

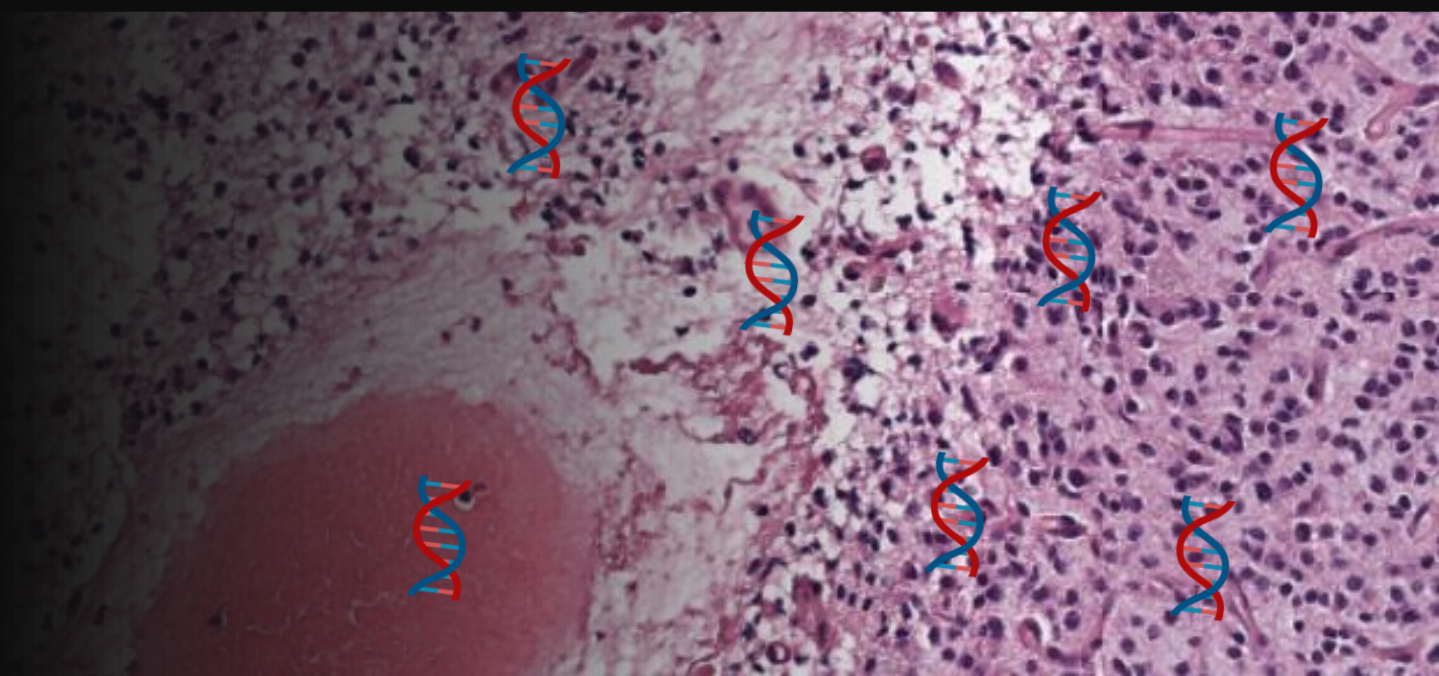
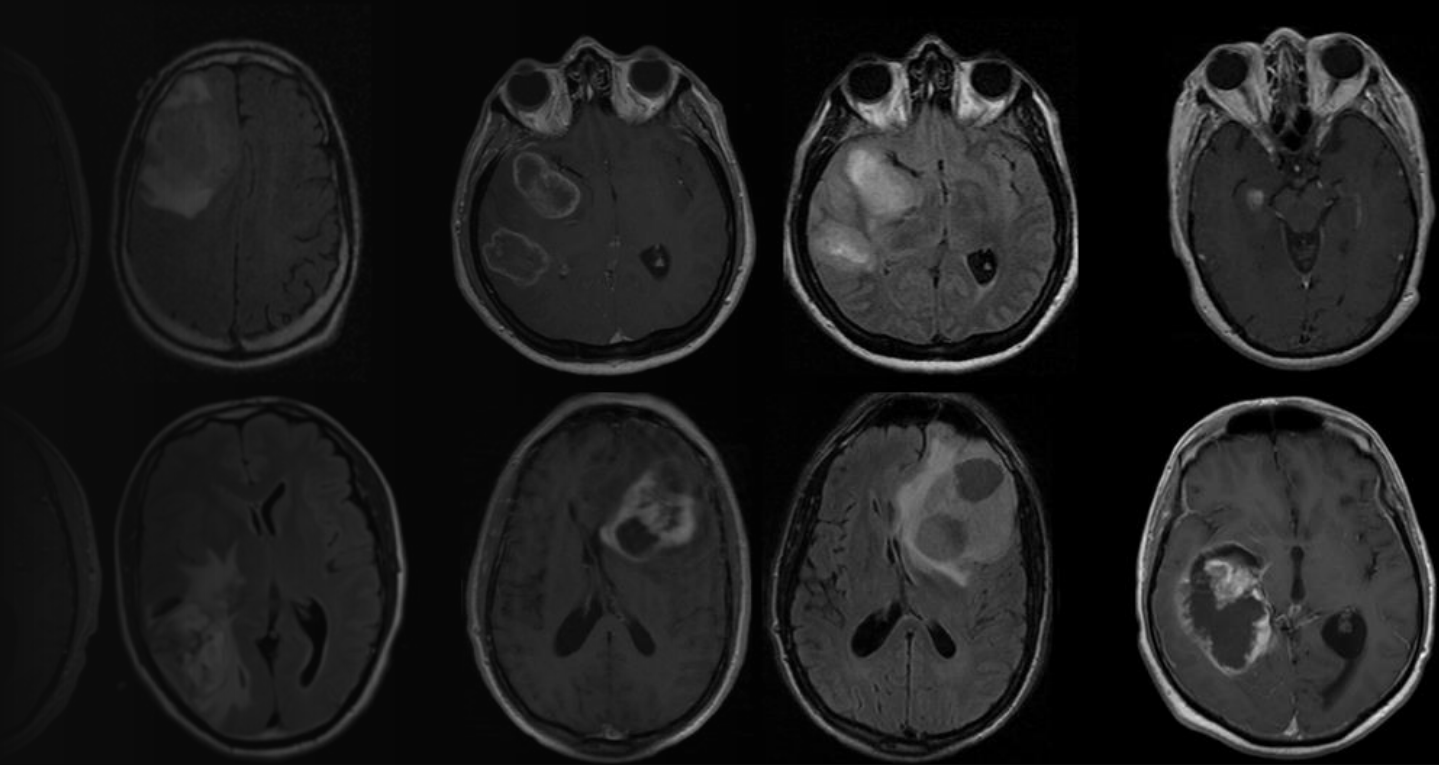
Radiomic and genomic approaches to survival stratification in adult-type diffuse glioma

