ANERIS

Operational Sensing Life Technologies for Marine Ecosystems

`

Deliverable 3.7 – Training Material

Lead Beneficiary: Euro-BioImaging ERIC

Author/s: Ayoub El Ghadraoui, Johanna Bischof

16/12/2024

**Funded by
the European Union**

Prepared under contract from the European Commission

Grant agreement No. 101094924

EU Horizon Europe Research and Innovation action

Project acronym:	**ANERIS**
Project full title:	**operAtional seNsing lifE technologies for maRIne ecosystemS**
Start of the project:	January 2023
Duration:	48 months
Project coordinator:	Jaume Piera
Deliverable title:	Training Material
Deliverable n°:	D3.7
Nature of the deliverable:	Other
Dissemination level:	Public
WP responsible:	WP3
Lead beneficiary:	Euro-BioImaging ERIC
Citation:	El Ghadraoui, A., Bischof, J. (2024). *Training Material*. Deliverable D3.7 EU Horizon Europe ANERIS Project, Grant agreement No. 101094924
Due date of deliverable:	Month n° 24
Actual submission date:	Month n° 24

Deliverable status:

Version	Status	Date	Author(s)
1.0	Final-Draft	16 December 2024	Euro-BioImaging ERIC
1.0	Revision	20 December 2024	Jaume Piera

The content of this deliverable does not necessarily reflect the official opinions of the European Commission or other institutions of the European Union

Table of content

Summary

This document will provide a comprehensive overview on the training material generated through a series of workshops organized within WP3 Task 3.7 with the aim of introducing the ANERIS consortium as well as the wider research community to the basics of AI in image processing as well as to the different technologies and tools being developed within the ANERIS project.

In the context of Task 3.7, the Euro-BioImaging Bio-Hub is responsible for overseeing the arrangement of three virtual workshops for the imaging communities scheduled for M9, M21, and M47.

Given the extensive interdisciplinary nature of the network, the **first training workshop** was initially planned as an internal consortium session focusing on fundamental AI concepts for image analysis. This initiative aims to enhance collaboration across work packages.

The **second workshop** was framed to be a first platform of exchange between ANERIS project technology developers and potential end-users to introduce them to the technologies and tools developed within the project and how they can be used for a better, more efficient, and sustainable monitoring of the oceanic and coastal life ecosystem, thus tackling the challenges related to biodiversity loss in the oceans.

The deliverable will delve into both workshops and provide an in-depth overview of the different sessions, and highlight the reusable training material that was generated through these workshops.

List of Abbreviations

AI – Artificial Intelligence

CNRS – Centre national de recherche scientifique

EPFL - École Polytechnique Fédérale de Lausanne

General considerations on generation of Training material

One of the goals of Task 3.7 is the creation of online training material that allows anyone, and particularly technical staff linked to the different ERICs involved in the project, to use and understand the tools based on image processing and analysis that are being developed within ANERIS.

In line with ANERIS' commitment to FAIR practices and open science, the generated training material should follow these standards and it was also decided that the workshops organised within Task 3.7 should be open and accessible to all researchers and technical staff. The workshops represent an ideal opportunity to produce training material in the form of slide decks and lecture recordings, which can be reused by the trainers in other contexts, as well as by other trainers for their own teaching and can be used by anyone, researchers or members of the public, for asynchronous learning.

The imaging and bio-optics tools developed in WP3 and particularly the AI-based image analysis tools are of significant interest, which was reflected in the attention and attendance of the workshops. Due to the timings of this deliverable, we can here only report data on the uptake of the training material generated from the first workshop, as the second workshop was only held in the month of delivery of this deliverable. However, the attendance at the workshop and the data from the 1st workshop's training material uptake are leading us to assume that there will also be good uptake of the material from the second workshop.

As introduction and framing of the created training material, we first here present the two organised workshops and their content, to highlight the scale and topic-coverage of the created training material.

Workshop I: AI basics for image processing

Euro-BioImaging Bio-Hub led the coordination of this task in close partnership with its two Nodes involved in the ANERIS technology development - CNRS (France BioImaging) and the University of Haifa (Israel BioImaging), as well as the WP3 Lead OSLOMET.

Conducted in three sessions spanning from November 29th to December 7th, each of the three sessions (See Figure 1) was thematically curated and featured speakers from various institutions, including participants from ANERIS.

