not reported ^c	Nominally < 3%	Some	Detections deemed false if the frequency at maximum amplitude was different than that of unit-A
Balazar et al. 2017 ²⁵	Energy sum (Ishmael)	Not reported	93.3–97.3%	14.6–98.9%	All	Comparison against expert human observer who annotated 1 randomly selected day each month for each site. Visual inspection of all detections to remove false positives
Buchan et al. 2017 ²²	Spectrogram correlation (Ishmael)	Not reported	99.998% ^d	Not reported	All	20% subset of days with no automated detections visually inspected to determine false negative rate. Visual inspection of all detections to remove false positives
Shabangu et al. 2017 ¹³	Spectrogram correlation (XBAT)	Not reported	42–83%	Not reported	All	Visual inspection of entire dataset (1518 h) to assess remove false positives and include missed detections

2017 Salish Sea hydrophone observation log					
Fichier	Édition	Affichage	Insertion	Format	Données Outils Extensions Aide
100% Commentaire uniquement					
apx time - going up island - 18 Transient KWs...had been on LK, moving on north and on OS for about 45 min.					
	A	B	C	D	
1	Date	Time (PDT,24hr)	Observer	Notes	Links
2	2/2/2017	17:00:00	Jeanne	apx time - going up island - 18 Transient KWs...had been on LK, moving on north and on OS for about 45 min.	
3	2/6/2017	11:00:00	Jeanne	apx time - may have been on their prior. Whales spread from LK (calls there started in earnest at 09:18). Some J Pod coming back down at this time.	
4	2/7/2017	9:10:00	Jeanne	Ts on OS and LK at same time. I just got the last minute or so of them, so they may have been vocal before this time.	
5	2/16/17	12:00:00	Jeanne	apx time - J and K calls on LK. Leaders passed the park at about 11 a.m. so estimating time to be about noon that they would come onto OS HPs.	
6	2/18/17	11:25:00	Alisa	Heard a couple faint S4 descending type calls few minutes apart. (J's SW bound)	
7				J Pod calls, heard first over LK about 10 minutes before hearing them on OS (and on both HPs over the next while)...distant calls...first seen over by Sidney is, intermittent calls continued and at about 50 minutes into it some calls were a bit louder. Then at 1:12 hrs into it an S4 call. Then there was either a crow or a raven! J Pod was 3 to 4 miles offshore and stayed that far out as they headed down toward Discovery Island.	
8	3/8/2017	11:40:00	Jeanne	Heard a few S4 calls couple of minutes apart, also echolocation. At 13:30 a couple of S6 like sounding calls.	
9	3/10/2017	4:38:00	Jeanne	4:38AM J pod had been on LK since 3:30AM. First call detected on OS was at 4:38a.m. intermittent calls and echolocation clicks over the next hour.	
10	3/12/17	9:22:00	Alisa	over from LK begin hearing faint calls and tanker/ship noise. (10:35 am Sakizaya Glory (PA) NB 12.3 knots on AIS)	
11	3/12/2017	9:48:00	Alisa	single loud S4 like call. intermittent faint calls have continued. 9:55 Distant S1 & S10 calls getting louder just as small boat coming through. (10 am calls on LK too and thought I saw dorsal on webcam)	
12	3/12/2017	20:06:00	Jeanne	8:06PM echo clicks on OS, then intermittent calls until 6 min after midnight.	
13	9/20/17	3:45:00	Rachel	Hearing SRKWs. (Previously heard at Lime Kln, so likely headed north in Haro)	

[1] Miller et al. (2021) Scientific Reports, 11(1), pp.1-18 /

<https://researchdata.edu.au/an-annotated-library-whale-sounds/1447505>

[2] <https://github.com/orcasound>

Et voici ce que j'ai trouvé :

Workshops DCLDE depuis 2003 .. et challenges ?