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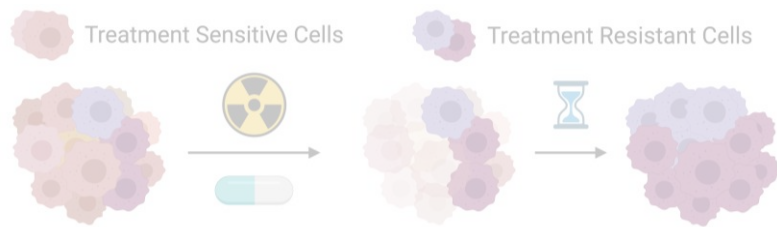
Adult-type diffuse glioma

- Most common primary adult malignant brain tumor
- Generally regarded as incurable
- Survival ranges from 12-15 months (glioblastoma) to nearly 10 years (oligodendroglioma)



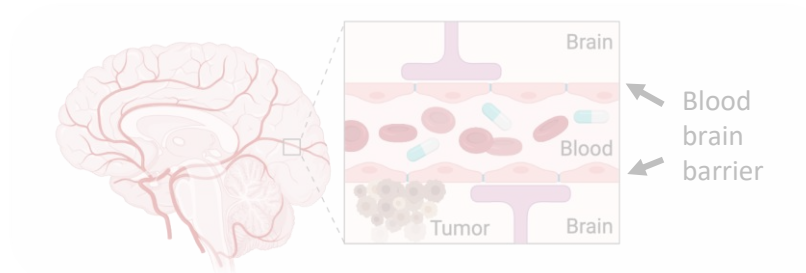
What makes adult-type diffuse glioma so difficult to treat?

Tumor molecular heterogeneity



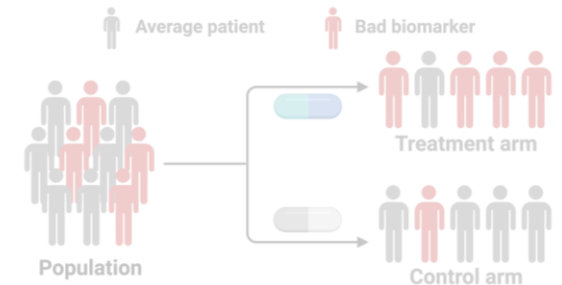
- Even “effective” treatments do not work on all cells
- Treatment resistant cells drive tumor recurrences

Drug delivery



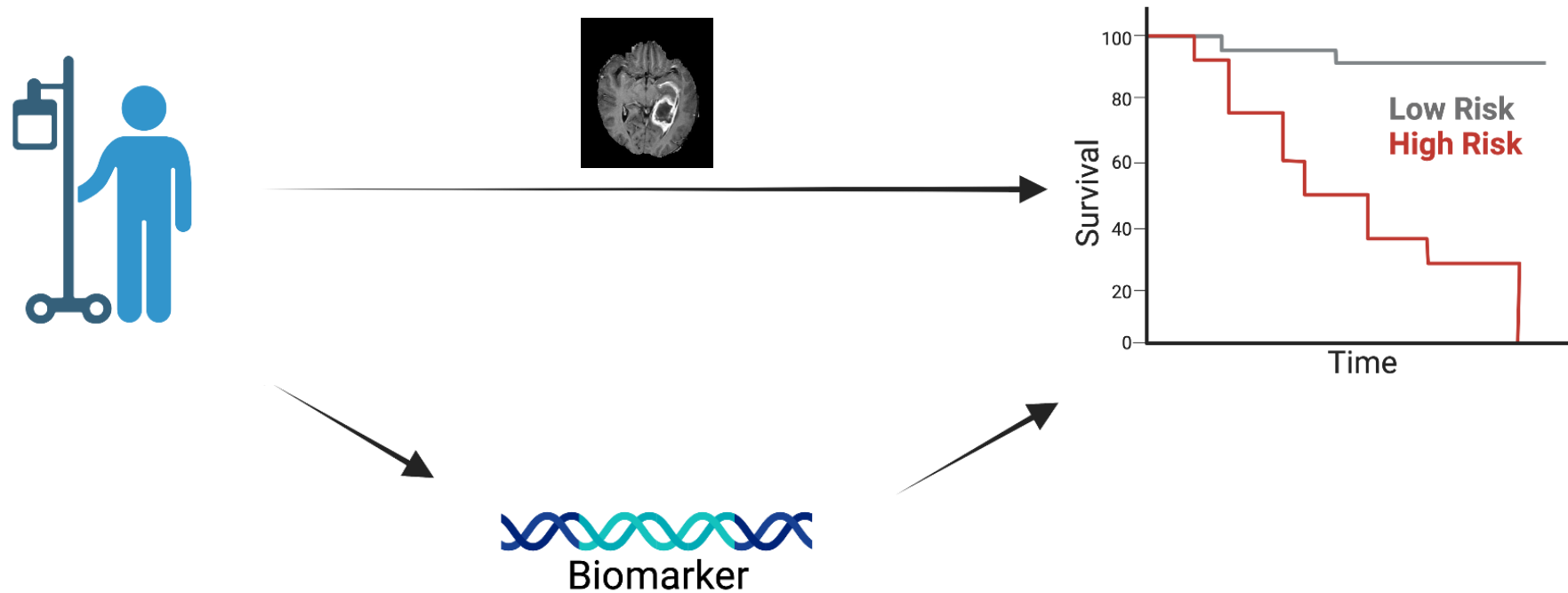
- Drugs are ineffective if they cannot reach tumor cells

