



Project Meeting

Project Name: Deep Learning-aided label-free Correlative Light Electron Microscopy.

Meeting Purpose: Progress update meeting.

Place: Laboratorio de Procesado de Imagen. Universidad de Valladolid.

Date: 18/10/2024. **Start:** 10:00. **End:** 11:30.

Attendees:

Name	Institution
Biagio Mandracchia (PI1)	Universidad de Valladolid (UVa)
Rosa María Menchón Lara (PI2)	Universidad de Valladolid (UVa)
Marcos Martín Fernández (MMF)	Universidad de Valladolid (UVa)
Susana Merino Caviedes (SMC)	Universidad de Valladolid (UVa)

Agenda & Notes:

The current objectives and planned tasks for the upcoming phase of the project are aimed at improving the segmentation of subcellular structures in label-free microscopy data and enhancing the generalization capability of deep learning models through physics-informed and foundation-based approaches.

a) Segmentation of Subcellular Structures Using U-Net Architectures

- Design and conduct experiments using U-Net-based convolutional neural networks for the segmentation of subcellular structures in label-free optical microscopy images.
- Train and evaluate these models using existing multimodal datasets to establish reference performance levels and identify areas for improvement.

b) Development of Physics-Informed Deep Neural Networks

- Develop deep learning models that integrate physical knowledge of the image acquisition process, particularly in the CLEM context.
- Leverage these physics-informed models to improve segmentation accuracy and robustness, especially in inverse problem settings.

c) Exploration of Foundation Models for CLEM

- Examine the implementation of foundation models trained on large-scale, heterogeneous datasets.
- Apply fine-tuning techniques to adapt these pre-trained models to CLEM-specific tasks.
- Evaluate their performance in 3D, multimodal microscopy contexts, where high data complexity and volume are prevalent.



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