



MMD-Disease
Detection



Multi-Modal Deep Learning Framework

For Disease Detection

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Problem Statement

- ***Primary Problem:***

- Traditional diagnostic systems analyze single data modalities (images or text).
- Limited accuracy and robustness in real-world scenarios.

- ***Sub-Problems:***

- Lack of integration between visual and textual information.
- Challenges in generalizing across diverse datasets.



Data Description

Dataset Used

- MIMIC-CXR dataset: **377,110** chest radiographs, **227,835** studies.
- Includes paired clinical notes and frontal/lateral chest X-rays.



Basic Statistics

- MIMIC dataset with labels 0/1/-1 as a distribution for the diagnoses.
- Full Report dataset: With an average length of clinical notes: **~200** tokens.



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Data Preprocessing

For Clinical Notes/Reports Data:

- Match subject_id between the clinical notes data file and the mimic file.
- Applied tokenization and embedding extraction with BERT.
- Replaced missing values with the placeholder "missing".
- Replaced -1 with 0 for labels (binary format).

For Clinical Images:

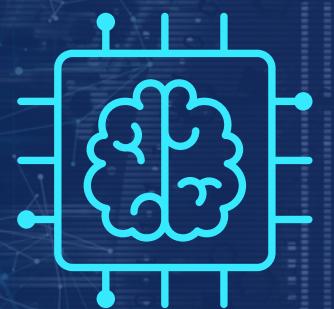
- Applied data augmentation techniques to enhance generalization and reduce overfitting.
- Normalized pixel values to a range of [0, 1] for efficient training.
- Resized all images to a consistent dimension (e.g., 224x224) suitable for the selected CNN backbone.

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Model/Architecture Design

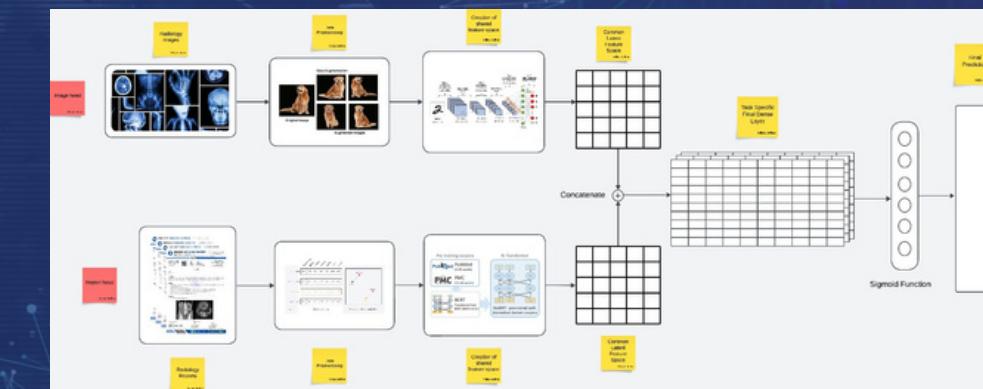


FRAMEWORK



WORKFLOW DIAGRAM

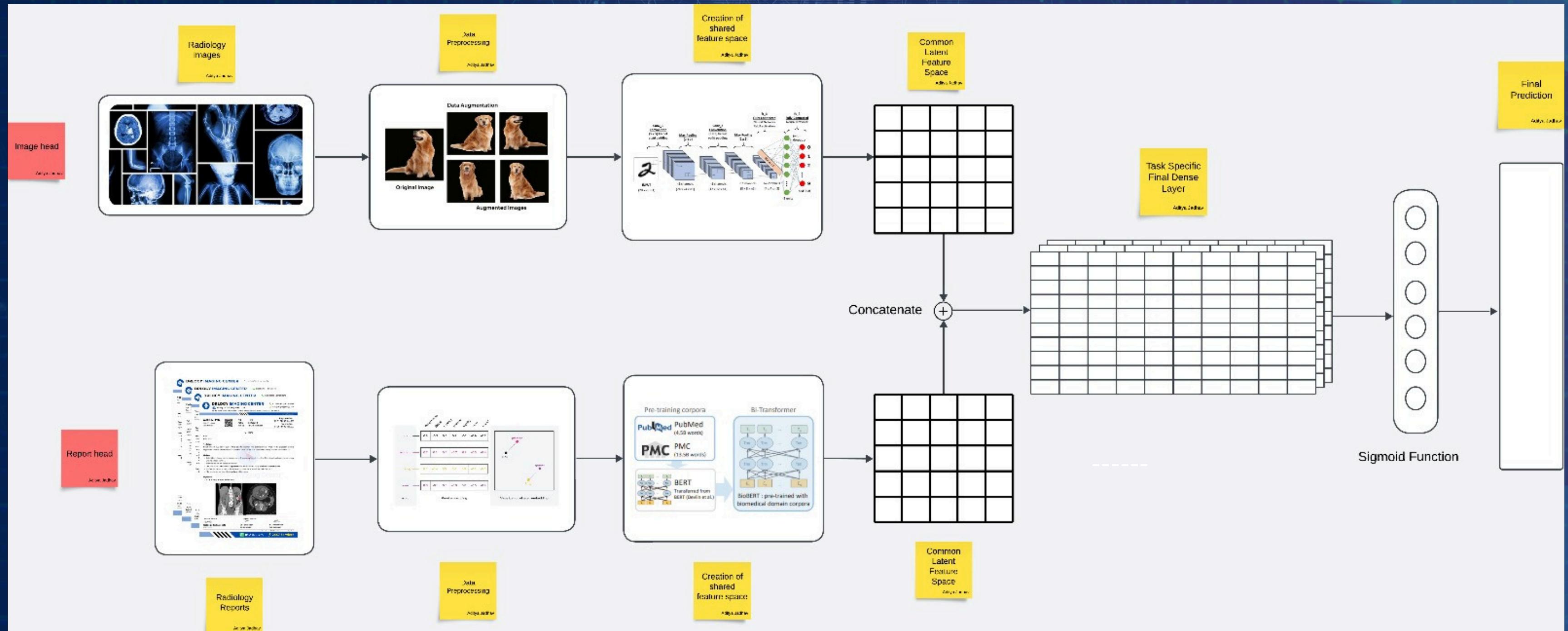
- **Image Branch:** Pre-trained EfficientNets and ResNets
- **Text Branch:** BioBERT model fine-tuned on clinical notes.
- Feature Fusion: Concatenated vectors passed through dense layers.



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Evaluation Metrics

- *Accuracy*
- *Precision*
- *Recall*
- *F1-score*
- *Cross Validation*

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Experimental Results



-	Accuracy	Precision	Recall	F1-Score
BioBERT For Clinical Text Reports	0.71	0.64	0.55	0.59
EfficientNet for Clinical Images	0.67	0.62	0.56	0.58

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Lessons Learned

- Balancing feature importance between modalities.
- Use a larger dataset with diverse patient demographics.
- Clinical notes played a critical role in improving diagnosis for ambiguous cases.
- It is always better to try different modalities to check what fits your needs.



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Broader Impacts

Clinical Implications:

- Improves diagnostic accuracy, reducing false negatives.
- Enhances trust in AI-driven medical systems.

Actionable Insights:

- Could support overwhelmed radiologists in real-time.
- Highlights the value of integrating multi-modal data in healthcare.

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Thank You!

Questions?