Clinical trial failure

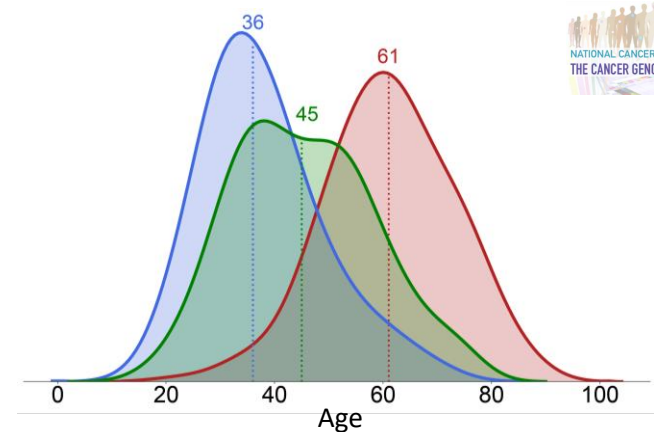
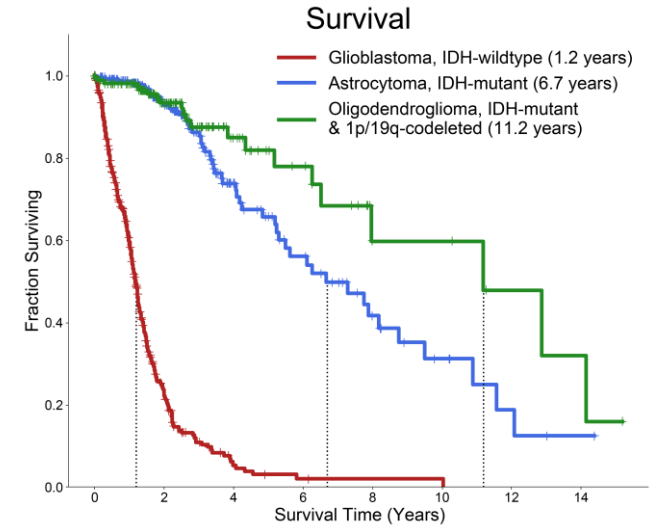
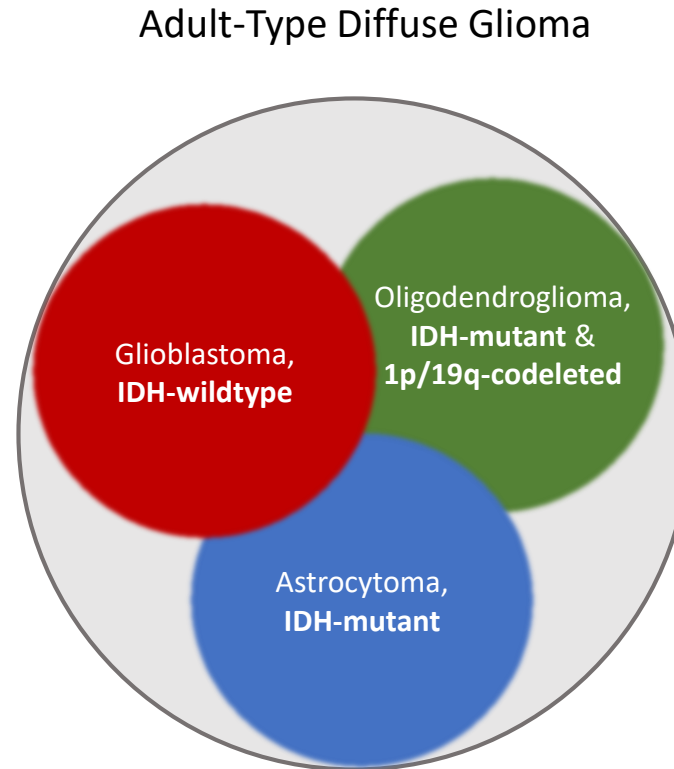
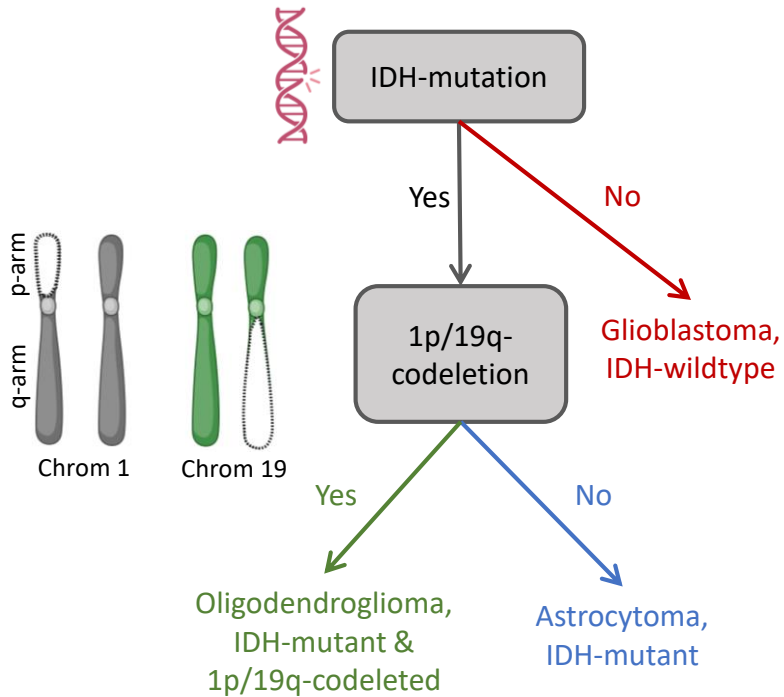


- Unknown biomarkers can lead to:
- Phase 2 success for ineffective therapies
 - Phase 3 failure for beneficial therapies

