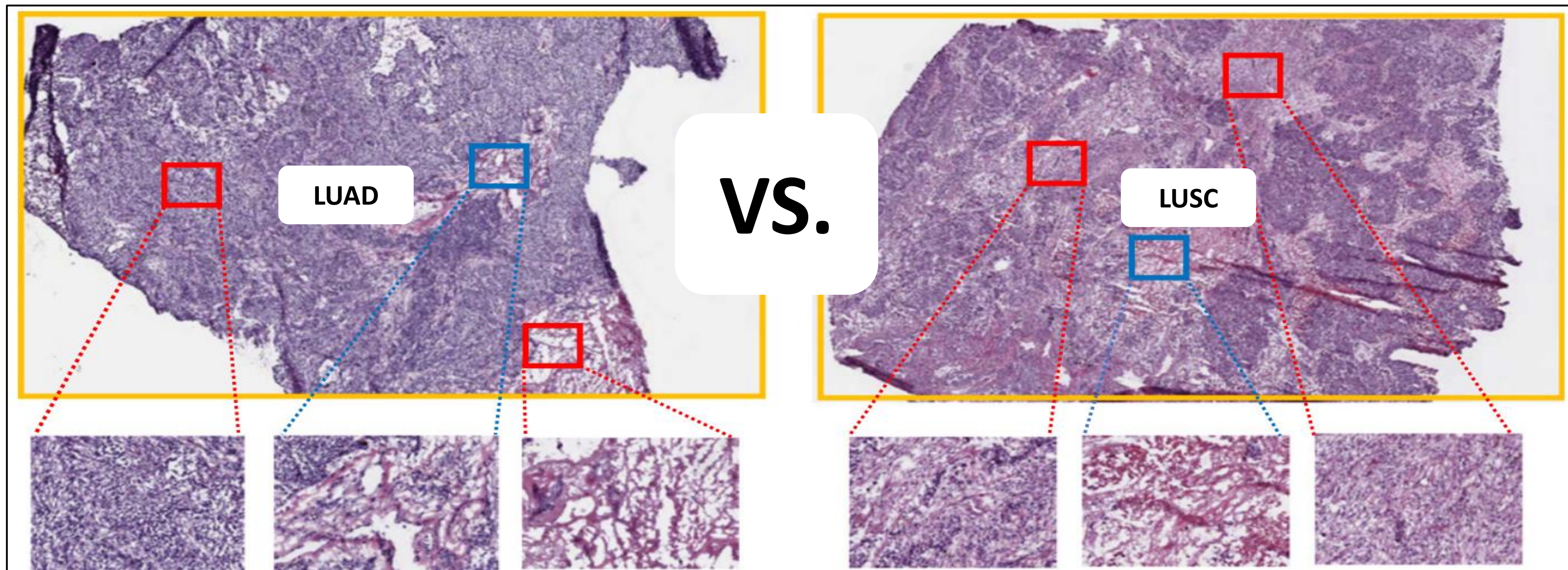


MultiModal DeepEnsemble: A Multimodal and Deep Learning Approach for Integrated Lung Cancer Subtype and Staging Prediction Using TCGA Histopathology Images and Clinical Data

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Background



NLSCC Sub-types:

- Lung Adenocarcinoma (**LUAD**)
- Lung Squamous Cell Carcinoma (**LUSC**)
- Requires **distinct treatments**
- Accounts for 85% cases
- Leading cause of cancer mortality globally