- **2013 (St Andrews) :**
 - Tâche et Dataset OK : tâche de référence (kaggles..)
 - Benchmark : Néant
- **2015 (San Diego) et 2018 (Paris) :**
 - Tâche et Dataset OK (annotations qualité moyennes [1], HF sur disque dur ..)
 - Benchmark : Néant
- **2022 (Oahu) :**
 - Tâche : Néant complet
 - Dataset : (Trop) gros dataset multimodal / Google Cloud
 - Benchmark : Néant

[1] Nguyen et al. (2021) Ecological informatics, 101185

2013 : <https://soi.st-andrews.ac.uk/dclde2013/>

2015 : <http://sabiod.lis-lab.fr/DCLDE/challenge.html>

2018 : <https://www.cetus.ucsd.edu/dclde/dataset.html>

2022 : <https://www.soest.hawaii.edu/ore/dclde/dataset/>

Autres workshops de 2003 à 2013 :

<http://www.mobysound.org/workshops.html>

2013) que pas loin, on trouve ... les tâches DCASE (depuis

Tâches de référence pour recherche + industriels, formalisées IA et suivies sur le long terme










Challenges

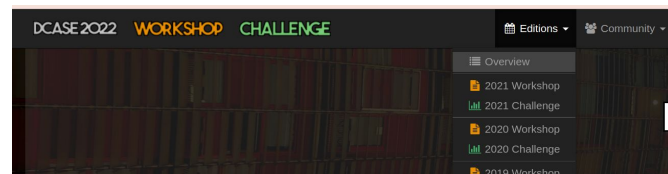
The number of participating teams has increased steadily in DCASE organized challenges. The following table shows teams per task type over the years:

Task	2013	2016	2017	2018	2019	2020	2021
Acoustic Scene Classification	11	36	40	25	46	45	44
Classification	11	36	40	24	38		
Mismatched recording devices				8	10		
Multiple devices						28	
Open set					6		
Low-complexity						30	32
Audio-visual							12
Sound Event Detection	7	18	20	15	18	21	24
Synthetic audio	3	9	12				
Real-life audio	7	12	12				

Steering group

The steering group provides advice on the challenge organization and moderates task proposals for future challenges.

 Juan P. Bello Associate Professor New York University	# G	 Daniel P. W. Ellis Research Scientist Google, Inc.
 Frederic Font Corbera Post-doc Universitat Pompeu Fabra	# G	 Noboru Harada Executive Manager NTT Communication Science Laboratories
 Sacha Krstulović Vice President of Technology Audio Analytic	# In	 Mark D. Plumbley Professor University of Surrey
 Gaël Richard Professor Telecom ParisTech	# G	 Romain Serizel Associate Professor University of Lorraine
 Tuomas Virtanen Professor Tampere University	# G	



Content
Introduction
2021
2020
2019
2018
2017
2016
2013

Introduction

This page collects basic information about DCASE organized challenges available on the each event websites. Created by DCASE Community in 2013.

Workshops

DCASE organized workshops have brought together researchers to discuss about DCASE topics. The following table shows attendances from our workshop

Workshop	Attendance (Academic / Companies)	Papers	Acceptance rate
DCASE2021 Workshop Barcelona, Spain (Virtual)	554 (65% / 35%)	47	70%

Alors que pas loin, on trouve ... les datasets DCASE !

Un unique portail d'accès et de description de TOUS les jeux de données

All datasets DCASE Datalist

Info page	Name	Collection name	D	S	Year	General domains	Total duration (min)	Content type	Material source	Channel setup	Meta types	Scene classes	Event classes	Captions per item
→	TAU Urban Acoustic Scenes 2021 Mobile, Evaluation dataset	TAU Urban Acoustic Scenes			2021	ASC Mobile devices	1320	Freefield	Original	Mono	Scene	10		
→	TAU Urban Audio-Visual Scenes 2021, Development dataset	TAU Urban Acoustic Scenes			2021	ASC Audio-visual	2049	Freefield	Original	Binaural	Scene	10		
→	TAU Urban Audio-Visual Scenes 2021, Evaluation dataset	TAU Urban Acoustic Scenes			2021	ASC Audio-visual	1320	Freefield	Original	Binaural	Scene	10		
→	An Open-set Recognition and Few-Shot Learning Dataset for Audio Event Classification in Domestic Environments	PSL-QSR			2021	Open-set Few-shot learning Tagging	91	Isolated	Original	Mono	Tag		11	

DCASE DATALIST

Curated List of Open Datasets for DCASE Related Research

This data listing is a **DCASE Community effort** to collect curated meta-information about DCASE related datasets into a uniform structure. The DCASE is a community for research on Detection and Classification of Acoustic Scenes and Events, and the community offers a platform for discussion of the different perspectives and approaches, from algorithm development to practical applications and their commercial value.