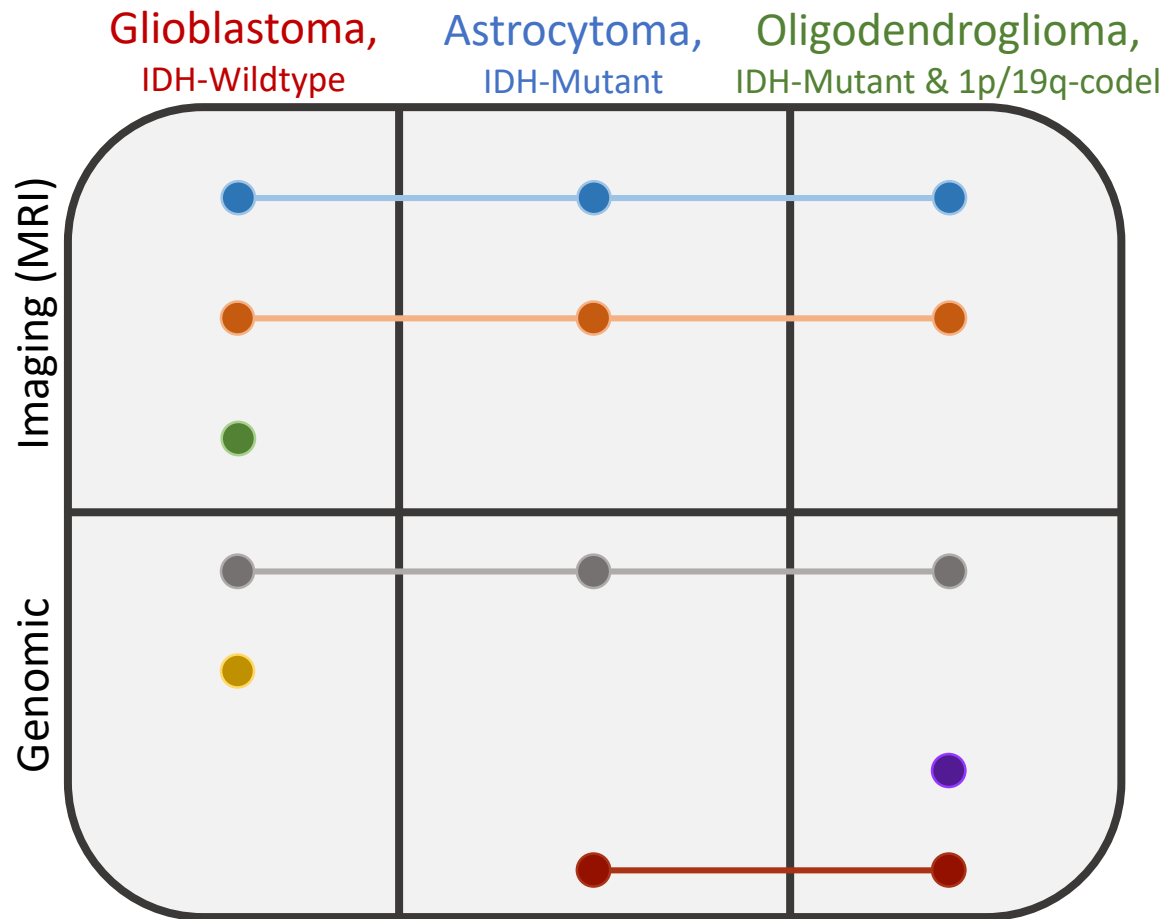
Survival stratification helps balance clinical trials



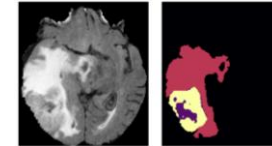
Types of adult-type diffuse glioma



PhD trajectory



1. Tumor segmentation tool



Nuechterlein et al.,
MICCAI Workshop,
2018

2. Classify tumors by type (IDH, 1p/19q)

- From imaging data

Nuechterlein et al., ICPR, 2021

- From old genomic data

Nuechterlein et al., AANP, 2021

Nuechterlein et al., Acta Neuro Com, 2021

3. Find high-risk IDH-wildtype glioblastoma patients

- From imaging data

Nuechterlein et al., SNO, 2020

- From genomic data

Nuechterlein et al., Neuro-Onc Adv, 2021

Nuechterlein et al., In Preparation

(*PDE10A*) 

4. Find low-risker patients in IDH-mutant tumors

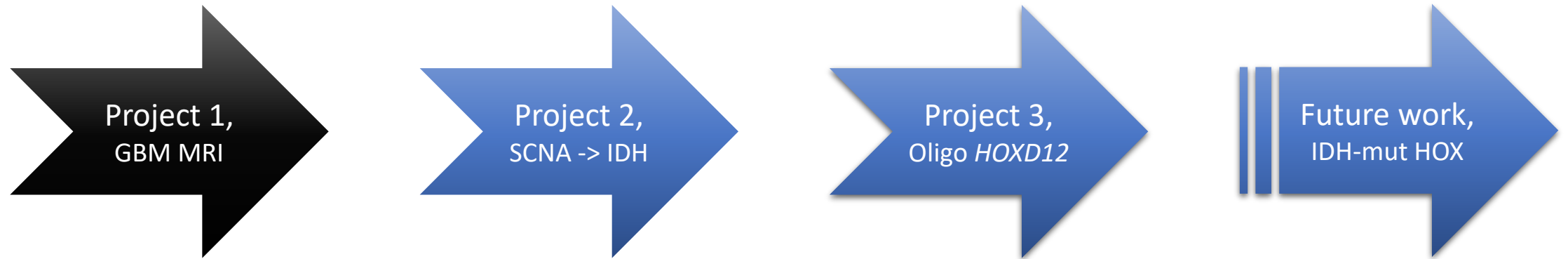
- Find gene (*HOXD12*) in oligodendroglioma

Nuechterlein et al., SNO, 2022

Nuechterlein et al., In Preparation

- Extend findings to all IDH-mutant tumors

Postdoc work



Radiogenomic modeling predicts survival-associated prognostic groups in glioblastoma

Neuro-oncology advances, 2021

JOURNAL ARTICLE

Radiogenomic modeling predicts survival-associated prognostic groups in glioblastoma

Nicholas Nuechterlein, Beibin Li, Abdullah Feroze, Eric C Holland, Linda Shapiro, David Haynor, James Fink, Patrick J Cimino 

Neuro-Oncology Advances, Volume 3, Issue 1, January-December 2021, vdab004,
<https://doi.org/10.1093/noajnl/vdab004>

Published: 15 February 2021 [Article history](#) 

