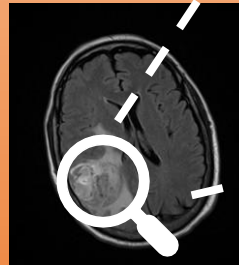
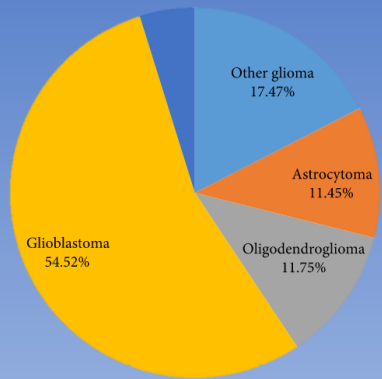


Feature Disentanglement to Aid Imaging Biomarker Characterization for Genetic Mutations

Padmaja Jonnalagedda, Brent Weinberg, Jason Allen, Bir Bhanu*

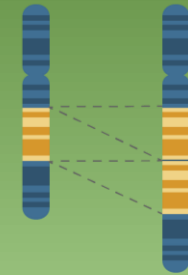
*Center for Research in Intelligent Systems
University of California, Riverside, CA, USA

Why?



What?

How?

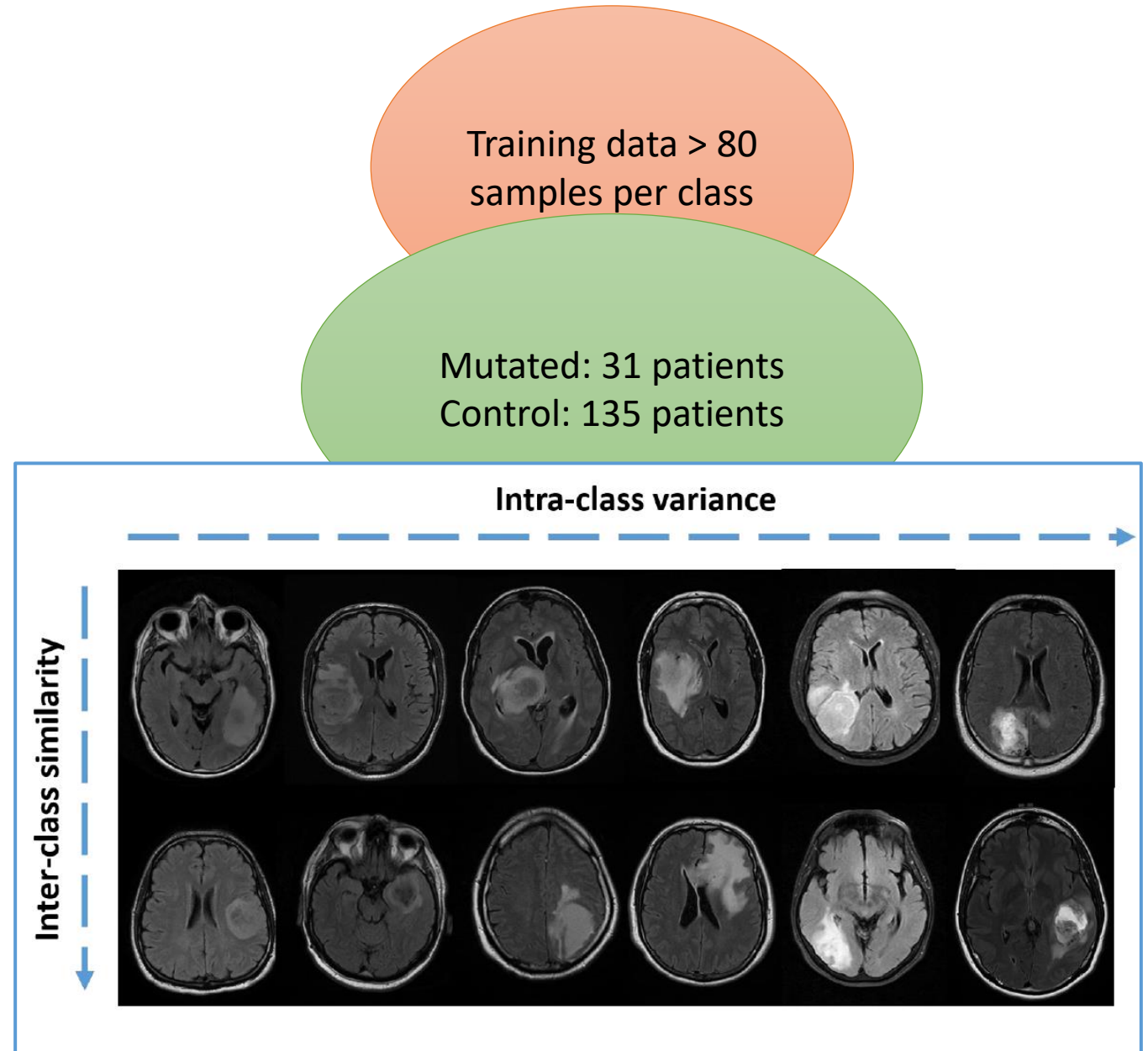


Extract visual
features of 19/20
co-gain

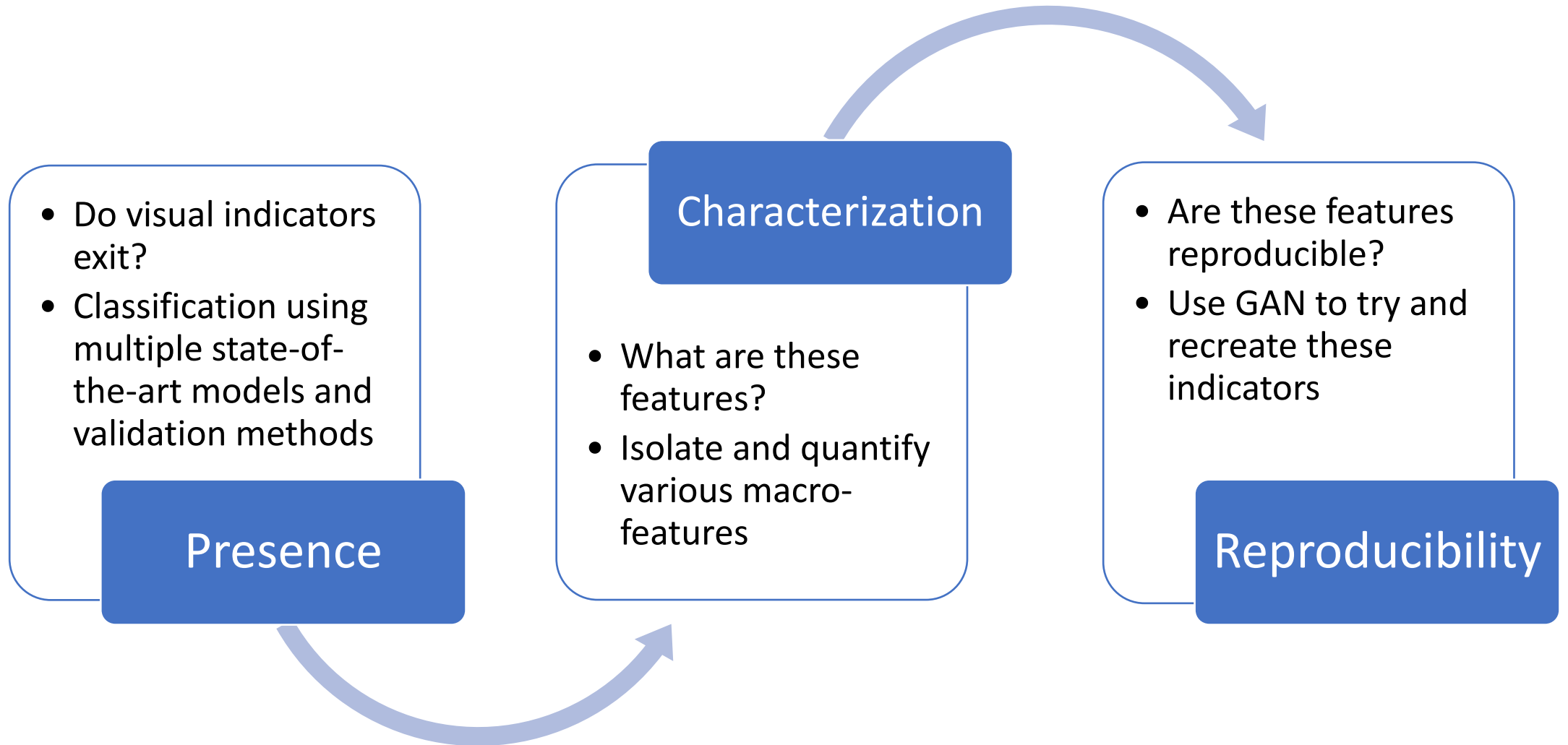
Mutated \Rightarrow
Higher median
survival

