



IM-Fuse: A Mamba-based Fusion Block for Brain Tumor Segmentation with Incomplete Modalities

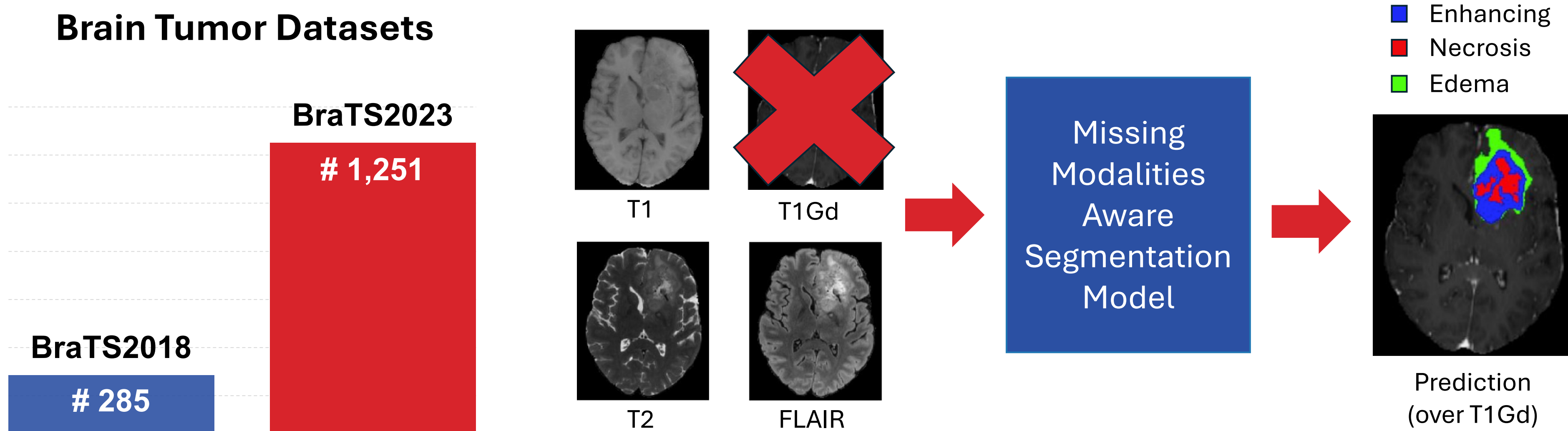
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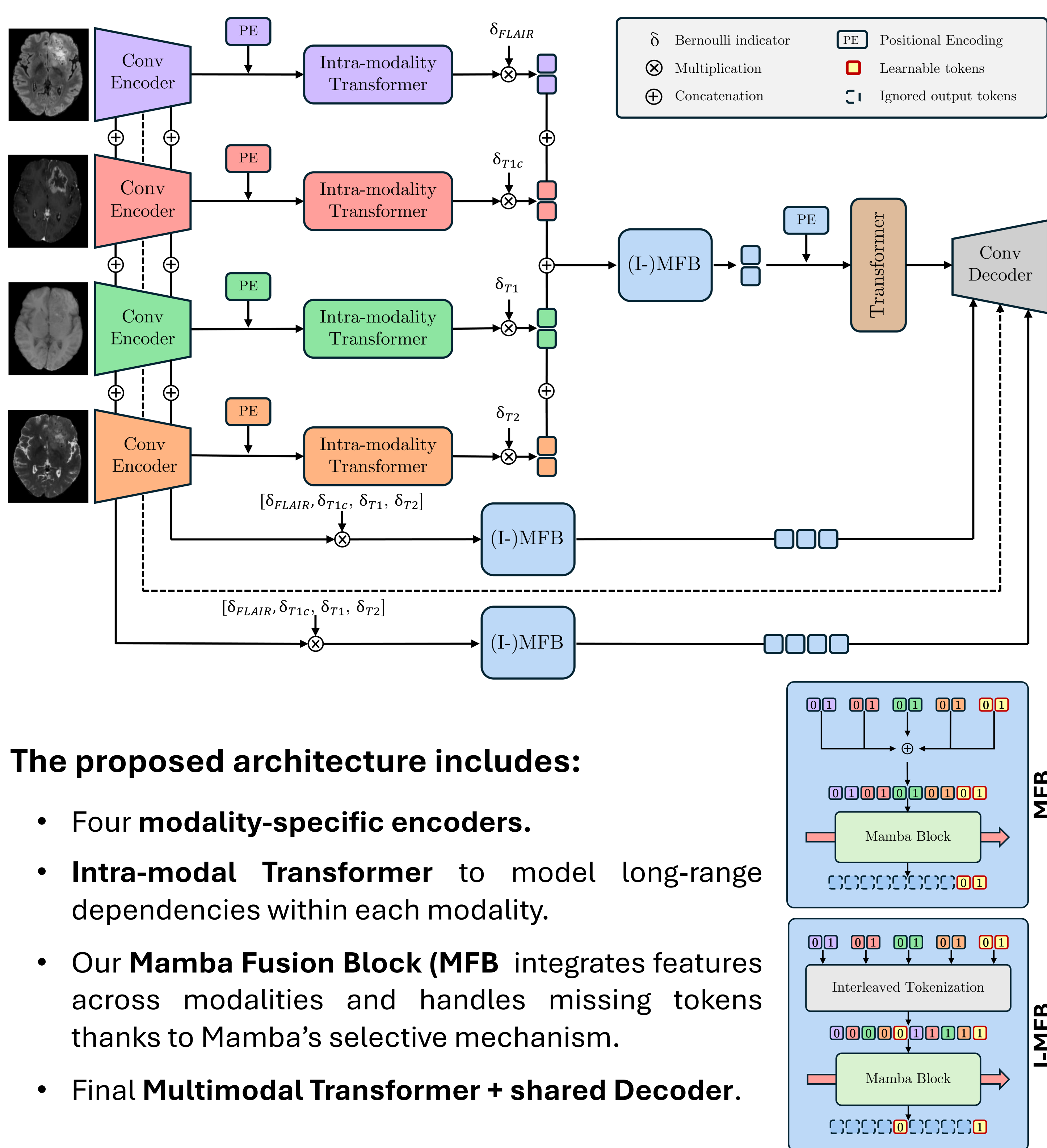