Figure 1: Graphical illustrations of the different sessions. Workshop I: AI basics for image processing

The **first session** on Nov 28th, "**AI Basics for Image Processing**" showcased enlightening talks such as "**Introduction to image processing**" by Jean Yves Tinevez from Institut Pasteur & France BioImaging, "**AI enhanced microscopy imaging: challenges and perspectives**" by Estibaliz Gomez de Mariscal from Instituto Gulbenkian de Ciencia/AI4Life, and "**Deep learning and classical machine learning / demo of classification and segmentation**" (https://zenodo.org/records/10498744) by Thierry Pecot from Rennes University & France Bioimaging.

The **second session** on Dec 04th, "**Image Restoration**" delved into lectures like "**Microscopy Image Restoration: Physics-Driven or Data-Driven Models**" by Daniel Sage from EPFL, "**Denoising microscopy images with self-supervised deep-learning**" (https://zenodo.org/records/10498617) by Joran Deschamps from Human Technopole/AI4Life, and "**Underwater video image restoration**" (https://zenodo.org/records/10498713) by Tali Treibitz from the University of Haifa.

The third and final session on Dec 07th centered around the topics of "**Image Classification and Segmentation**" featuring talks such as "**Image segmentation and classification using deep**

learning" (https://zenodo.org/records/10498761) by Perrine Paul-Gilloteaux from CNRS; France Bioimaging, "**AI for Marine life classification and Drone images analysis**" by Enoc Martinez from the Universitat Politecnica de Catalunya and the iMagine project, along with Elena Vollmer from the Karlsruhe Institute of Technology and the AI4EOSC project. The session also included "**Plankton classification using Ecotaxa (Demo)**" by Victor Retanauer from Fotonower & Sorbonne University, providing a comprehensive overview of various techniques for segmentation and classification of different biodiversity imaging data.

The AI-themed workshop attracted **over 400 participants (about 85% from Europe)** from around the globe (see figure 2).

Figure 2: Graphical illustrations of the different sessions. Workshop I: AI basics for image processing

All sessions throughout the workshop were interactive, with active discussions and exchanges between the speakers and attendees.
Following the conclusion of each session, a satisfaction evaluation form was systematically distributed among the participants, underscoring our commitment to continuous improvement.

Overall, we had a **strong response rate** with over 60 active participants who contributed their experiences and feedback by answering the circulated survey. The response received shows that more than 60% of participants were **very satisfied** with both the content and the overall organization of the event.

Many of the aspects of the workshop sessions were well appreciated, especially those talks where speakers focused on **classical machine learning, application of marine data, use of AI**, and repositories. In particular, they stood out for their introductory approach, giving a strong base of basic knowledge while covering a wide range of topics. All very much appreciated such a balance of depth and variety, as it was serving both beginners in the field and those looking at a broad overview of the subject area.

Workshop II: Underwater Imaging, Bio-optic, and Participatory Technologies

In December 2024, ANERIS **project** organized **an online** workshop entitled "Underwater Imaging, Bio-optic, and Participatory Technologies," drawing substantial attendance and garnering positive feedback from citizen scientists, students, and young researchers**. The overall objective from this event is** to introduce the scientific community, potential end users and the public to the different technologies and tools developed within the ANERIS project.

Figure 3: Graphical illustrations of the different sessions. Workshop II: Underwater Imaging, Bio-optic, and Participatory Technologies

The workshop consisted of two sessions, orchestrated by Euro-BioImaging and its Nodes France Bioimaging (CNRS), and Israel BioImaging (University of Haifa), which brought together

specialists in underwater imaging and general image analysis and processing to learn about these advancements, offer feedback for validating methods and technologies, and aid in disseminating ANERIS project developments to the broader community.

Endorsed by the **United Nations' initiative UN Ocean Decade** and conducted in two sessions (on December 2nd and December 4th), the workshop attracted about 150 participants from various corners of the globe. The workshop was appreciated by a wide audience drawing substantial attendance and garnering positive feedback from citizen scientists, students, and young researchers.

