

Methylation Prediction for Glioblastoma Treatment Using Brain MRI

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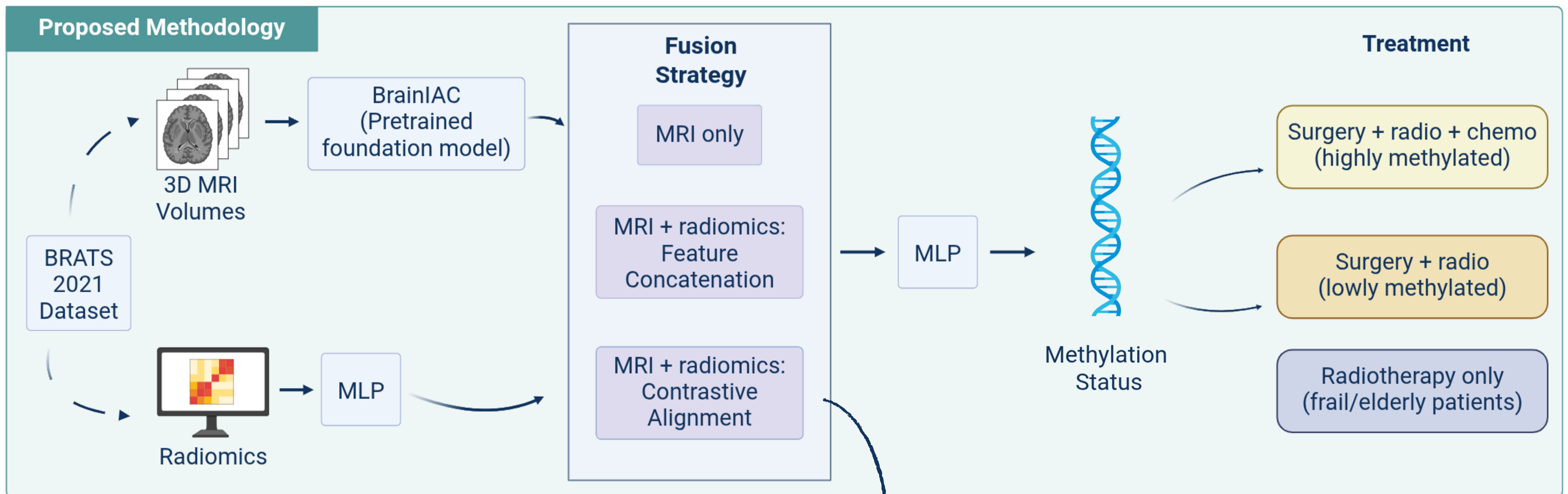


BACKGROUND

- Glioblastoma is one of the deadliest and most aggressive brain cancers
- MGMT promoter methylation levels determine effectiveness of temozolomide (TMZ) chemotherapy

MOTIVATION

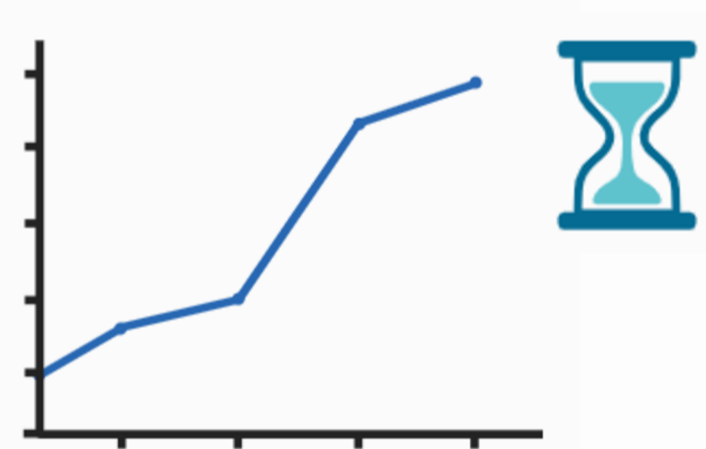
- Determining tumour methylation involves brain biopsy
- Existing methods mostly utilise 2D MRI data and do not leverage pretrained foundation models



