Title: FedVGM: Enhancing Federated Learning Performance on Multi-Dataset Medical Images With XAI

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Abstract: Advances in deep learning have transformed medical imaging, yet progress is hindered by data privacy regulations and fragmented datasets across institutions. To address these challenges, we propose FedVGM, a privacy-preserving federated learning framework for multi-modal medical image analysis. FedVGM integrates four imaging modalities, including brain MRI, breast ultrasound, chest X-ray, and lung CT, across 14 diagnostic classes without centralizing patient data. Using transfer learning and an ensemble of VGG16 and MobileNetV2, FedVGM achieves 97.7% $\pm$ 0.01 accuracy on the combined dataset and 91.9-99.1% across individual modalities. We evaluated three aggregation strategies and demonstrated median aggregation to be the most effective. To ensure clinical interpretability, we apply explainable AI techniques and validate results through performance metrics, statistical analysis, and k-fold cross-validation. FedVGM offers a robust, scalable solution for collaborative medical diagnostics, supporting clinical deployment while preserving data privacy.

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