

Open-source framework for multimodal microscopy



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ABSTRACT

We present an open-source framework combining advanced AI and multimodal microscopy for biological imaging. By integrating electron microscopy (EM), label-free light microscopy (LM), and AI tools, our framework enhances imaging workflows with automated, artifact-free analysis. This platform empowers researchers to achieve scalable, reproducible, and high-resolution insights into biological systems.

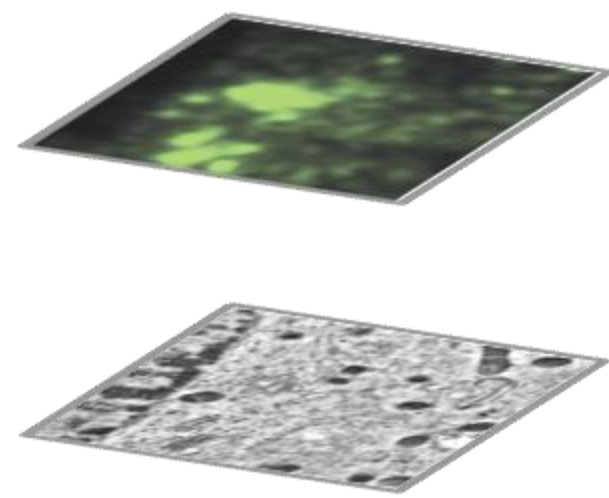
INTRODUCTION

Multimodal imaging is the integration of two or more imaging modalities, which provides a more comprehensive understanding of biological processes.



Microscopy: Correlative Light Electron Microscopy (CLEM)

Great potential for characterizing biological processes in its cellular domain (molecular mechanism in virus assembly)



AI in biomedical multimodal imaging

Enhancement in several tasks related to microscopy.