Public Health Scotland Data



~ 2000 GBM patients based in Edinburgh



Treatment and overall survival data over time

RESULTS

Modalities	Accuracy	AUC	F1	Confusion Matrix			
				TN	FN	TP	FP
MRI (no fusion)	0.621	0.642	0.615	14	8	22	14
MRI + radiomics (feature concatenation)	0.638	0.610	0.636	20	13	17	8
MRI + radiomics (contrastive: 0.3)	0.603	0.635	0.599	14	9	21	14
MRI + radiomics (contrastive: 0.5)	0.621	0.652	0.615	14	8	22	14
MRI + radiomics (contrastive: 0.8)	0.621	0.646	0.621	17	11	19	11

Feature concat: Best accuracy/F1, but worst AUC (poor class separation)

Contrastive (alpha 0.5): best AUC-ROC (best class separation)

Tight performance margins: requires multi-seed cross-validation

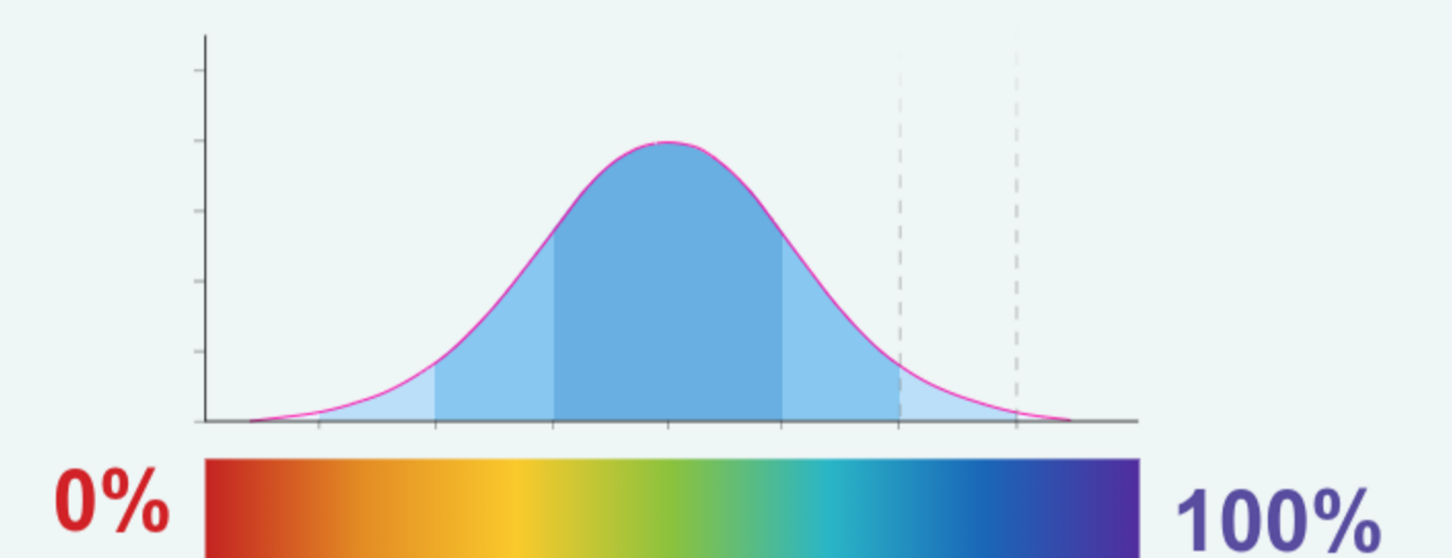
Future Work



Leverage Real Patient Data



Integrate patient demographics and blood sample data



Perform continuous prediction with uncertainty quantification

Illustrations created with BioRender.com

References:

1. İ. Ö. Koska and Ç. Koska, "Deep learning classification of MGMT status of glioblastomas using multiparametric MRI with a novel domain knowledge augmented mask fusion approach," *Scientific Reports*, vol. 15, no. 1, Jan. 2025, doi: <https://doi.org/10.1038/s41598-025-87803-0>.
2. M. T. C. Poon et al., "Extent of MGMT promoter methylation modifies the effect of temozolomide on overall survival in patients with glioblastoma: a regional cohort study," *Neuro-Oncology Advances*, vol. 3, no. 1, Jan. 2021, doi: <https://doi.org/10.1093/oaajnl/vdab171>.
3. Biorender, "BioRender," Biorender, 2025. <https://biorender.com>