The list focuses specifically on **pre-packaged datasets** rather than online data repositories. Datasets included in the list are well documented, packaged for easy usage, and have a free or open license. Many of the listed datasets have been used in **DCASE Challenges** or peer-reviewed academic papers.

Datasets are placed roughly into a couple of **data collections** at the high level based on the audio content analysis type they are mainly focusing on. Some datasets can be used for multiple content analysis tasks, and in these cases, they are placed into multiple collections.

DCASE COMMUNITY

Contributing

The data listing is maintained through a [Github repository](#). In case you notice datasets missing, errors, or you want to contribute otherwise to the data listings, you can raise issues in the repository with a link to a new dataset or fork the repository and make a pull request with your edits. Proposals for new data collections are welcomed as well.

The list is maintained by [Toni Heittola](#).

Datalist

This collection pools together all task-specific collections into dynamic table to ease the data search across collections.

105 datasets

All datasets collected into single static table with links to dataset information pages.

105 datasets

Task-specific data collections

Acoustic scenes

An acoustic scene is a descriptor for the surrounding acoustic environment defined by physical and social situations in the scene. The acoustic scene is identified by scene label, for example, "outdoor market", "busy street", and "office". The goal of automatic acoustic scene classification is to classify a test recording into one of the predefined classes that characterize the environment in which it was recorded.

→

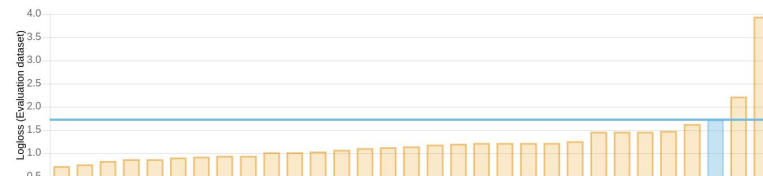
https://dcase-repo.github.io/dcase_datalist/

Alors que pas loin, on trouve ... les benchmarks DCASE !

**Protocole évaluation standardisée +
unique portail fournissant
descriptifs de modèles et
statistiques de résultats**

Teams ranking

Table including only the best performing system per submitting team.



Plan

Part I : la communauté DCLDE du point de vue de l'IA

Part II : OSmOSE dans les grandes lignes

Part III : Etude de cas sur APLOSE et annotation collaborative

OSmOSE : tour d'horizon en 2 slides

- Un groupement d'intérêt scientifique visant à renforcer les **principes FAIR** en **acoustique passive sous-marine**

- Objectif (très) long-terme : **l'intégrer**
aux programmes internationaux
d'observation des océans



OSmOSE : tour d'horizon en 2 slides

- **Équipe (pour la rentrée 2022/2023)**
 - 4 doctorants + 4 ingénieurs + 4 informaticiens freelance + 1 BE + 3 EC
 - 2 affiliations académiques ! + 1 BE
- **Services & Outils : Datarmor / IFREMER** <https://osmose.ifremer.fr/>
 - plateforme de développement
 - 1 serveur web / jupyterlab / 20 TB stockage / calcul jusqu'à 16 machines de 52 CPU et 128 GB RAM / 2 GPU 16cores 128 GB RAM / frameworks Hadoop-Spark
 - plateforme de déploiement accessible par le web -> plateforme de services
 - APLOSE : outil web pour l'annotation collaborative
 - Notebooks d'analyses acoustiques

Pourquoi **Datarmor** / IFREMER ?

local -> **datahome** -> **datawork** -> **dataref** -> **Sextant** -> **Odatis** / **Dataterra** (IR)

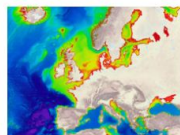


Cherchez une donnée

Pour découvrir les données présentes dans le Catalogue de Sextant, cliquez sur l'icône ci-dessous et en utilisant les critères de filtre de recherche (texte libre, géographique, mot-clé), vous pourrez visualiser et télécharger les données.