- Deep Learning + CLEM → **deepCLEM**

Challenges in microscopy workflows

Growing demand for robust software frameworks



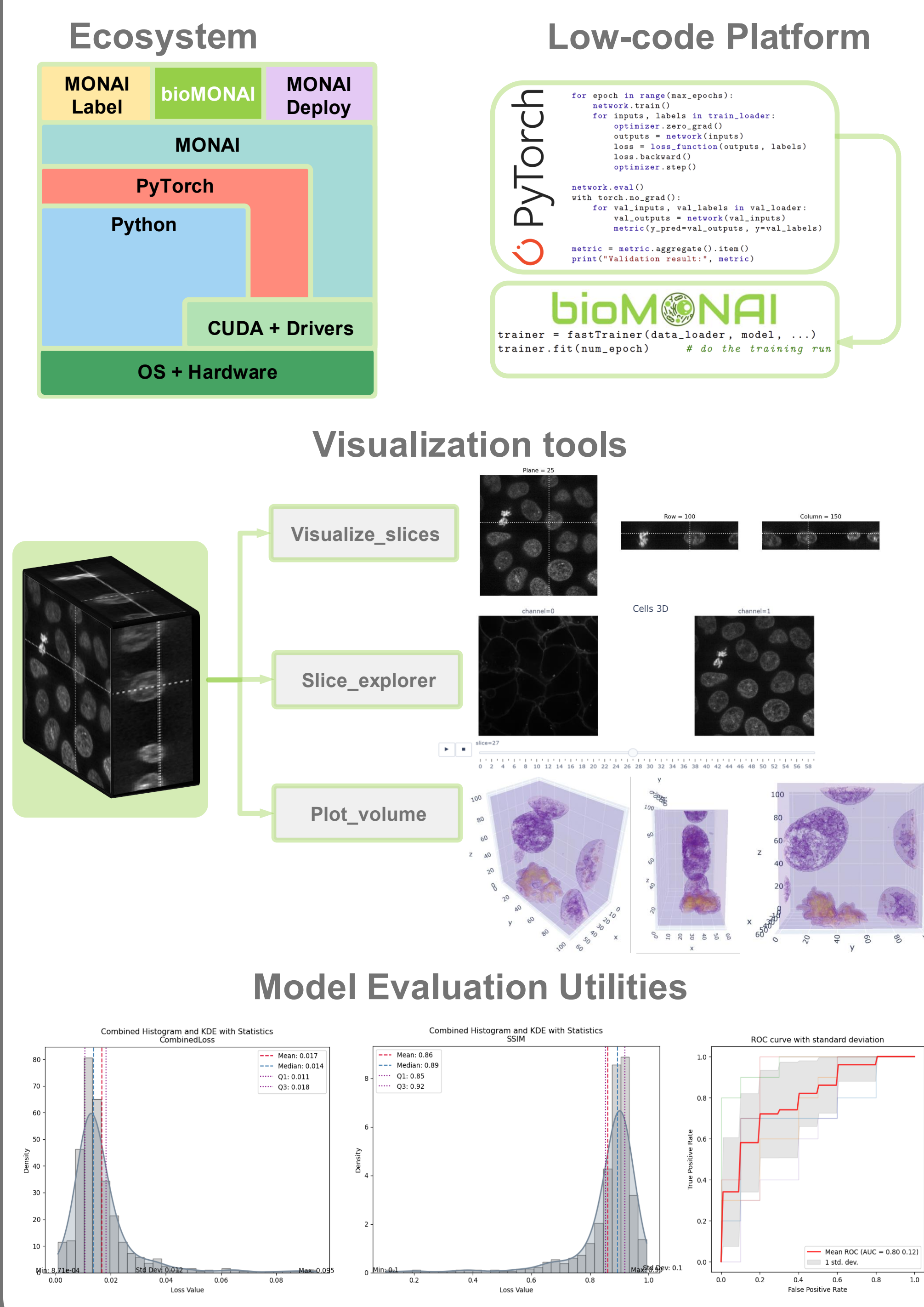
TensorFlow
PyTorch

MONAI⁺

Lack of biomedical imaging component focused on multimodal microscopy workflows

bioMONAI
Deep learning for biomedical imaging

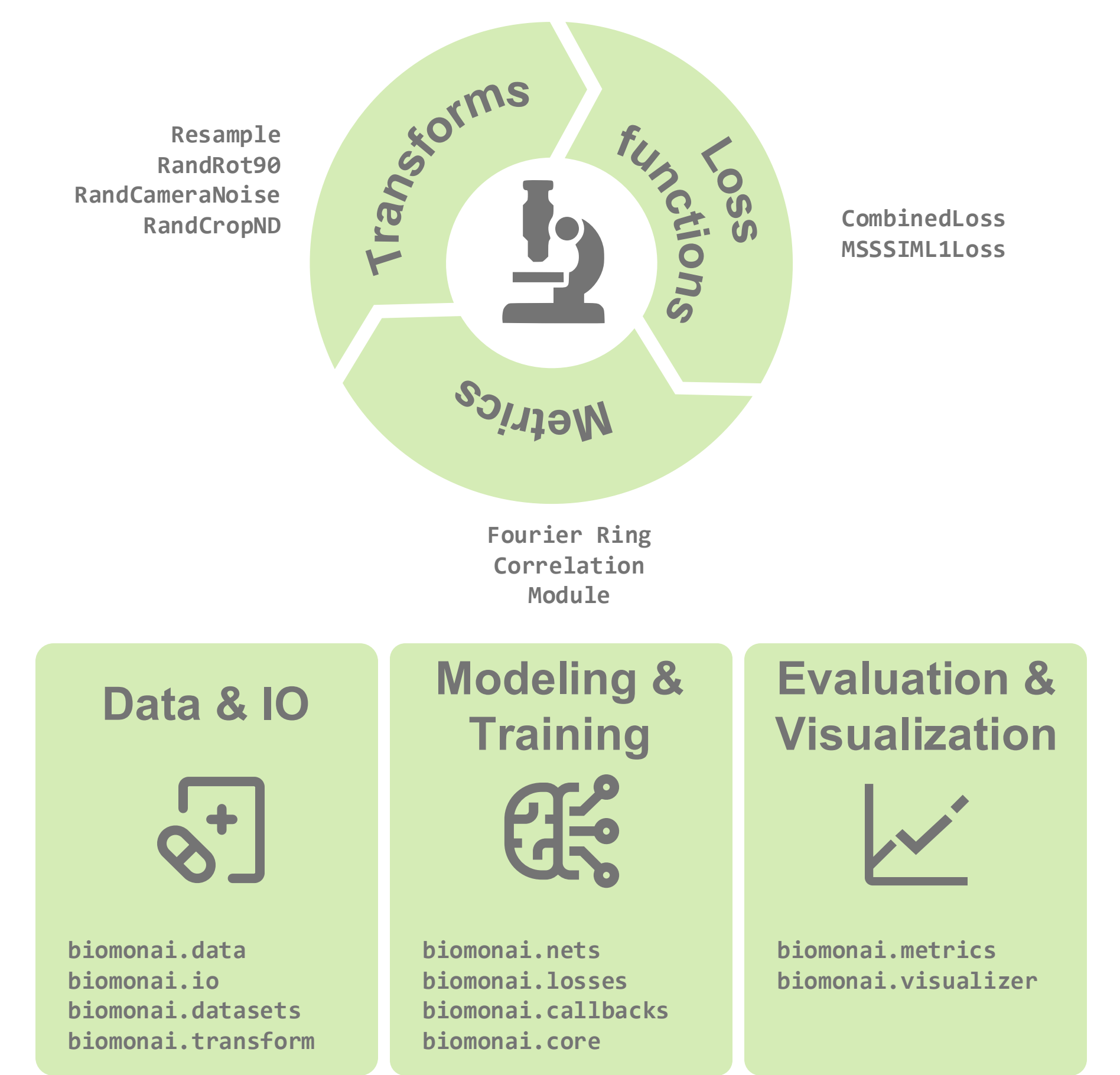
IMPLEMENTATION



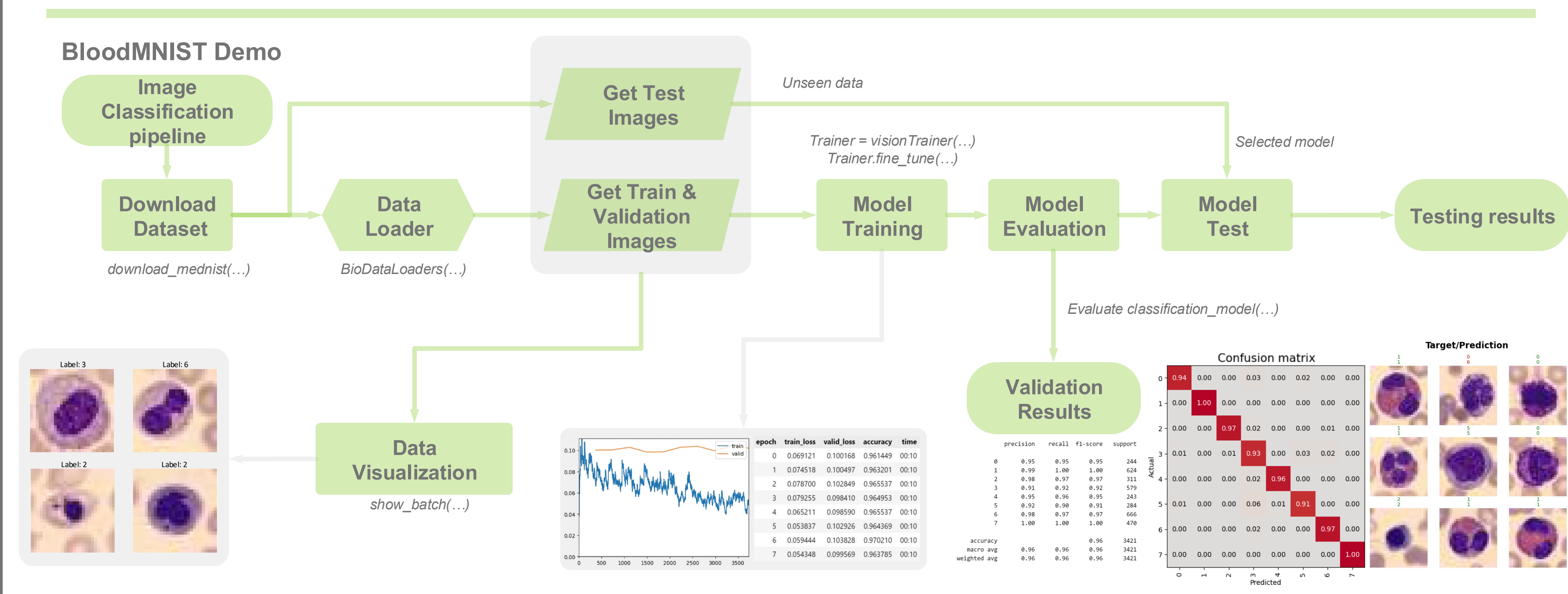
MICROSCOPY-SPECIFIC FEATURES

- Support for the most **common formats** used in microscopy
- Specific** transforms, metrics and loss functions are fundamental for **field-based tasks**
- Integration of **image metadata** through the **Biolmage class**

bioMONAI provides both general-purpose and domain-specific tools



WORKFLOW EXAMPLE: CLASSIFICATION



CONCLUSION

bioMONAI is an open-source framework that extends the MONAI ecosystem to meet the specific demands of biomedical imaging, especially in advanced microscopy workflows and Correlative Light Electron Microscopy (CLEM).

Available at: github.com/deepCLEM/bioMONAI

REFERENCES

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- [3] P. de Boer, J. P. Hoogenboom, y B. N. G. Giepmans, "Correlated light and electron microscopy: ultrastructure lights up!", *Nat. Methods*, vol. 12, núm. 6, pp. 503–513, 2015.



bioMONAI's docs!



bioMONAI's Github!



deepCLEM's docs!

This work was supported by the Spanish 'Ministerio de Ciencia, Innovación y Universidades'-'Agencia Estatal de Investigación' (MICIU-AEI) and FEDER, UE, under grant PID2022-142166NA-I00. B. M. and R.M. M.-L. are supported by the Spanish MICIU-AEI 'Ramón y Cajal' program under grants RYC2021-032084-I and RYC2023-045078-I, respectively.