Diagnostic Challenges

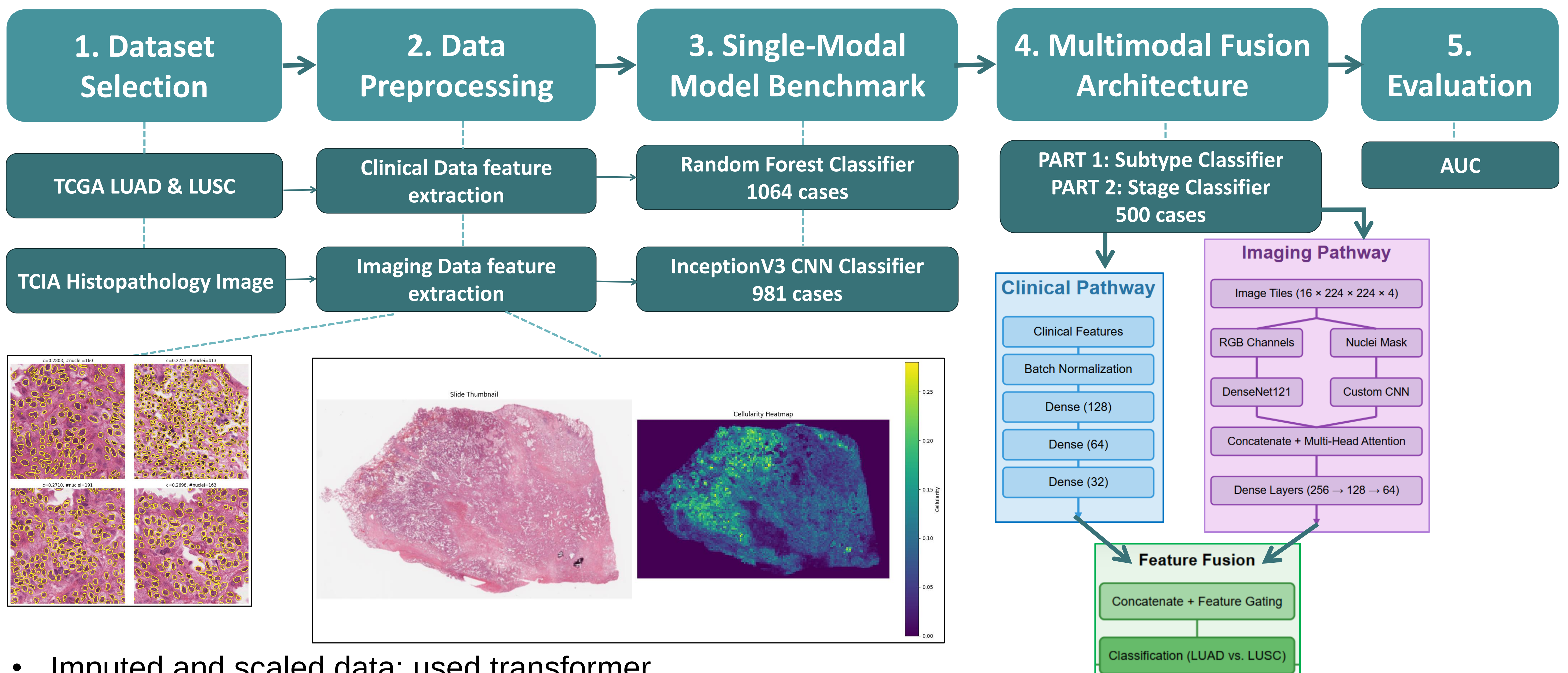
Frequent misdiagnosis due to:

- Biological heterogeneity
- Overlapping morphological features
- Inter-observer variability in histopathology