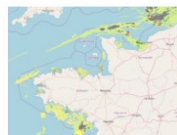
Découvrez les cartes interactives



Bathymétrie européenne



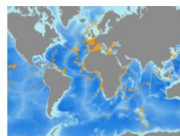
Habitats physiques



Granulats marins



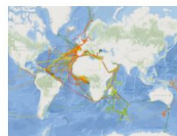
Hyperspectrale - La Réunion



Échantillons marins



Données des navires (géophysique)



ADCP des navires (courants)



Typologie des habitats - Nouvelle-Calédonie



EMODnet



European Marine Observation and Data Network

OSmOSE : recherche collaborative

- **Etudes expérimentales sur la donnée réelle : large échelle et collaboratives**

- *input* : 1 question méthodo + 2/3 objectifs + 1 responsable
- *output* : 1 rapport court + production outils

- **Etudes en cours**

- Adoption de **métadonnées standardisées** pour décrire nos données, méthodes et résultats (resp. D. Cazau)
- Quels sont mes **premiers traitements** pour de l'analyse de **bruit ambiant** ? (resp. M. Torterotot)
- Comment évaluer les **performances d'un nouvel outil de détection** ? (resp. M. Dupont)
- **Mieux caractériser et comprendre la variabilité inter-annotateur en contexte de sciences participatives (responsable G. Dubus)**

Annonces réus + rapports + codes : <https://osmose.ifremer.fr/>

- **Atelier de formation à venir**

- vendredi 1er juillet à ENSTA Bretagne : appropriation des codes de traitement OSmOSE à travers GitHub

Plan

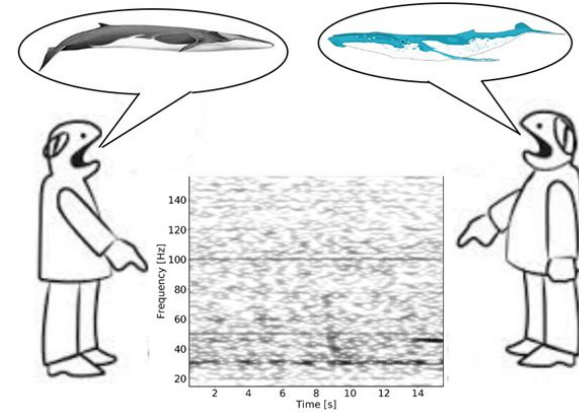
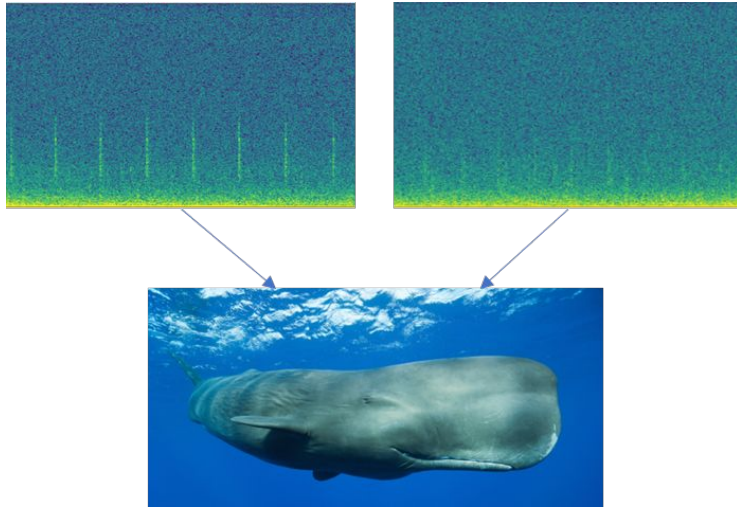
Part I : la communauté DCLDE du point de vue de l'IA

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L'annotation de données : un processus complexe

- Très larges jeux de données
- Forte dépendance au choix de représentation et à la qualité des données



- Connaissance parfois incomplète des répertoires de chaque espèce
- **Variabilité de l'appréciation humaine [1][2]**

➤ Très impactant pour l'utilisation du machine learning dans l'automatisation des tâches de détection et de classification

[1] : P. Nguyen Hong Duc, et al.. *Assessing inter-annotator agreement from collaborative annotation campaign in marine bioacoustics*. *Ecological Informatics*, Elsevier

[2] : Leroy, et al. (2018). *On the reliability of acoustic annotations and automatic detections of Antarctic blue whale calls under different acoustic conditions*. *The Journal of the Acoustical Society of America*.