Problem motivation

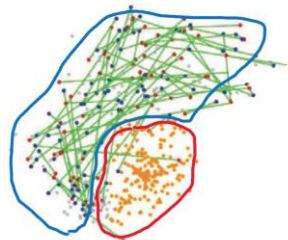
Background

Binary classification \approx short-term survivors vs. long-term survivors

Patients with second resections survive longer

Patients with second resections are associated with a copy number signature

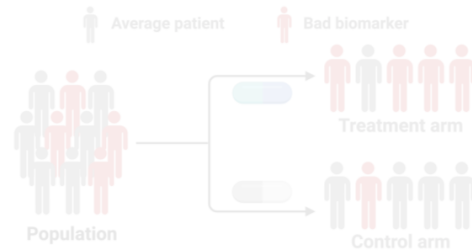
Longer-term survivors



Short-term survivors

Motivation

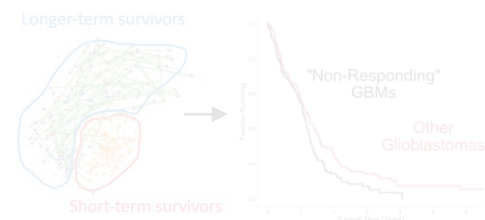
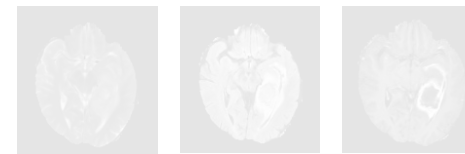
Acquisition of MRI data is non-invasive and routinely collected



Upfront clinical trials are needed for highest-risk patients

Question

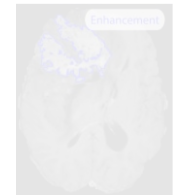
Is MRI data predictive of GBM prognostic copy number signatures?



Approach

Radiomic analysis

Segment tumor



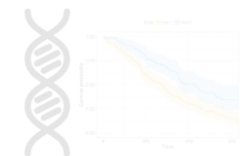
Extract radiomic features



Feature selection

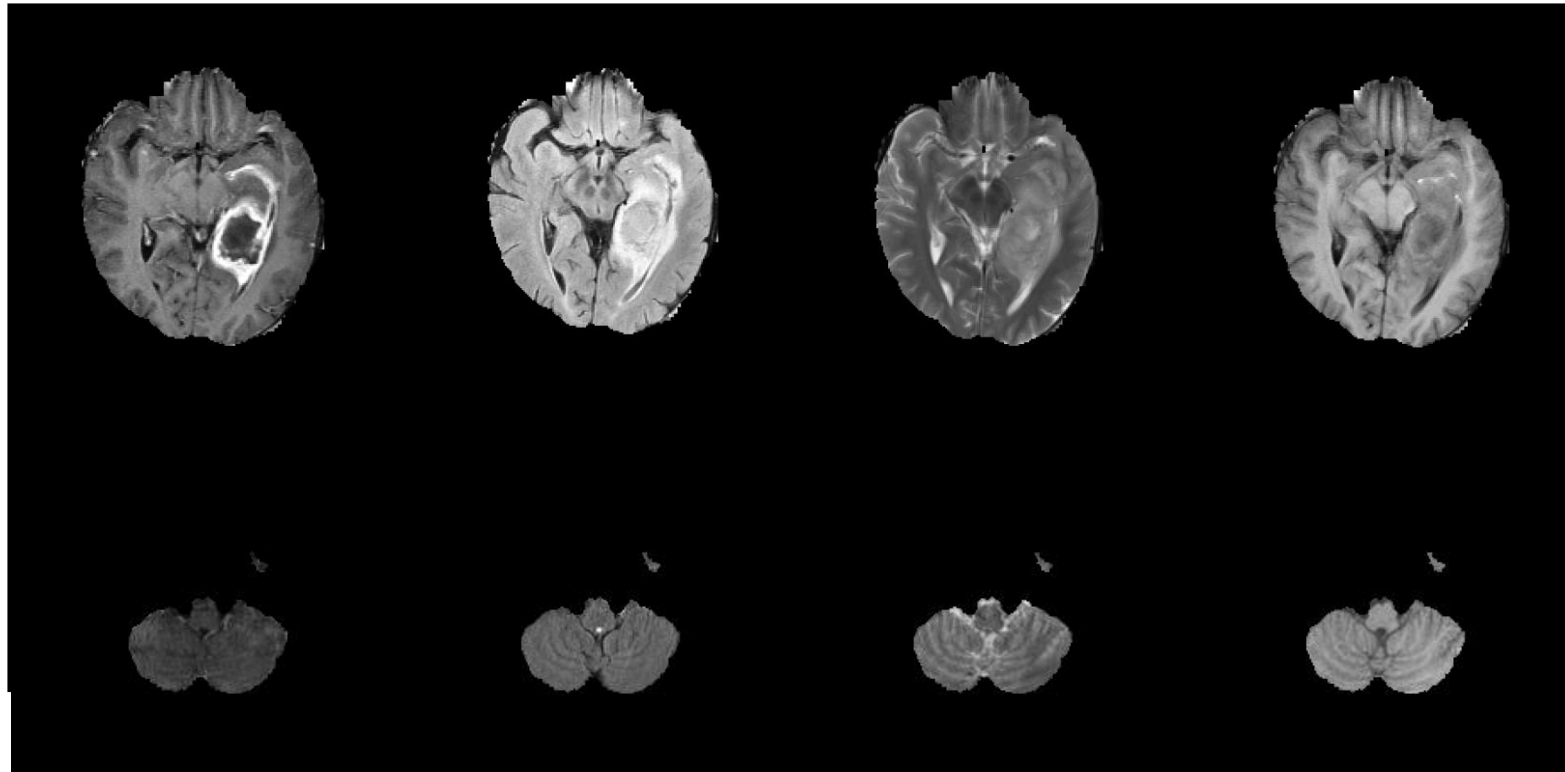


Predict survival class



Magnetic resonance imaging (MRI)

Magnetic Resonance Imaging (MRI)



255 x 255 x 155 x 4
(> 40 M voxels)

