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Guest Editorial

Proceedings of the 4th International Workshop on Detection, Classification and Localization of Marine Mammals using Passive Acoustics and 1st International Workshop on Density Estimation of Marine Mammals Using Passive Acoustics, University of Pavia, Collegio Cairoli, Italy, September 2009, 10–13

The objective of the DCL series of workshops is to improve general understanding of methods to detect, classify, locate, track and monitor marine mammals in their environment. After three workshops dedicated to individual species (Halifax, Canada, 2003; Oceanographic Museum of Monaco, 2005; Boston, US, 2007), this fourth workshop was focused on a more complex issue: the analysis of real-world complex acoustic scenes and the use of the context for identifying acoustic components of interest. The scientific program was focussed on recent methods successfully used for observations of different species (Beaked whales, delphinids, bulegas, sperm whales, blue whales, humpback whales...). Algorithms were based on Fourier spectrogram, wavelet analysis, cepstrum, and different detectors were suggested using time and/or frequency energy, non-linear filtering (extended Kalman filter, time–frequency-phase tracker), supervised methods (artificial neural networks, kurtosis estimation) or unsupervised methods (*k*-means, ascendant hierarchical classifier, SVM).

Three sets of underwater recordings were made available online to encourage researchers to work on common datasets, to focus on the same problems, to find original solutions, and to present and compare them at the workshop. Researchers working on their own datasets also presented their results.

The DE workshop was the first of a new series of scientific encounters to bring together researchers working on estimating absolute density or abundance of marine mammal populations using passive acoustics.

These workshops were organized together in recognition of the emerging interest and need to process acoustic monitoring data into meaningful population statistics to be used for science, management and conservation.

The workshops were held in the historical buildings of the University of Pavia, Italy, where Spallanzani in the 18th century studied the ability of bats to fly in the dark. They were hosted by CIBRA, the Interdisciplinary Center for Bioacoustics and Environmental Research, in the amazing buildings of the "Collegio Cairoli", close to the core of the University.

The town of Pavia, besides harbouring one of the oldest universities in the world, is a very pleasant and easy-to-reach location; the venue was located in the heart of the medieval city with its pedestrian streets and profusion of monuments and restaurants. Lunch buffets, the numerous coffee breaks (with fabulous Italian coffee) and the social dinner helped the participants to make useful contacts.

After the welcome of the Dean of the University of Pavia and the introductory talk of the workshops' organizer, Gianni Pavan, two excellent invited lectures were delivered to more than 120 participants attending the two workshops.

Participants of the DCL & DE Workshops – Pavia 2009

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Invited Lectures

The first, delivered by Peter Tyack of Woods Hole Oceanographic Institution, was entitled "Lazarro Spallanzani: a hero of pre-animal welfare experimental biology." The second, by Robert Gisiner of the Marine Mammal Commission, was entitled "Underwater noise, marine resource management and passive acoustic monitoring."

The DE workshop was introduced by a tutorial overview of the topic, followed by presentations showcasting relevant research. The tutorial was given by Len Thomas and Tiago A. Marques of St. Andrews University, and was entitled "Review of methods for estimating cetacean density from passive acoustics."

The workshops were very successful, with more than 120 attendees coming from 10 countries, and a tight schedule: 46 talks have been presented at the DCL workshop and 12 at the DE workshop; 17 posters have been shown in a common poster session, for the whole duration of the workshops.

Three acoustic datasets were made available for download; marine mammals' recordings were selected to provide a dataset for exercising with the development of software able to recognize specific sound features and provide a description of the acoustic contents of a sound recording. Specific interest was about the detection and classification of marine mammal sounds to be performed either in real-time or in post-processing. Files provided a mix of clean recordings of individual identified species and "real-world" recordings where environmental noises and the sounds of different species overlap.

Scientific Sponsors:
University of Pavia, NURC, ACCOBAMS, JIP.
Organizing Committee:
Gianni Pavan, CIBRA (DCL Workshop) and Len Thomas, St. Andrews (DE Workshop).
Scientific Committee:
Gianni Pavan (Univ. of Pavia, CIBRA, Italy); Walter Zimmer (NURC, Italy); David Moretti (NUWC, US); Bob Gisiner (MMC, US); John Potter (NURC, Italy); Olivier Adam (NAMC, Paris University, France); Len Thomas (Univ St Andrews, Scotland; convenor of the DE workshop).
Financial Sponsors:
The workshops were supported by the Office of Naval Research US, Award N00014-09-1-0894 and by the Office of Naval Research Global, Grant No. N62909-09-1-1088.
The content of the information presented at the workshops does not necessarily reflect the position or the policy of the United States Government and no official endorsement should be inferred.

Datasets

The three acoustic datasets were available to the participants of these workshops. They may be downloaded from the ftp site: ftp://mammiferimarini.unipv.it.

Please write to gianni.pavan@unipv.it for the password.

Descriptions of the datasets follow.

Dataset 1 – Towed array recordings of Cuvier's beaked whales

Cuvier's beaked whales recorded in the Alboran Sea in SIRENA 08 NURC cruise; files contain a mix of poor and good recordings of whales' click series, in some cases there are also clicks and whistles from dolphins around.

192 K sampling rate – 16 bits – two hydrophones.
Array depth: about 20 m.
Hydrophone spacing: 8 m.
Average Ship Speed: 4.8 knots.
Details on ship position and speed for each recording are in the file DCL_Dataset_1_Ziphius.doc.
The files also contain the detection/classification codes of the recorded sounds.
Bibliographic references:

Zimmer, W.M.X., Pavan G., 2008. Context driven detection/classification of Cuvier's beaked whale (*Ziphius cavirostris*). IEEE Proc. Passive 08. *PDF available on request.*

Dataset 2 – Towed array recordings of Odontocetes

Various dolphin species recorded in the Alboran Sea in SIRENA 08 NURC cruise: striped dolphins mixed with common dolphins, pilot whales, risso's dolphins, Cuvier's beaked whales.

192 K sampling rate – 16 bits – two hydrophones.
Array depth: about 20 m.
Hydrophone spacing: 8 m.
Average Ship Speed: 4.8 knots.
Details on ship position for each recording was available on request.

Dataset 3 – NEMO ONDE deep sea platform

Sperm whale sounds recorded at 96 K sampling rate by four hydrophones on a tetrahedron placed at 2000 m depth, 25 km off Catania (Eastern coast of Sicily, Italy).

Most files contain sperm whales' sounds, in some cases with ship noise; one contains other clicks, probably emitted by Cuvier's beaked whales. This dataset is very interesting to exercise click recognition algorithms and 3D localization of the sound sources by using TDOA and surface reflections. See the textfile in the dataset folder.

The next workshop will be held at Mt. Hood, Oregon, USA on 22-25 August 2011. The data sets for the conference are in preparation, with the goal that they will be released well before the workshop. The conference website, including data sets, will be accessible via http://www.mobysound.org/workshops.html.

The organizing committee is: David K. Mellinger, OSU (head of committee), Sara Heimlich, OSU (logistics), Eva Marie Nosal, UH (localization), Marie A. Roch, SDSU&SIO (classification), Holger Klinck, OSU (detection).

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