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ENHANCING NSCLC HISTOLOGICAL SUBTYPE CLASSIFICATION: A FEDERATED LEARNING APPROACH USING TRIPLET LOSS

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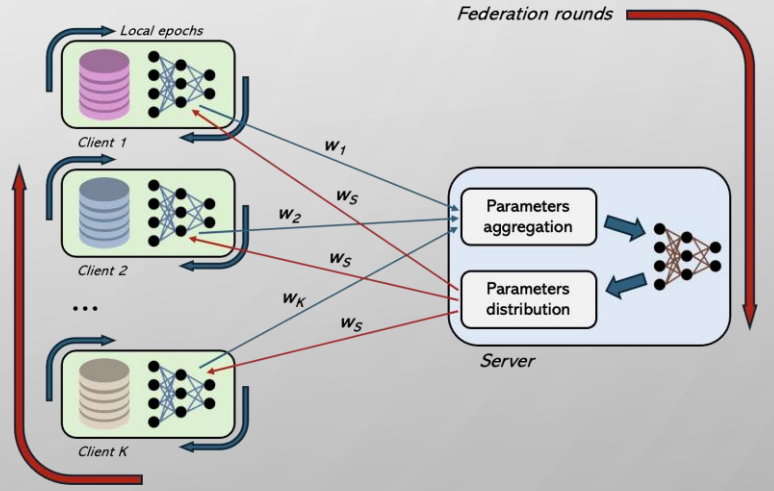
Introduction

- Lunger cancer is one of the most common and deadly malignancies worldwide
- 85% of all lung cancers are NSCLC, with ADC and SCC being the most common subtypes
- Differentiating between ADC and SCC is crucial for effective and personalized treatment planning
- Currently, invasive methods remain gold standard, but it is not always feasible and can lead to clinical complications

