Multimodal Deep Learning for Predicting Prostate Cancer Recurrence from Histopathology and Multiparametric MRI

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This thesis investigates deep learning methods for integrating whole-slide histopathology and multiparametric MRI to predict biochemical recurrence in prostate cancer. The project evaluates multimodal fusion strategies and survival modeling approaches to determine whether combining micro- and macro-scale imaging features improves prognostic accuracy compared to single-modality models. Based on the Chimera challenge[a].

METHODOLOGY

Data Collection

- Acquire a dataset of prostate cancer patients with matched whole-slide histopathology images, multiparametric MRI scans, and clinical follow-up data.
- Ensure data is de-identified and compliant with ethical standards.

Data Preprocessing

- Preprocess histopathology images (e.g., normalization, augmentation).
- Preprocess MRI scans (e.g., skull stripping, intensity normalization).
- Align and register multimodal images.

Model Development

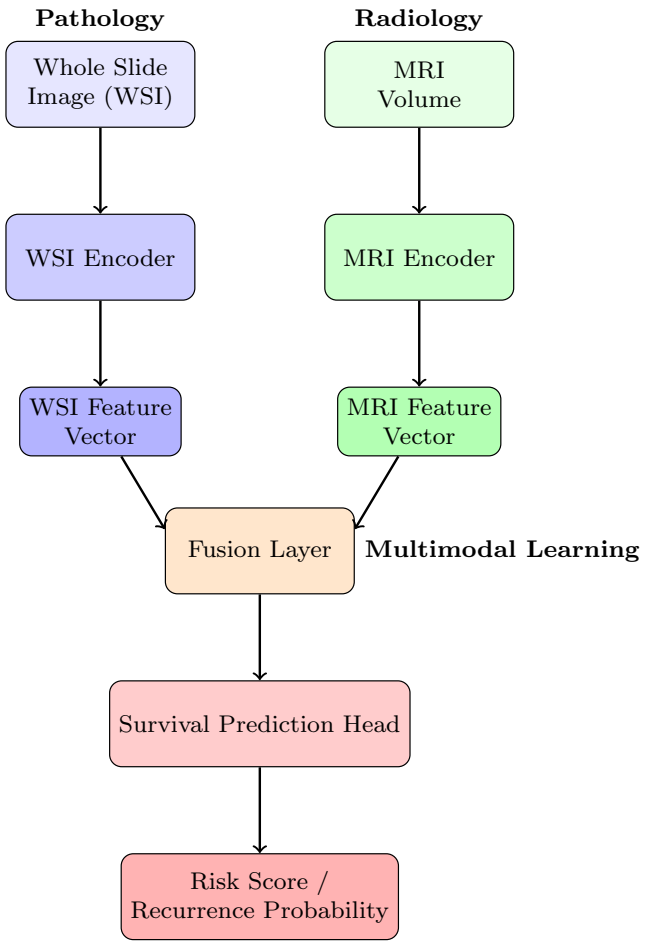


FIG. 1. Multimodal deep learning architecture for prostate cancer recurrence prediction, combining WSI and MRI encoders with a fusion module and survival prediction head.

Baseline Models

- Develop and evaluate baseline models using single-modality data (e.g., histopathology only, MRI only).
- Implement survival analysis techniques to assess model performance.

[a] https://chimera.grand-challenge.org/

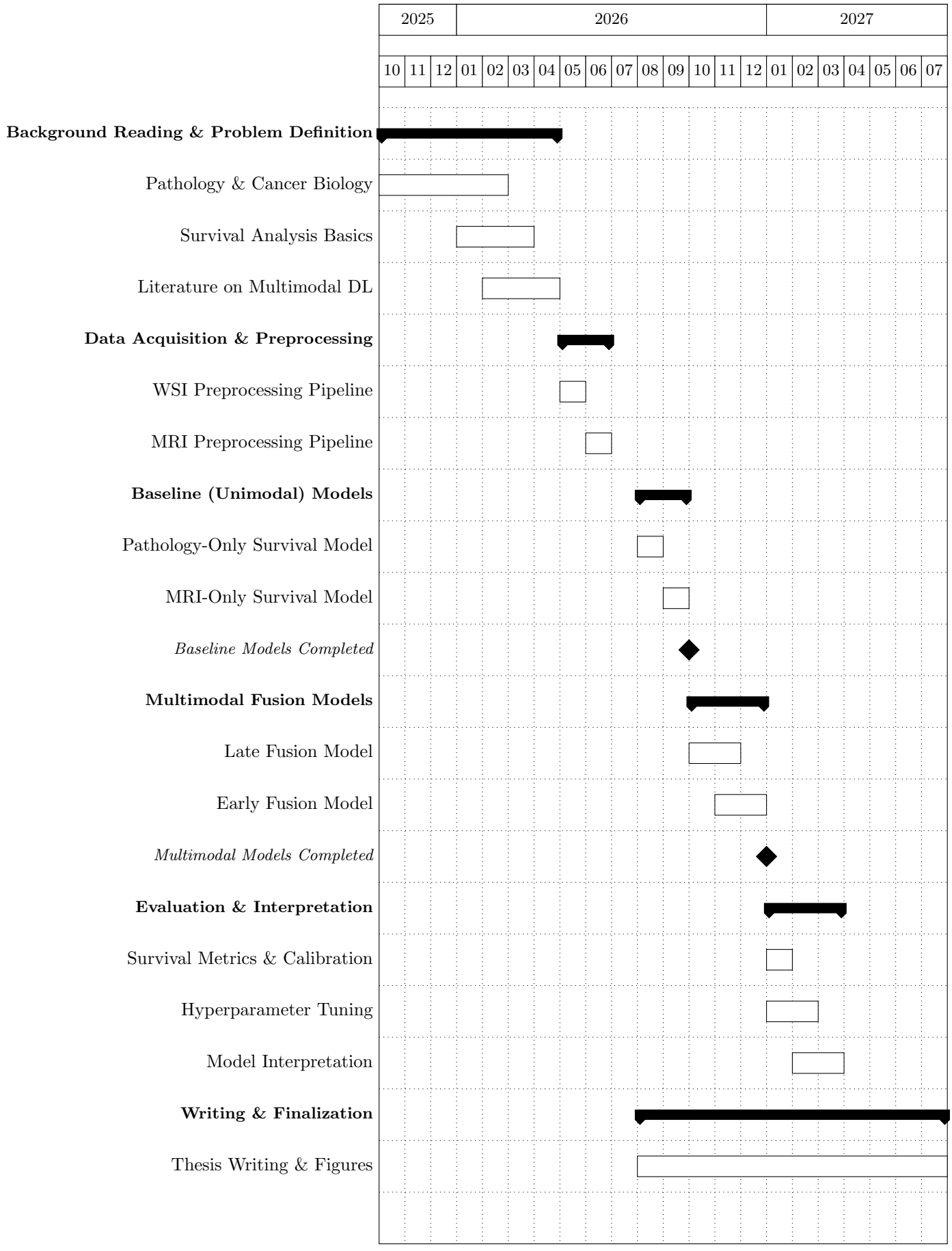
Multimodal Models

- Explore various multimodal fusion strategies (e.g., early fusion, late fusion).
- Investigate the impact of different feature extraction methods on model performance.

Model Evaluation

- Compare unimodal models (pathology-only, MRI-only) vs. multimodal models
- Evaluate improvement in prognostic performance

PROGRESS PLAN



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