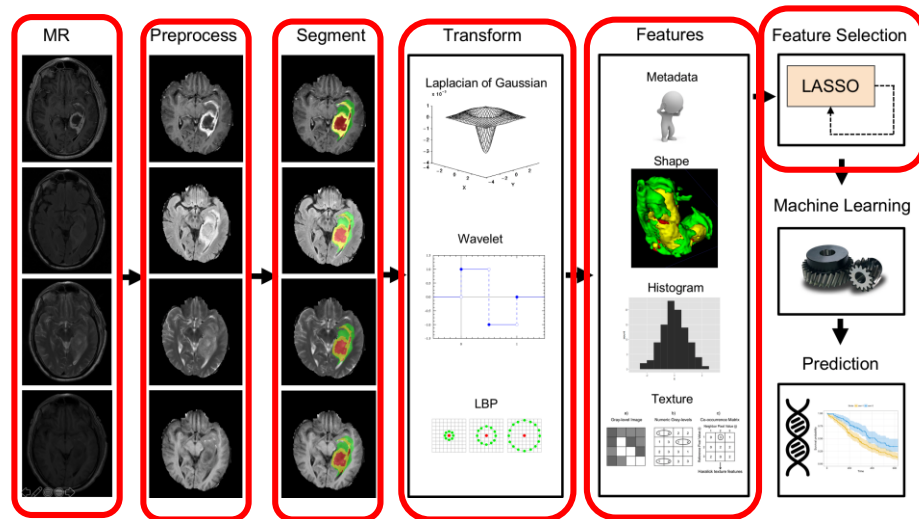
Standard-of-care, fast,
non-invasive, repeatable

THE **CANCER**
IMAGING ARCHIVE

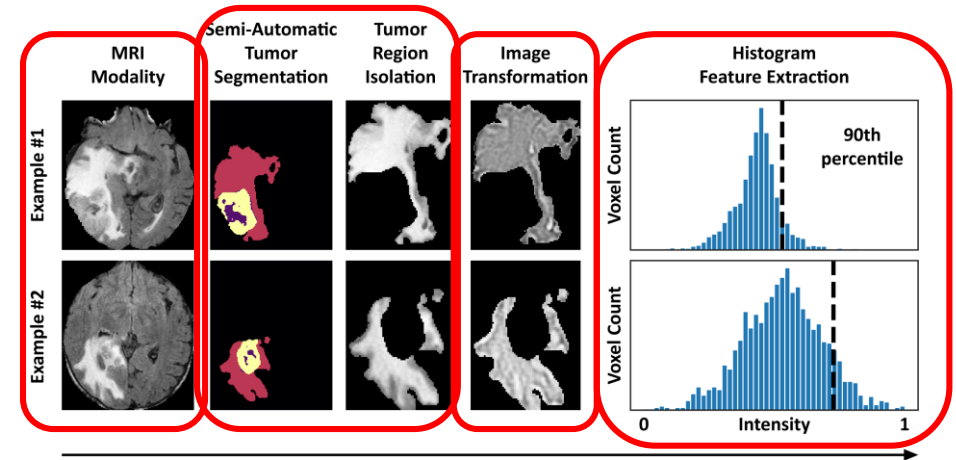


Method

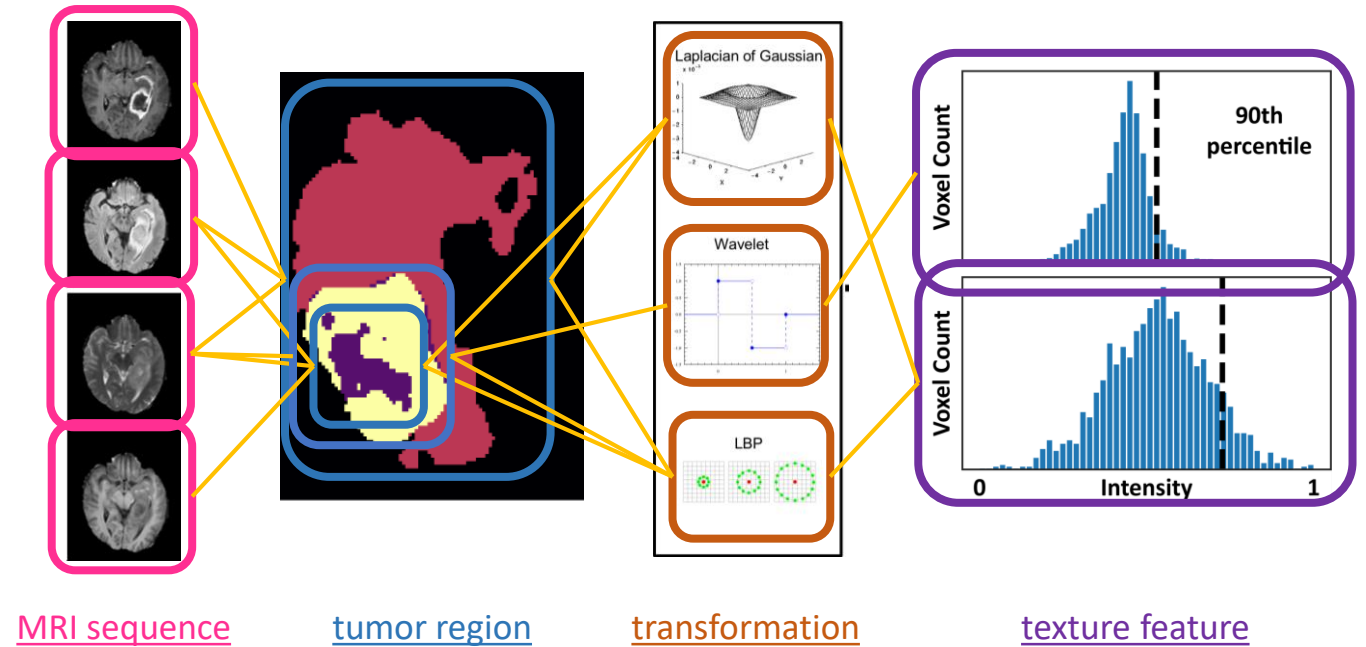
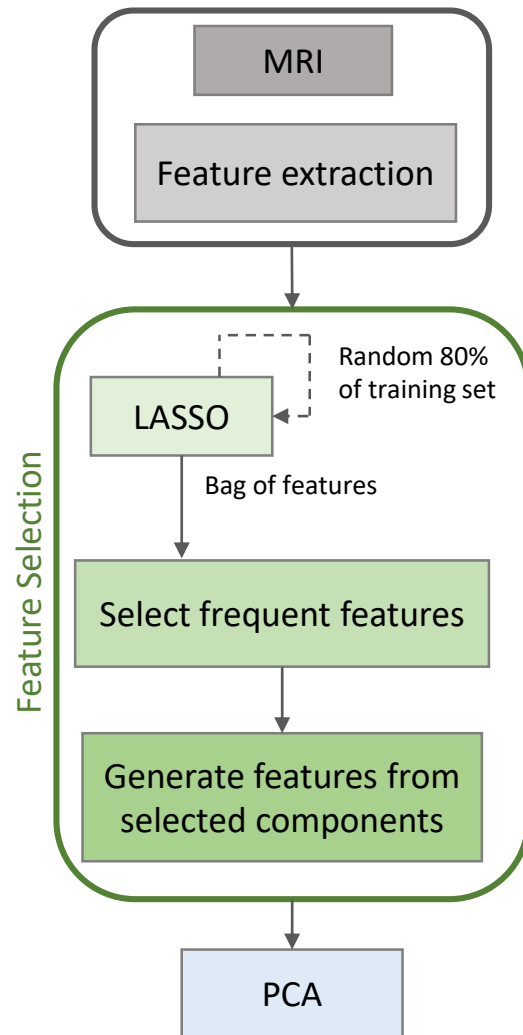
Radiomic Pipeline