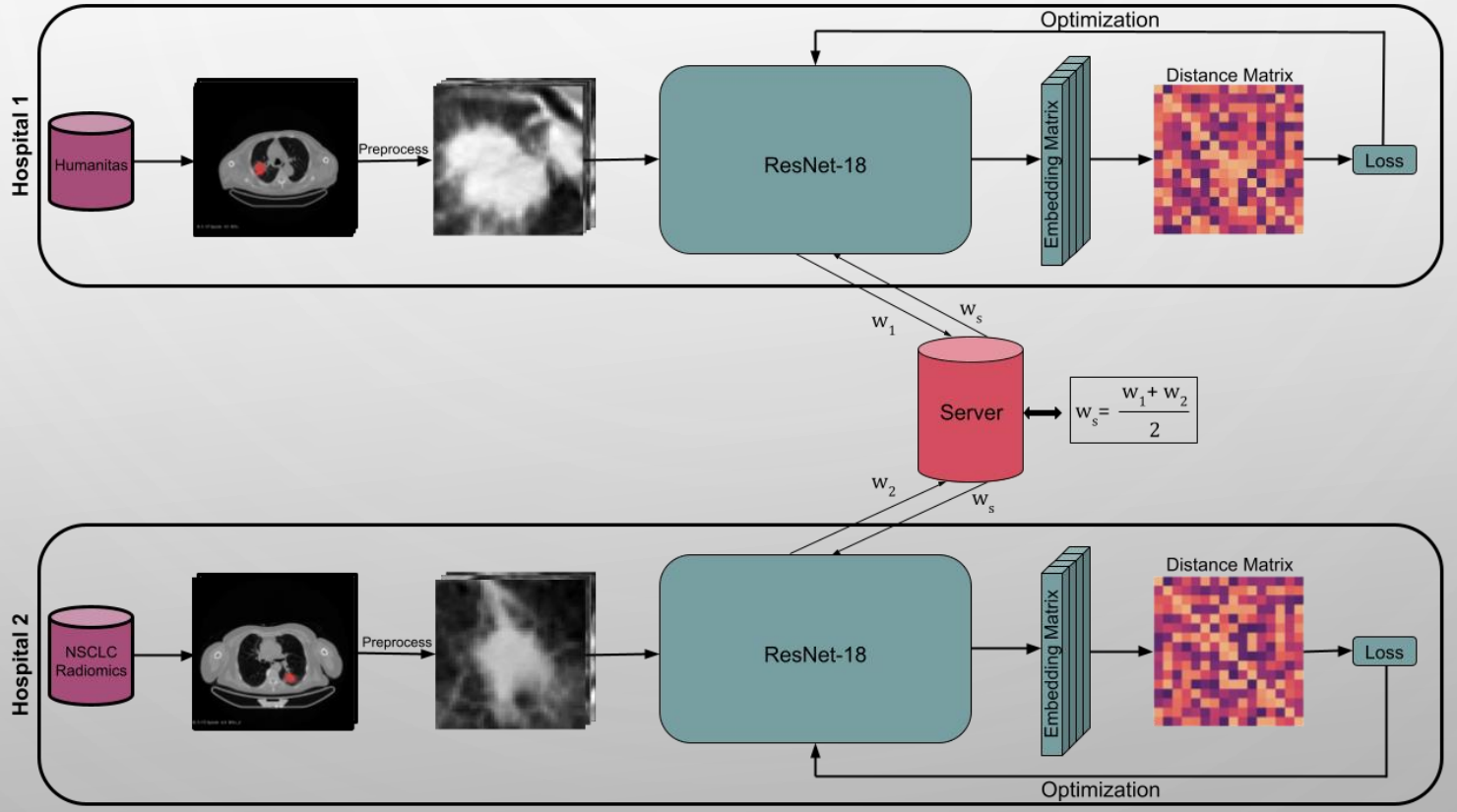
Credit: Echelon Health

Introduction

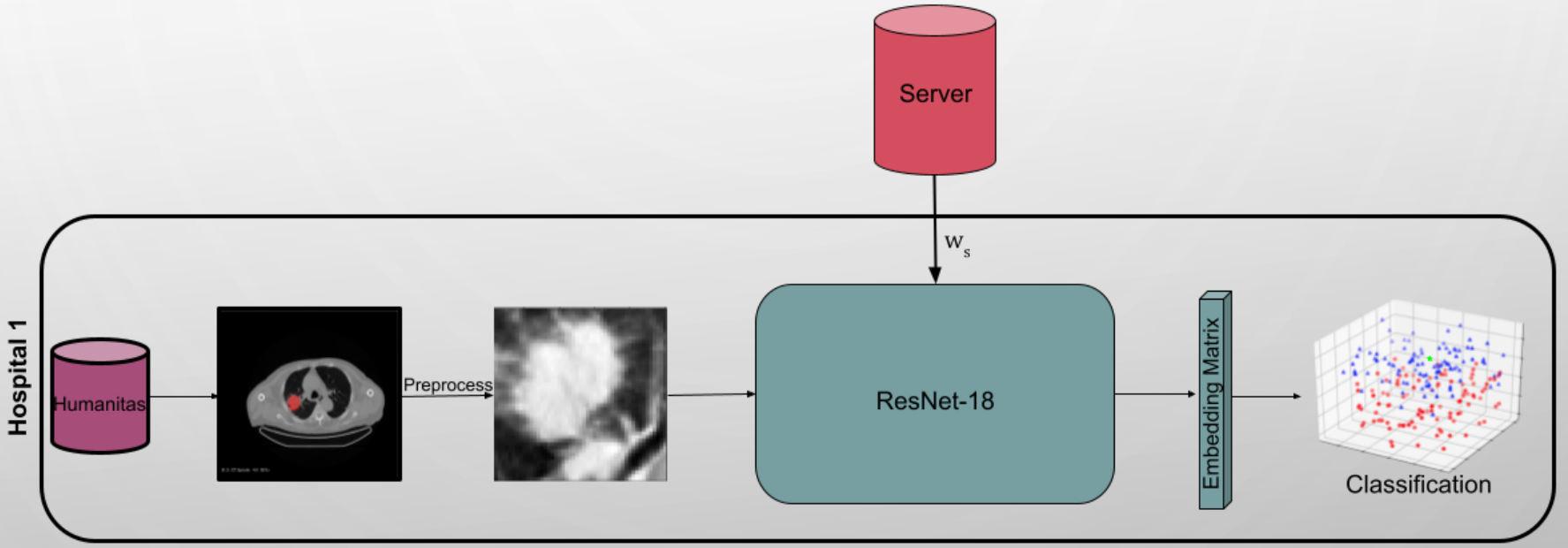
- CNNs have shown exceptional performance in various domains, including medical image analysis
- The power of analyzing vast amounts of data is crucial for AI's performance
- Limited data availability, particularly in the medical domain, poses significant challenges
- Federated Learning enables multiple models to extract insights from local data while maintaining privacy



Training Pipeline



Inference


Server
w_s
Hospital 1
Humanitas
Preprocess
ResNet-18
Embedding Matrix
Classification

Results

Model	Accuracy	AUROC	Sensitivity	Specificity	Gmean
*Triplet (Federated)	**0.664**	**0.664**	0.739	0.550	**0.630**
Softmax (Federated)	0.579	0.610	0.586	**0.567**	0.572
Triplet (Local)	**0.664**	0.654	**0.793**	0.468	0.604
Softmax (Local)	0.629	0.632	0.726	0.477	0.582
Chaunzwa et al. [1]	0.600	0.581	0.680	0.478	0.568

Conclusion

- Combining federated learning with triplet loss improves classification performance while protecting data privacy.
- Our method consistently outperformed alternatives, with triplet loss showing superior results in both federated and local training settings.
- Enhanced model accuracy can support more precise, personalized lung cancer treatment strategies.

For further discussion:

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Code available here:

References

[1] T. L. Chaunzwa, A. Hosny, Y. Xu, A. Shafer, N. Diao, M. Lanuti, D. C. Christiani, R. H. Mak, H. Aerts, “Deep learning classification of lung cancer histology using CT images,” Scientific reports, vol. 11, 2021.