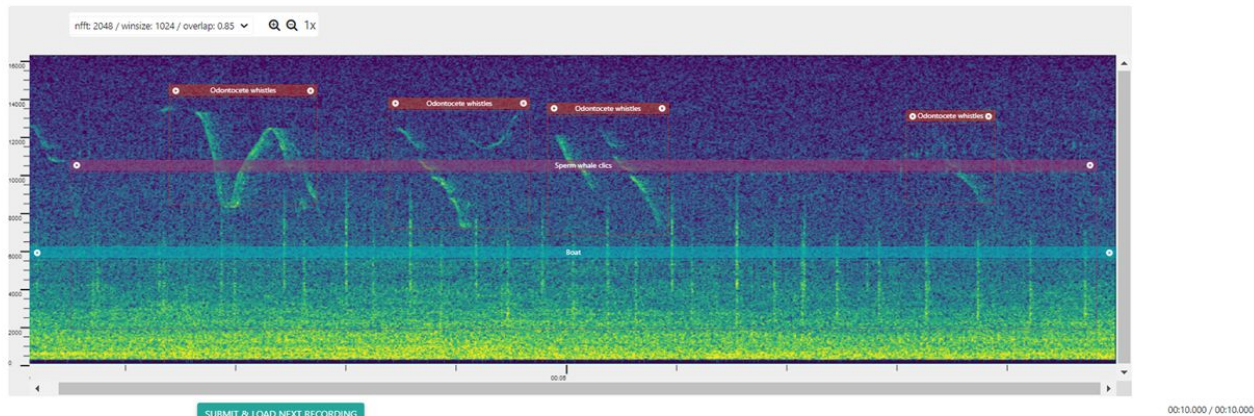
APLOSE : une plateforme pour simplifier l'annotation

APLOSE

[Annotator User Guide](#)

[BACK TO CAMPAIGN](#)

- Stockage en ligne de toutes les données
<https://osmose.ifremer.fr/app/>
- Uniformisation de la représentation pour tous les annotateurs
- Larges possibilité concernant les modalités d'annotation



Presence / Absence

☐ BOAT ☐ SPERM WHALE CLICS ☐ ODONTOCETE CLICS ☐ ODONTOCETE WHISTLES ☐ MYSTICETES VOCALISES ☐ ODONTOCETE BUZZES

Annotations

Boat		
00:00.148 > 00:10.000	0.00 > 5512.20 Hz	Boat
Odontocete whistles		
00:01.405 > 00:02.756	8353.80 > 14037.00 Hz	Odontocete whistles
00:03.398 > 00:04.688	7125.00 > 13345.80 Hz	Odontocete whistles
00:04.834 > 00:05.939	6779.40 > 13115.40 Hz	Odontocete whistles
00:08.090 > 00:08.905	8469.00 > 12693.00 Hz	Odontocete whistles
Sperm whale clics		
00:00.505 > 00:09.825	1787.40 > 10081.80 Hz	Sperm whale clics

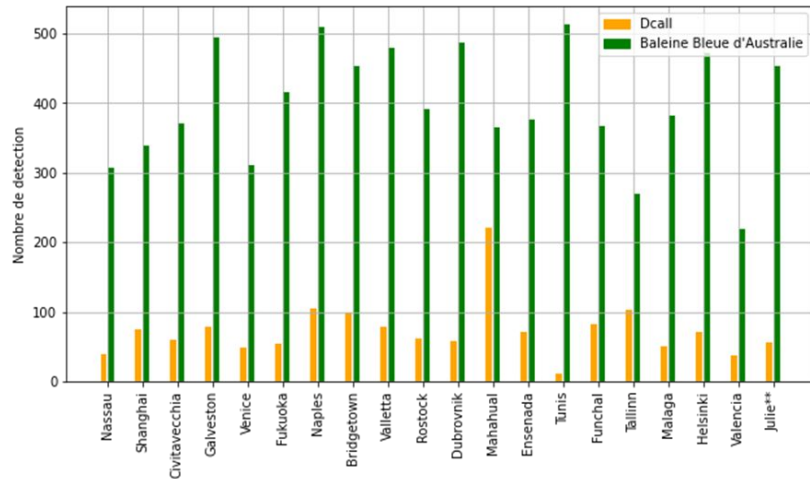
Objectifs :