Brain Tumor Segmentation and Missing Modalities

- **Glioblastoma** is one of the most common **malignant** primary brain tumors.
- **MP-MRI** (T1, T1Gd, FLAIR, and T2) is the gold standard for brain tumor imaging, but in real-life scenarios, **one or more modalities may be missing**.
- Recent literature focused on methods for **compensating for one or more missing modalities**.



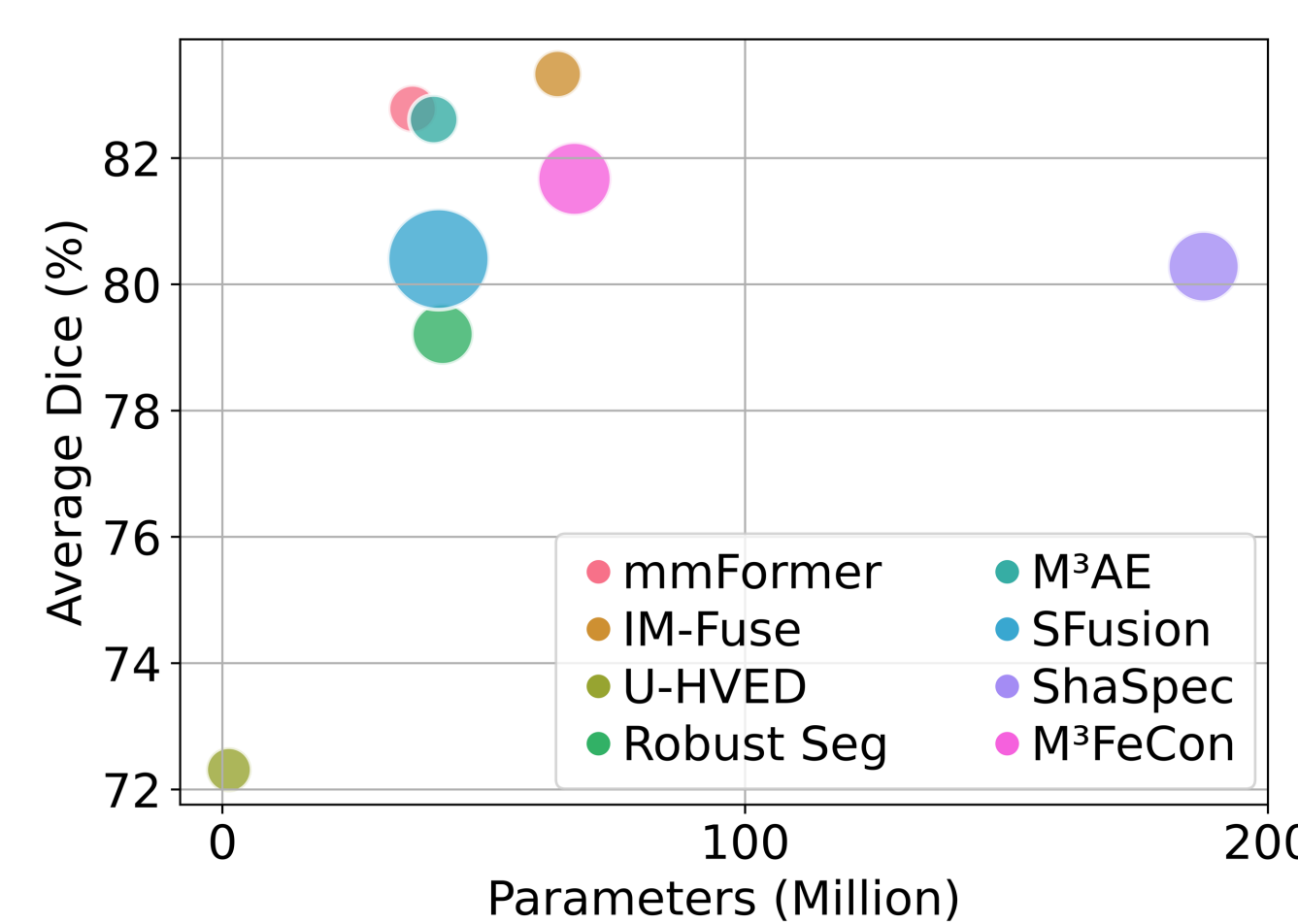
Our Proposal: IM-Fuse



First Benchmark on BraTS2023

- **Previous works conducted** the experiments on **BraTS2018**.
- We built a **new benchmark** on the 4-times larger **BraTS2023**.

BraTS2018				BraTS2023		
Model	Enhancing Tumor	Tumor Core	Whole Tumor	Enhancing Tumor	Tumor Core	Whole Tumor
U-HVED	50.0	64.0	80.1	59.8	73.7	83.5
RobustSeg	51.0	69.8	84.4	68.8	81.5	87.3
mmFormer	59.9	73.0	82.9	<u>73.6</u>	84.7	<u>90.0</u>
SFusion	53.6	75.0	84.4	70.6	82.6	88.0
ShaSpec	<u>61.6</u>	<u>77.5</u>	85.9	69.2	82.8	88.8
M³AE	59.9	77.4	85.8	73.2	<u>85.1</u>	89.6
M³FeCon	63.8	78.3	86.3	71.8	84.4	88.8
IM-Fuse	55.9	76.3	86.3	74.3	85.5	90.2



Deployment **model size** and **DSCs** across all the missing modalities and tumor classes on BraTS2023.
Larger circles → **higher GFLOPS**

Ablation IM-Fuse (BraTS2023)

Fusion	Enhancing Tumor	Tumor Core	Whole Tumor
MFB	53.4	72.6	76.1
I-MFB	74.3	85.5	90.2
MFB ♣	73.1	84.1	88.2
I-MFB ♣	73.2	84.3	89.1

♣ denotes that the fusion block is applied to the bottleneck and skip connections simply concatenating the different modalities.

Data Visualization: IM-Fuse Segmentation Results Under Missing Modality Scenarios