Being endorsed by the United Nations' initiative UN Ocean Decade, the workshop leveraged the communication and outreach channels of the UN Ocean decade who featured this event on their official website as well as the different social media platforms (e.g., LinkedIn, Twitter). This significantly enhanced the visibility of the ANERIS project, extending its reach beyond the European scientific community to an international audience, as evidenced by the broad global participation in the event (Figure 4).
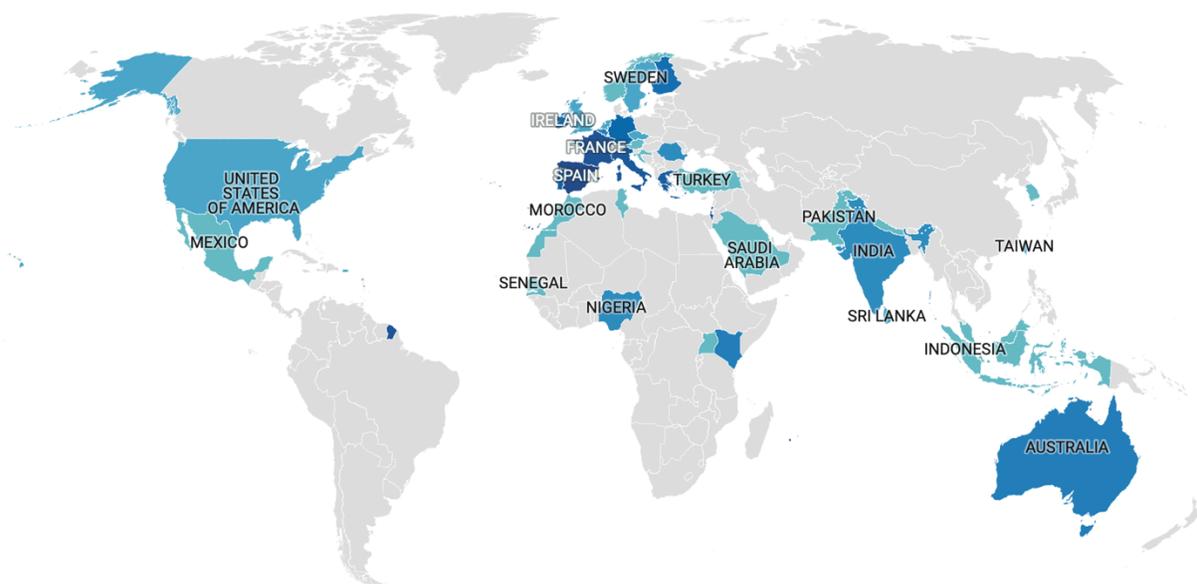
Figure 4: Geographic distribution of participants in Workshop II: Underwater Imaging, Bio-optic, and Participatory Technologies

The first session on December 2nd started with an introduction to the ANERIS project, presented by project coordinator **Jaume Piera** from CSIC. The workshop also garnered interest from the EU-Funded **AQUARIUS project**, which requested a slot to introduce their initiative through project coordinator **Aodhan Fitzgerald** (**the Marine Institute**) and highlight the current transnational access opportunity.

On a more technical note, **Simon Korman** from the **University of Haifa, Israel BioImaging,** showcased the **automatic underwater image restoration system** and explained how the SeaThru-NeRF technology can enhance underwater imagery, while **Perrine Paul-Gilloteaux** from **CNRS, France BioImaging** introduced a tool designed for **detecting and characterizing macro-organisms in underwater images**.

Finally, **Alex Tarragon** from **DRIBBA** explored the **advanced multi-platform application for marine life reporting** developed as part of the ANERIS project.
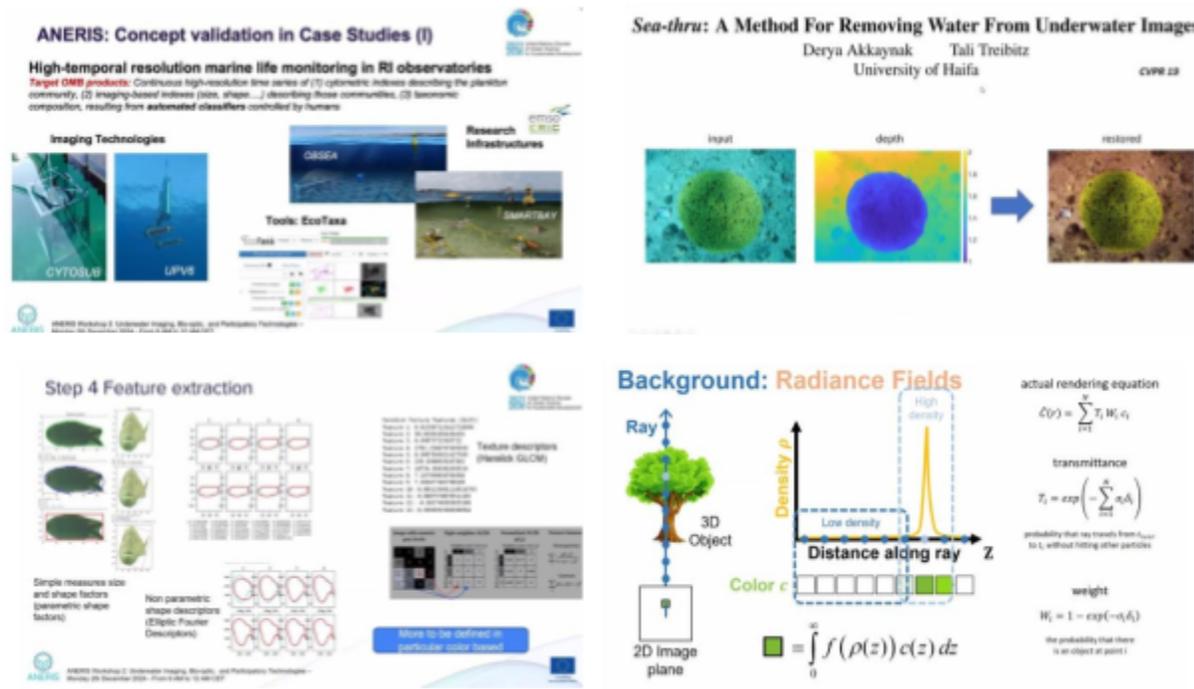