- Faciliter l'annotation pour la communauté
- Etudier le processus d'annotation en bioacoustique sous-marine

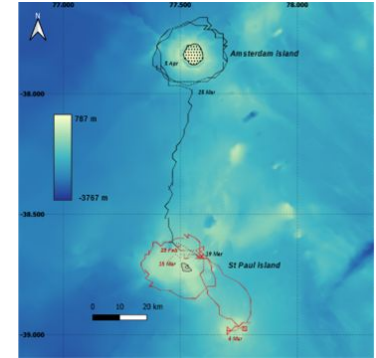
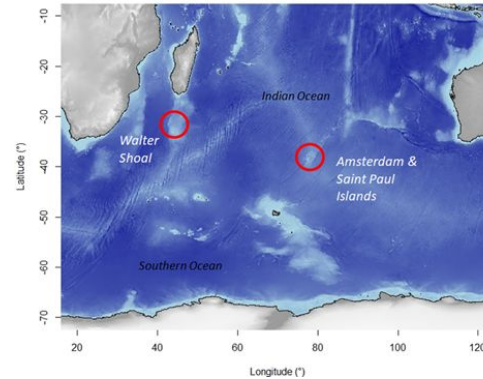
Illustration d'une annotation réalisée sur la plateforme APLOSE

Une campagne d'annotation avec APLOSE : un exemple

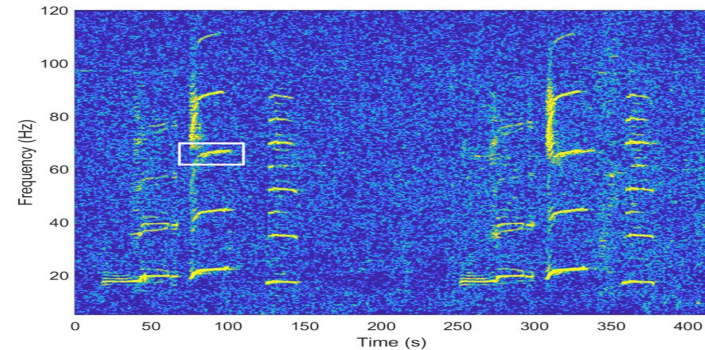
- Campagne réalisée dans les îles Amsterdams
- Hydrophone : Seaexplorer underwater Glider
- 103 fichiers de 10 minutes
- Campagne collaborative avec Astrolabe Expédition : 19 annotateurs novices