Challenges

- Lack of data
- High class imbalance
- High inter-class similarity
- High intra-class diversity

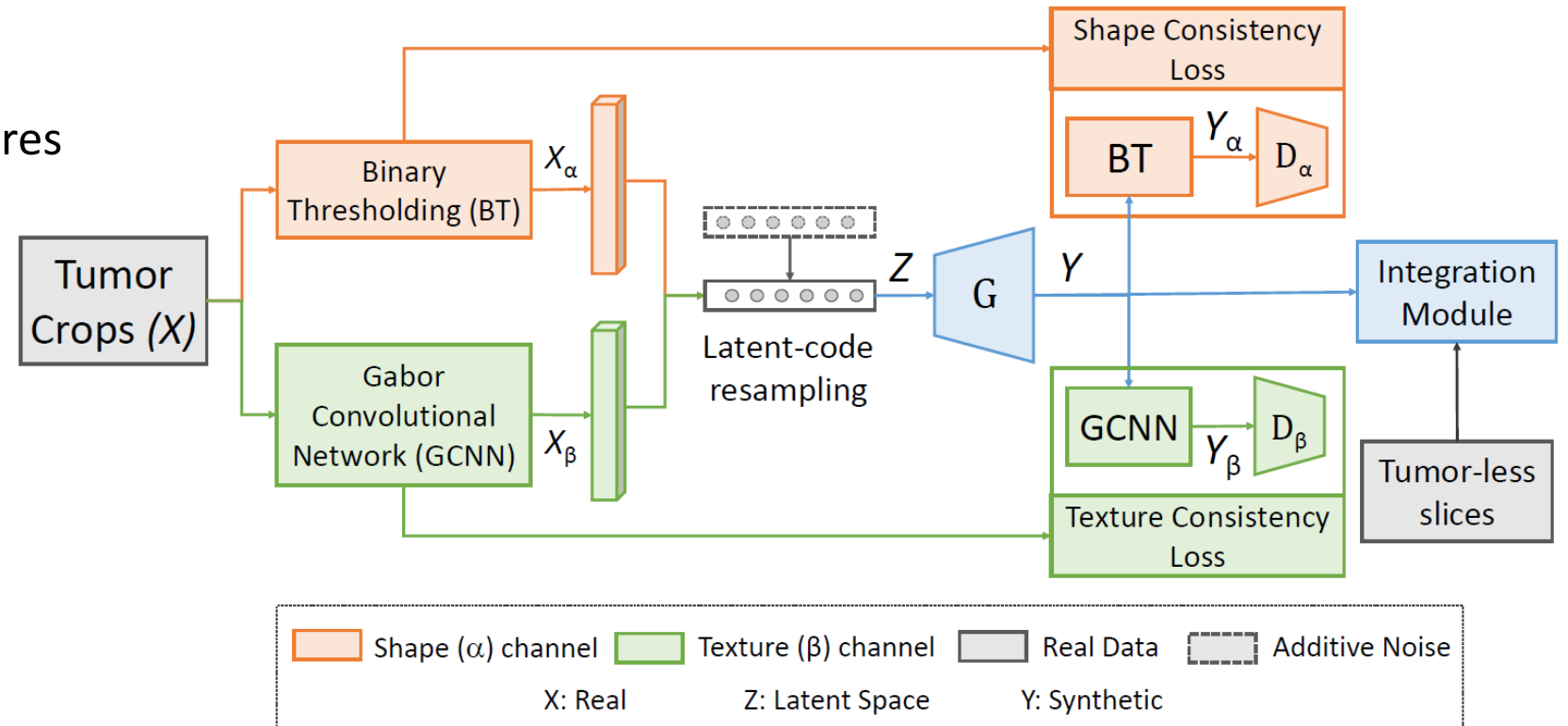


Assessment pipeline

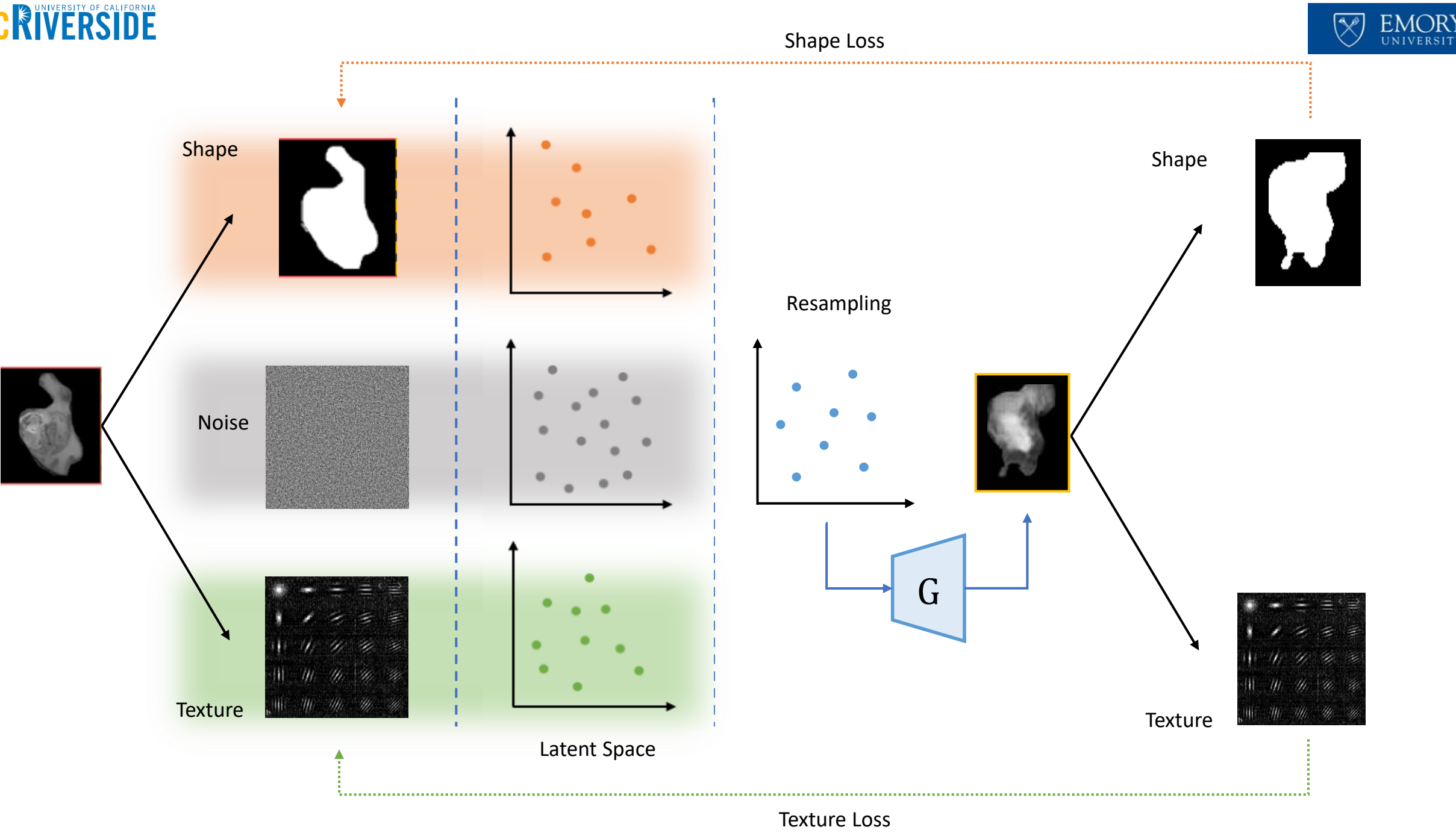


Reproducibility of Biomarkers

- If we use biomarkers to generate synthetic images, does it suggest mutation presence?
- We propose a generative model which can tackle the following problems:
 - Limited data
 - High data diversity
 - Learns unapparent features