Objective

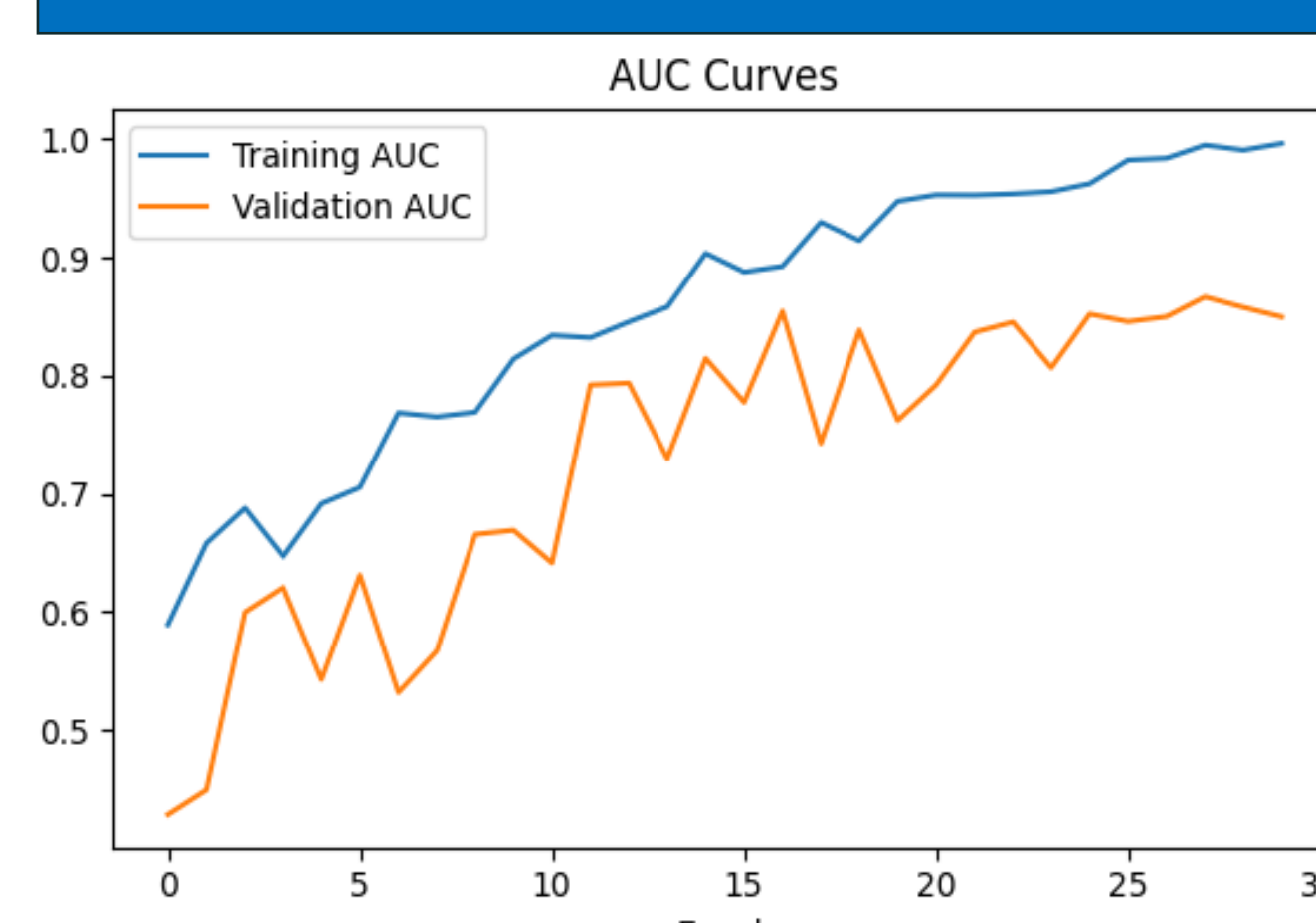
Explore a multimodal approach integrating clinical data with imaging data for improved diagnostic accuracy using segmentation data for lung cancer.

Methodology



- Imputed and scaled data; used transformer for clinical data
- R-tree indexing for high-cellularity, tumor boundary, and stromal image features.
- **Dual-path model** for 4-channel (RGB + nuclear mask) tiles
- Dense network for clinical features, fused via **hybrid attention** and **gating**

Results



Model AUC	Subtype Classifier	Stage Classifier
Clinical	0.74	0.53
Imaging	0.76	0.49
Multi-Modal	0.8658	0.6875

Multimodal model achieved AUCs of 0.8658 and 0.6875 with 500 cases