Figure 5: *Screenshots from the first session. Workshop II: Underwater Imaging, Bio-optic, and Participatory Technologies*

The second session on December 4th also began with introductions to the ANERIS and AQUARIUS projects before transitioning to the technical presentations.

Alex Alcocer from **OsloMet** showcased the **Expandable multi-Imaging underwater acquisition system**.

Cristina Palomares from **MARSBASED** introduced the **Minka** platform, an **adaptive web interface for marine life reporting, sharing, and consulting**, emphasizing its potential to engage citizens in science and biodiversity monitoring and preservation. Following this, **Marc Pickerel** from the **Institut de la Mer de Villefranche** presented an **automatic information extraction system for zooplankton images** developed within the ANERIS project.

Finally, **Andreu Fornors** from **QUANTA** introduced participants to the **advanced marine observations validation and identification system** based on hybrid intelligence.

Figure 6: Screenshots from the second session. Workshop II: Underwater Imaging, Bio-optic, and Participatory Technologies

Training material collection

In alignment with ANERIS' commitment to **Open Science** and to increase the spectrum of impact, all training material from our workshops is made **openly accessible**, the presentation slides were uploaded and can be openly accessed on **ZENODO** ANERIS repository (CC-BY), and the recorded sessions are compiled into a **playlist** on the Euro-BioImaging YouTube channel, already witnessing high view rate.

The first workshop on AI basics for image processing generated 13 videos and 7 presentation slide decks, which were shared on YouTube and ZENODO, respectively. The presentations are:

- Detecting and characterizing macro-organisms in underwater images
    - https://zenodo.org/records/14501769
- Automatic Information Extraction System for ZOOplankton images
    - https://zenodo.org/records/14501571
- Adaptive Web Interfaces for MARine life reporting, sharing and consulting
    - https://zenodo.org/records/14501545
- Advanced multiplatform App for marine life reporting
    - https://zenodo.org/records/14501505
- Under-Water Image Restoration Systems
    - https://zenodo.org/records/14501470

- AQUARIUS Transnational Access Funding call
  - https://zenodo.org/records/14501794

The uploaded videos generated **over 9300 views** so far and the documents over **350 views** and **370 downloads**. These numbers are growing as we are increasing the visibility of the ANERIS project and spreading the works across different scientific communities.

From the second workshop on underwater imaging, bio-optic, and participatory technologies, 7 videos and 6 presentation slide decks were published on the abovementioned repositories. Although the videos were published just two days ago from the time of writing this report, they are already witnessing an impressive view rate.

The engagement and uptake of the training materials highlights the relevance and appeal of the content generated during both workshops, indicating a strong interest from the target scientific community in the topics of underwater sensing and image processing tools. Due to the nature of the sharing platform, we cannot track who the users of the provided training material are, but the materials have been extensively advertised within the imaging community through Euro-BioImaging, so we assume that a significant percentage of viewers and users of the material come from the imaging community.

Conclusion

The workshop series (workshop I and Workshop II) allowed the development of an outstanding range of openly accessible training materials, offering an in-depth overview of the various **AI tools and technologies** used and developed under the ANERIS project and their potential applications for **more sustainable and efficient monitoring** of marine and coastal ecosystems. The produced training material features trainers with exceptional expertise, delivering valuable insights. The positive feedback from the participants in the live workshops and the high rate of uptake of the online open training material highlights the success of this activity in raising visibility for the ANERIS project outcomes and raising general awareness within the scientific community for the application of imaging and AI-based image analysis tools in marine science.