ODELIA

Open Consortium for Decentralized Medical Artificial Intelligence

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Deliverable D2.2

TRAINED NEURAL NETWORKS FOR DETECTION OF BREAST CANCER IN MRI IMAGES (INCLUDING MODELS TRAINED ON LOCAL DATA ONLY AND MODELS TRAINED IN THE SWARM)

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EXECUTIVE SUMMARY

This deliverable (D2.2) provides the trained neural network models and their associated weights for breast cancer detection in MRI. These models were developed as part of the ODELIA project, exploring both locally trained approaches and swarm learning (SL) methodologies. The weights are made available as Zenodo-hosted files to enable further review, replication, and integration by stakeholders while ensuring transparency and accessibility.

Locally trained models, developed at individual clinical sites, capture the imaging characteristics and diagnostic patterns specific to those datasets. Swarm learning models, on the other hand, incorporate knowledge aggregated from multiple participating institutions without directly sharing patient data. These approaches are designed to improve generalizability and robustness across diverse clinical settings.

By making the model weights openly available, this deliverable facilitates broader community engagement and supports the ODELIA project's objective to advance AI-driven, privacy-preserving clinical decision support in breast cancer imaging.

INTRODUCTION

Work Package 2.2 (WP2.2) of the ODELIA project aims to produce and share trained deep learning models for automated breast cancer detection in MRI. While Deliverable D2.1 focused on evaluating the performance and comparative outcomes of locally trained vs. swarm learning models, Deliverable D2.2 now provides the actual trained model weights. These openly accessible files on Zenodo enable other researchers and practitioners to test, refine, or build upon these models, thereby promoting transparency, reproducibility, and collaborative innovation.

TRAINED NEURAL NETWORK WEIGHTS: SETUP AND ACCESS

To ensure comparability and facilitate broad applicability, all models were developed following a standardized training protocol. The underlying architectures are variants of ResNet-based 3D convolutional neural networks, selected for their robustness in medical image analysis. Preprocessing steps—such as voxel resampling, intensity normalization, and spatial cropping—were applied consistently across sites.

For locally trained models, a ResNet18-based 3D architecture was used. Each institution trained its model independently using its own dataset, resulting in institution-specific weight sets that reflect local patient demographics, scanner protocols, and annotation standards.

For swarm learning models, a ResNet101-based 3D architecture was employed to better handle aggregated knowledge from multiple data sources. By training collaboratively across institutions without centralizing data, these models aim to achieve improved generalization and mitigate the biases associated with site-specific training.

All final model weights—both local and swarm-based—are provided as Zenodo repository links.

LOCALLY TRAINED MODELS

Each participating institution's locally trained weights encapsulate the unique imaging, clinical, and demographic characteristics of its dataset. Although these models performed well on their respective training sets, their variability in external test scenarios underscores the challenges of generalizing beyond the site of origin.

Despite these limitations, the locally trained weights are valuable resources. They enable researchers to:

- Investigate site-specific model behavior
- Conduct comparative analyses with other institutions' models
- Explore data augmentation or transfer learning techniques to enhance robustness

Links to each institution's locally trained model weights are available in the accompanying Zenodo repository references.

SWARM LEARNING MODELS

The swarm learning approach was designed to overcome the constraints of localized training by allowing multiple sites to collectively train a shared model without pooling sensitive patient data. Through decentralized learning, these models leverage the diversity of datasets and imaging protocols, resulting in weight sets that are generally more robust and better at handling inter-institutional variability.

The provided swarm learning model weights are derived from consensus training runs that combined data representations from multiple institutions. By making these weights available, this deliverable encourages others to:

- Test the swarm-derived models on their own datasets
- Further refine swarm learning algorithms
- Investigate the conditions under which swarm learning provides the greatest performance gains

All swarm learning model weights and corresponding metadata are accessible via the Zenodo links provided.

CONCLUSION

This deliverable serves as a critical resource for the ODELIA project and the broader medical AI community by making trained neural network model weights publicly available. These weights—both from locally trained and swarm learning approaches—offer valuable insights into the capabilities and limitations of breast cancer detection models in MRI.

The provision of these weights on Zenodo ensures long-term accessibility, transparency, and reproducibility. Researchers, clinicians, and developers are encouraged to leverage these resources for further experimentation, integration into clinical workflows, and the exploration of improved decentralized training strategies.

As ODELIA continues to advance the field of privacy-preserving, collaborative AI in healthcare, the availability of these models lays the groundwork for future innovations that may ultimately improve patient outcomes, streamline clinical decision-making, and foster trust in AI-driven diagnostics.

ZENODO REPOSITORY LINKS

- Locally Trained Model Weights: https://doi.org/10.5281/zenodo.14497231
- Swarm Learning Model Weights: https://doi.org/10.5281/zenodo.14448196