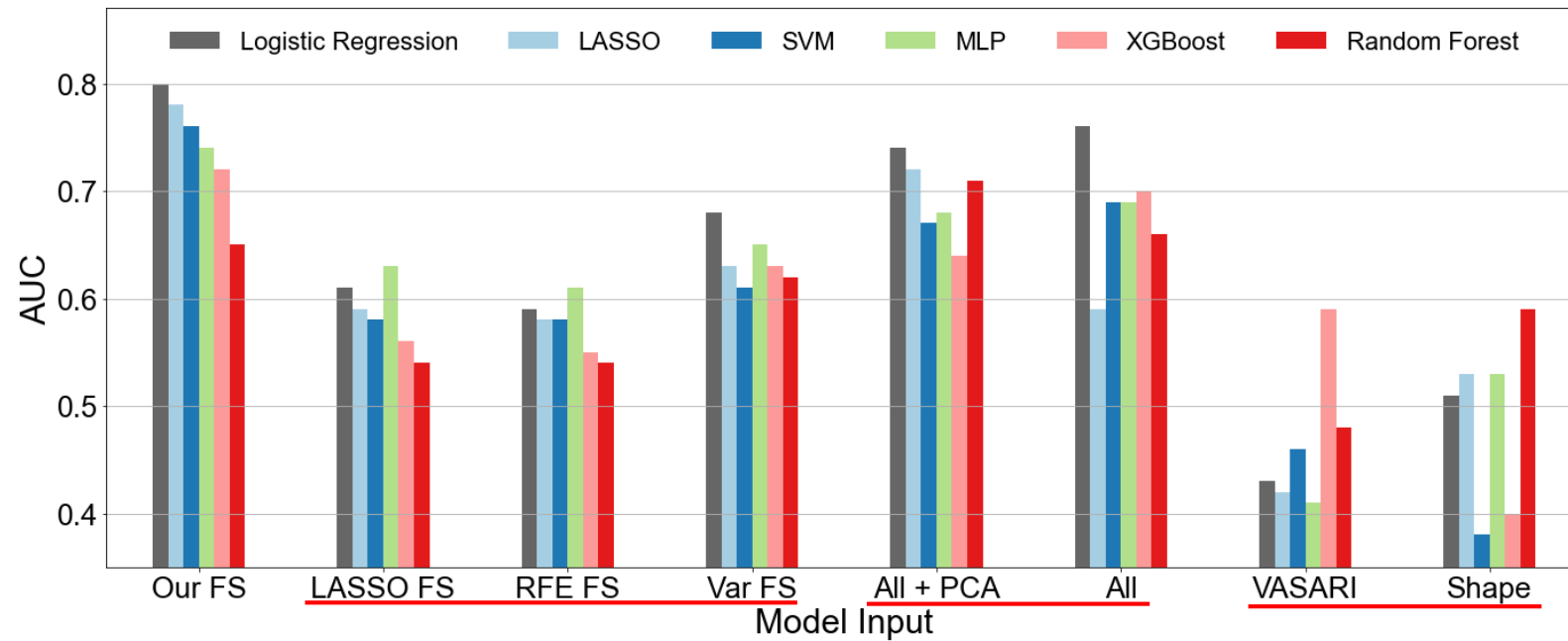
Radiomic Feature



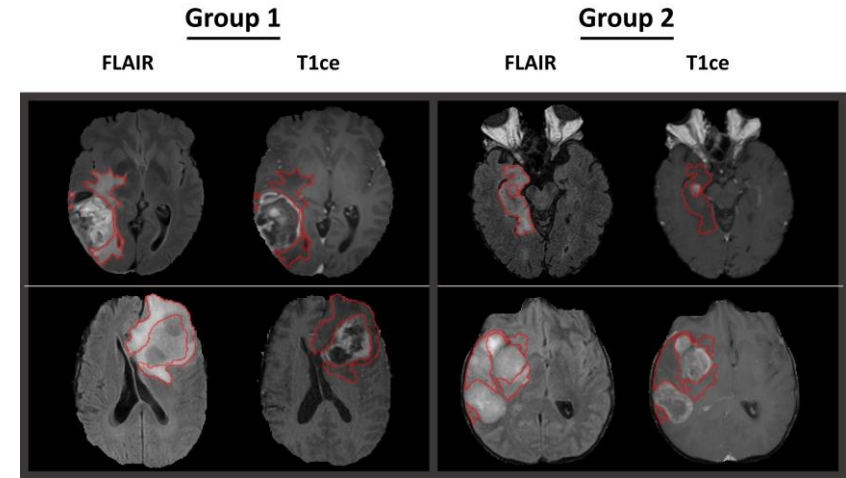
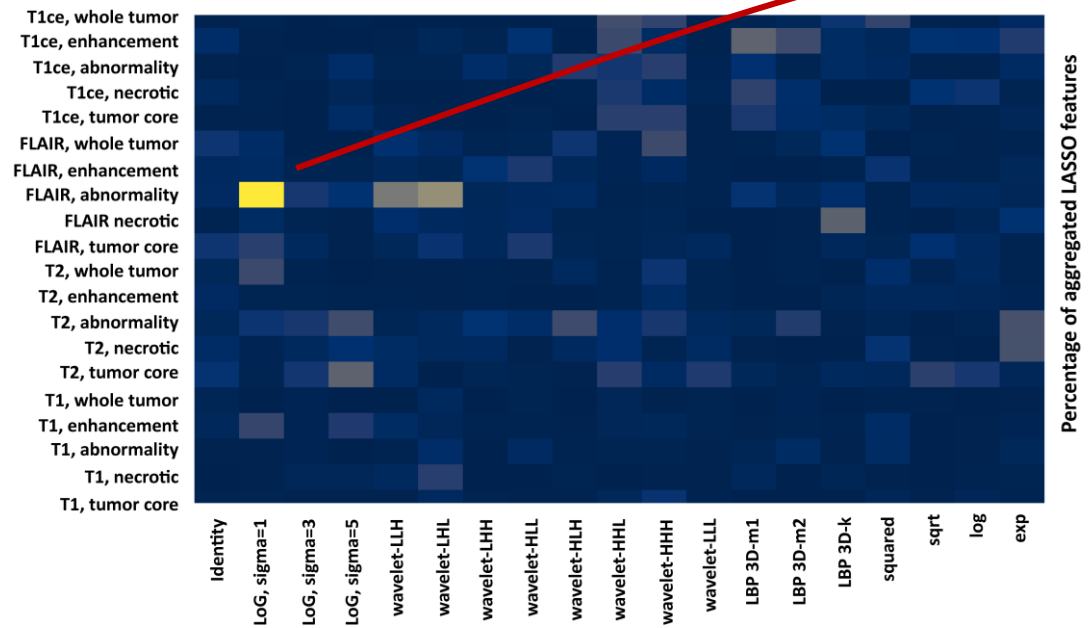
Feature selection



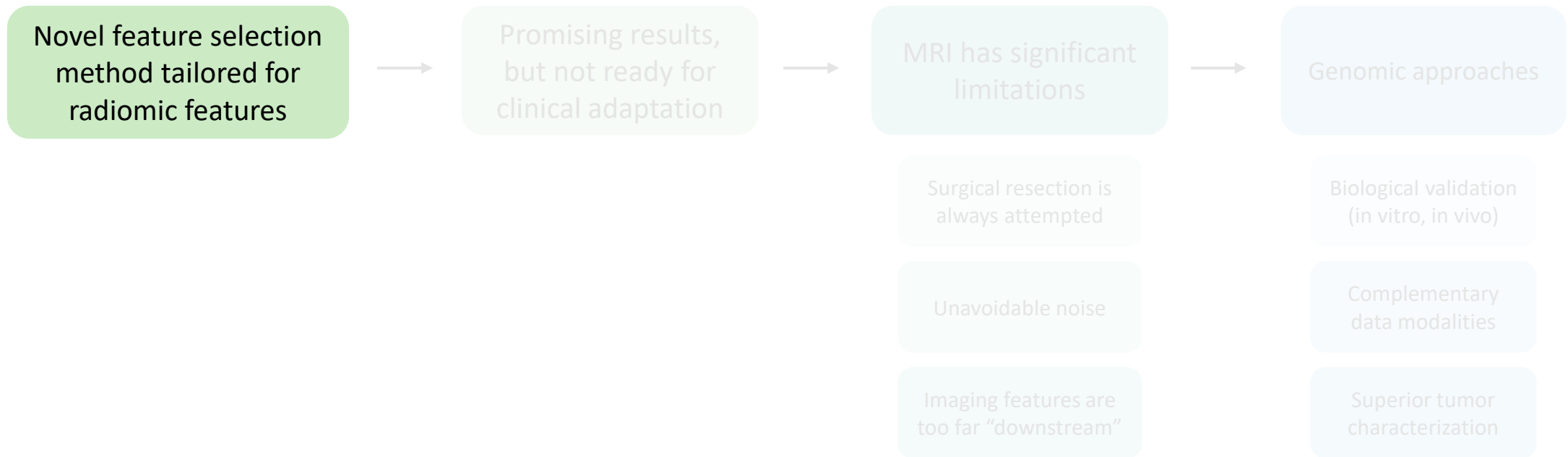
Results: comparisons to other feature selection methods



Where should we look, and what should we look for?



Take aways



Acknowledgments



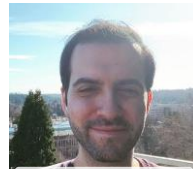
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Eric Holland, MD, PhD



Sonali Arora



PJ Cimino, MD, PhD



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Fateme Ghezloo



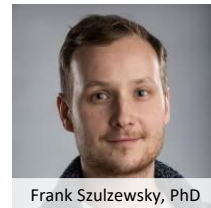
Wisdom Ikezogwo



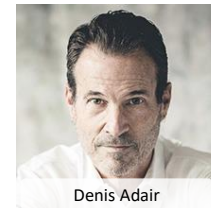
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Denis Adair



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Erin Wilson



Fatwir Mohammed



Seattle Children's



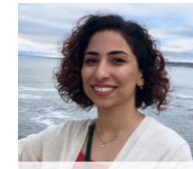
Beibin Li, PhD



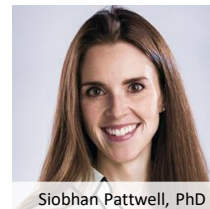
Sachin Mehta, PhD



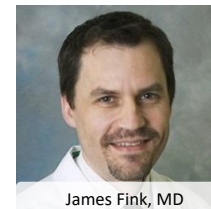
Rashmi Mudduluru



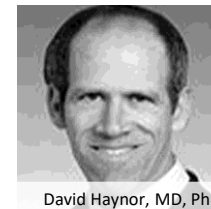
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