Nombre d'annotations par label pour chaque annotateur



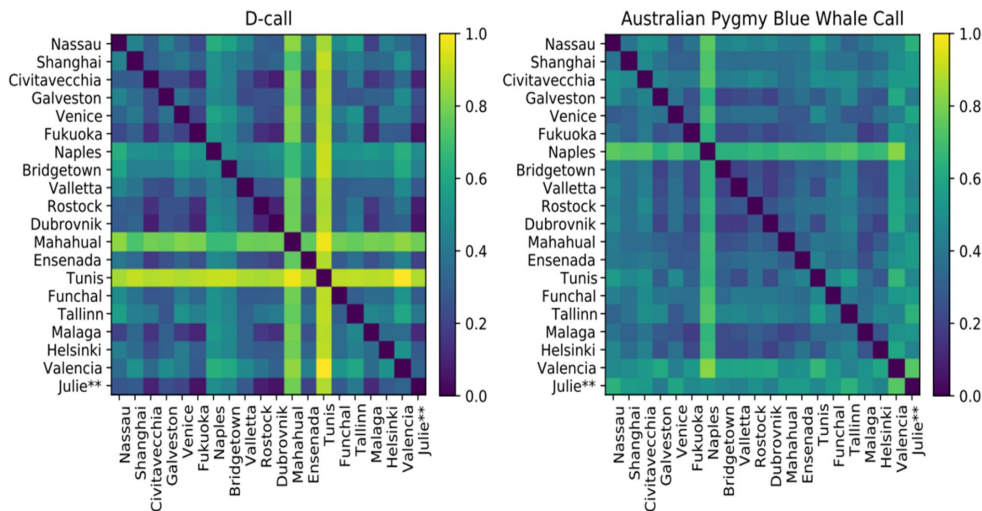
Iles Amsterdams dans l'océan Indien



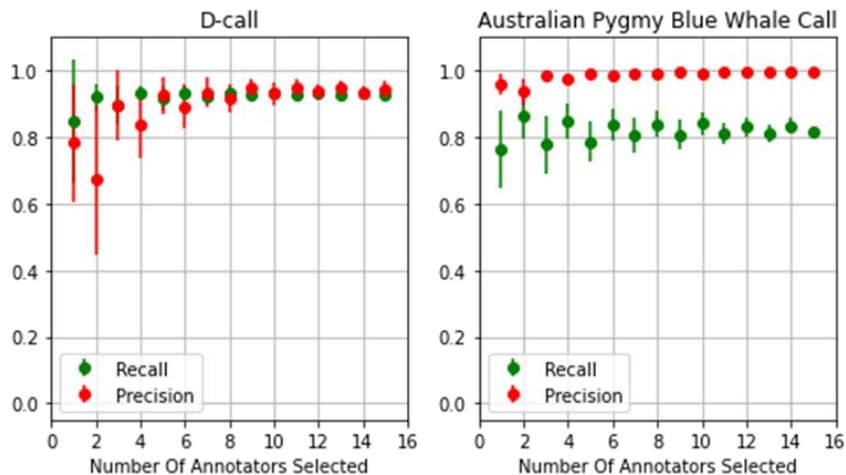
Exemple de spectrogramme de vocalises de baleines bleues pygmées d'Australie

Une campagne d'annotation avec APLOSE : un exemple

- Etude de la variabilité inter-annotateurs pour des profils novices
- En regroupant les annotateurs novices, on peut retrouver les annotations de l'expert



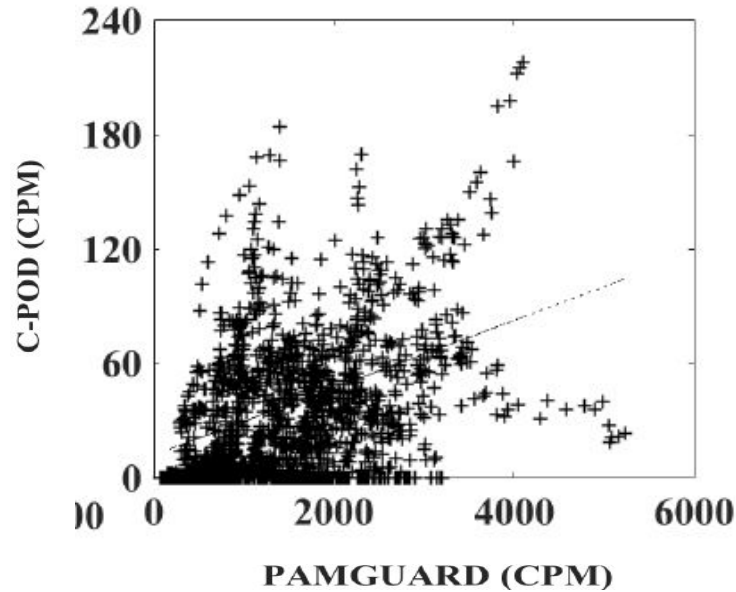
Distance de Hamming pour chaque pair d'annotateurs



Etude de la capacité des annotateurs novices à retrouver les annotation d'un expert en fonction du nombre d'annotateurs novices

Vers l'IA embarquée ?

Click per minute: a same metric ?



ANNEX

Challenge stats

Edition	Tasks	Entries	Teams
2013	3	31	21
2016	4	84	67
2017	4	200	74
2018	5	223	81
2019	5	311	109
2020	6	473	138
2021	6	394	127

https://dcase.community/documents/workshop2021/dcase2021_statistics.pdf

Avant de venir j'ai voulu ...

recupérer une méthode de l'état de l'art facilement **reproductible**
pour détecter la présence de mammifères marins

Idéalement on aurait eu :

- **Tâche :**
 - référence
 - longévité
- **Jeu de données :**
 - formatage IA
 - représentativité
 - généralisabilité
- **Benchmark de modèles :**
 - état de l'art
 - contribution

Tout ça
Ouvert et Standardisé !