FeaD-GAN: Feature Disentanglement GAN

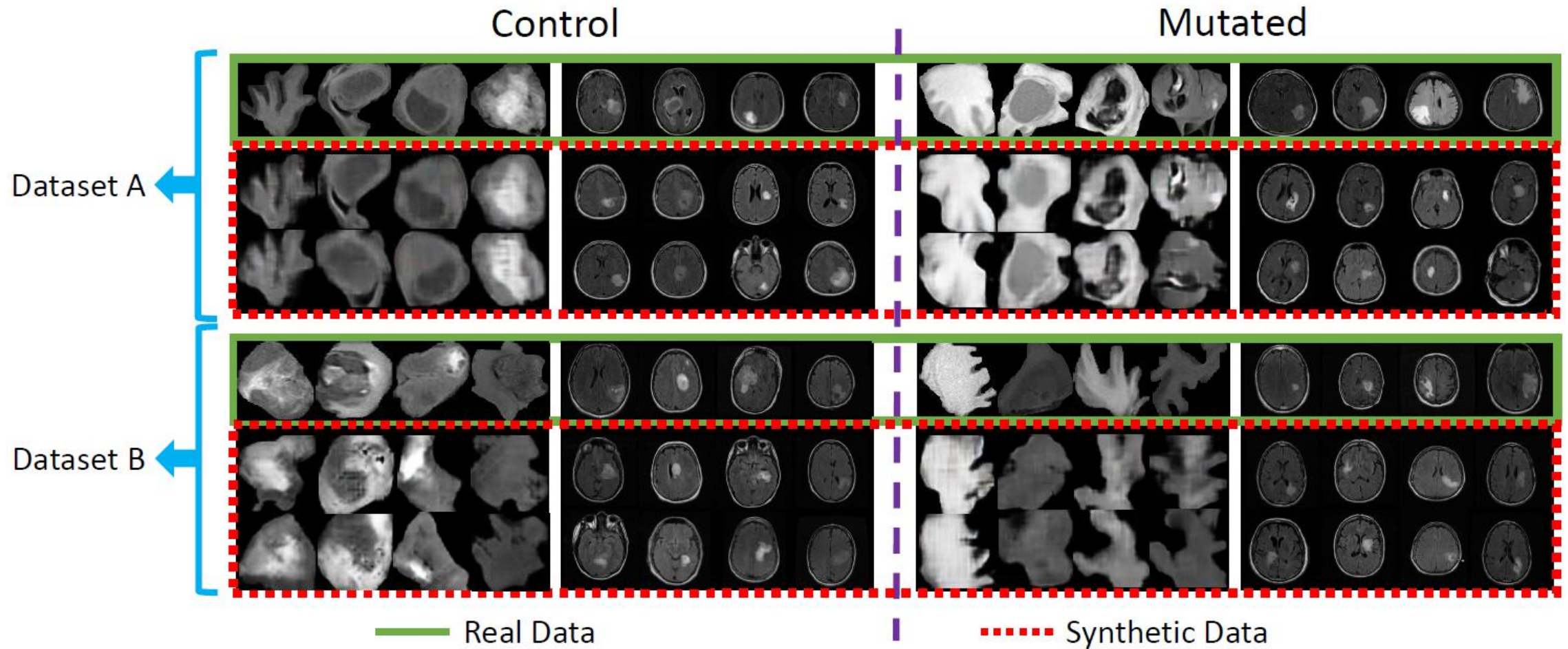


Results: Quantitative

RX: Representation of data (extent of features represented); ACC: Accuracy; SEN: Sensitivity; SPEC: Specificity and DIC: Dice Score. IL: Image Level; PL: Patient Level

Dataset	RX	ACC (PL)	ACC (IL)	SEN (IL)	SPEC (IL)	DIC (IL)
<i>Dataset A</i>	R1	0.92 (0.08)	0.89 (0.06)	0.85 (0.07)	0.95 (0.05)	0.87 (0.08)
	R2	0.95 (0.03)	0.92 (0.05)	0.88 (0.06)	0.98 (0.02)	0.88 (0.08)
	R3	0.85 (0.08)	0.80 (0.08)	0.67 (0.09)	0.84 (0.06)	0.69 (0.09)
	R4	0.70 (0.06)	0.68 (0.07)	0.65 (0.09)	0.75 (0.05)	0.66 (0.08)
<i>Synthetic (Dataset A)</i>	R1	0.92 (0.09)	0.88 (0.07)	0.85 (0.08)	0.94 (0.04)	0.86 (0.08)
	R2	0.95 (0.03)	0.90 (0.08)	0.87 (0.07)	0.98 (0.02)	0.88 (0.09)
	R3	0.85 (0.08)	0.82 (0.10)	0.70 (0.08)	0.86 (0.06)	0.68 (0.08)
	R4	0.68 (0.06)	0.66 (0.07)	0.62 (0.07)	0.74 (0.5)	0.62 (0.08)

Results: Qualitative



Conclusions

- Visual indicators of mutations that correlate to median survival are present in MRI
- Location, texture and shape are significant indicative features
- The features are reproducible
- FeaD-GAN:
 - Can faithfully generate good quality images from limited dataset
 - Can capture data diversity

The background of the slide features a large, light blue, semi-transparent seal of the University of California, Riverside. The seal is circular, with the words "UNIVERSITY OF CALIFORNIA" arched across the top and "RIVERSIDE" arched across the bottom. In the center of the seal is a shield containing a book, a torch, and a banner with the motto "LET THERE BE LIGHT".

Thank You!

Acknowledgement

This research is supported by the Bourns Endowment Fund at University of California Riverside