Glioblastoma Patient Survival Prediction Using Perfusion Imaging

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Glioblastoma

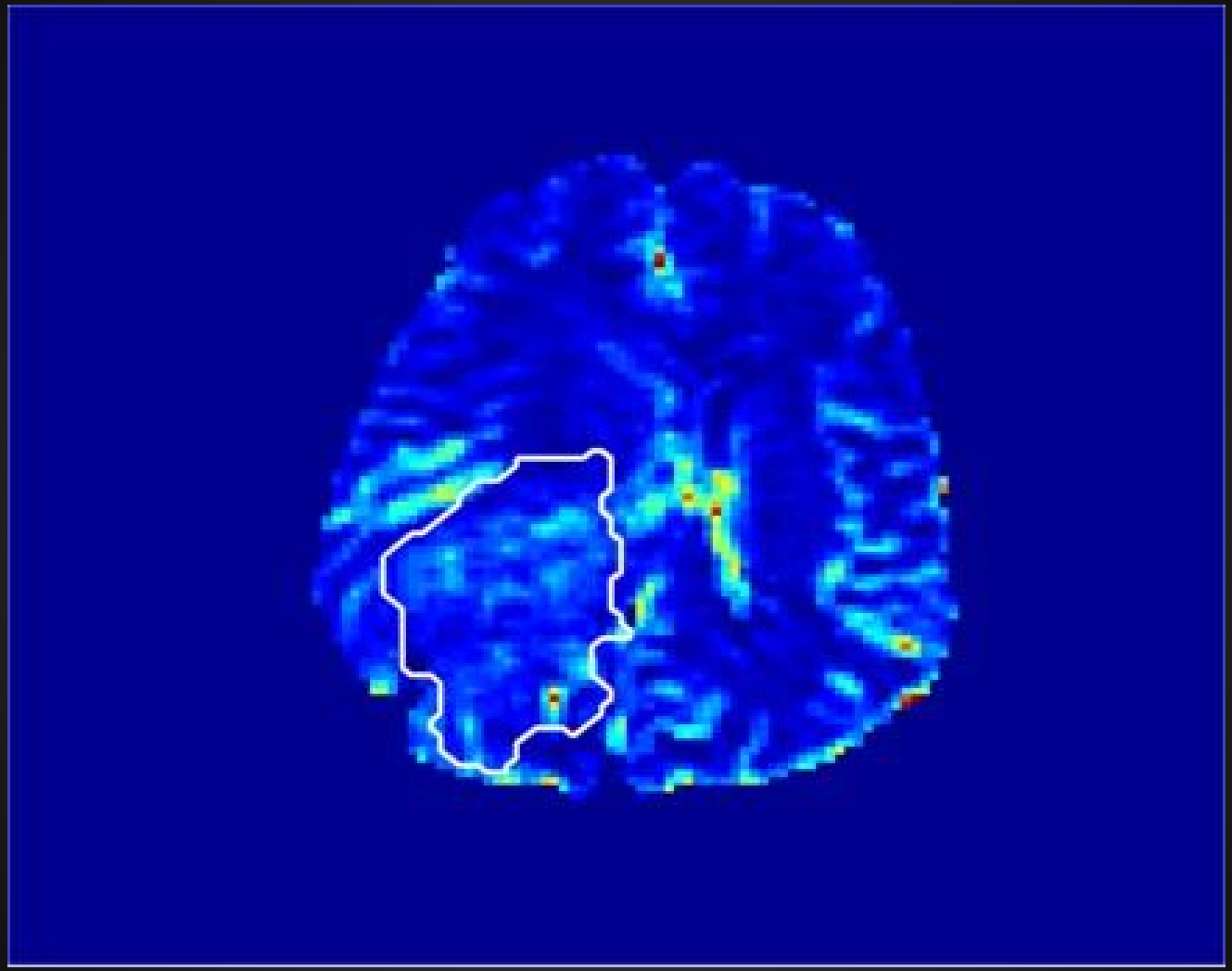
- 17% of all brain cancers
- 70% of patients die within 2 years
- Highly malignant and heterogenous

Hypothesis

Since glioblastoma is know to be comprised of many different types of cells AND heavily reliant on a constant blood supply, we hypothesize that texture features within perfusion images are useful in predicting patient survival

Prior Research

- Bonato (2010) used genetic data to predict patient survival. Obtained 75% accuracy
- Jain (2013) and Lemasson (2013) analyzed perfusion images of glioblastoma patients, but did not create a prediction model



Original Tumor

Convex Hull

Convex Hull Only

Methods

1. Obtained perfusion images, tumor ROIs, and clinical data for 30 glioblastoma patients
2. Two regions analyzed: CEL and Convex area (convex hull of CEL minux CEL)
3. Extracted texture features such Riesz energies and GLCM, as well as other stats

Methods (continued)

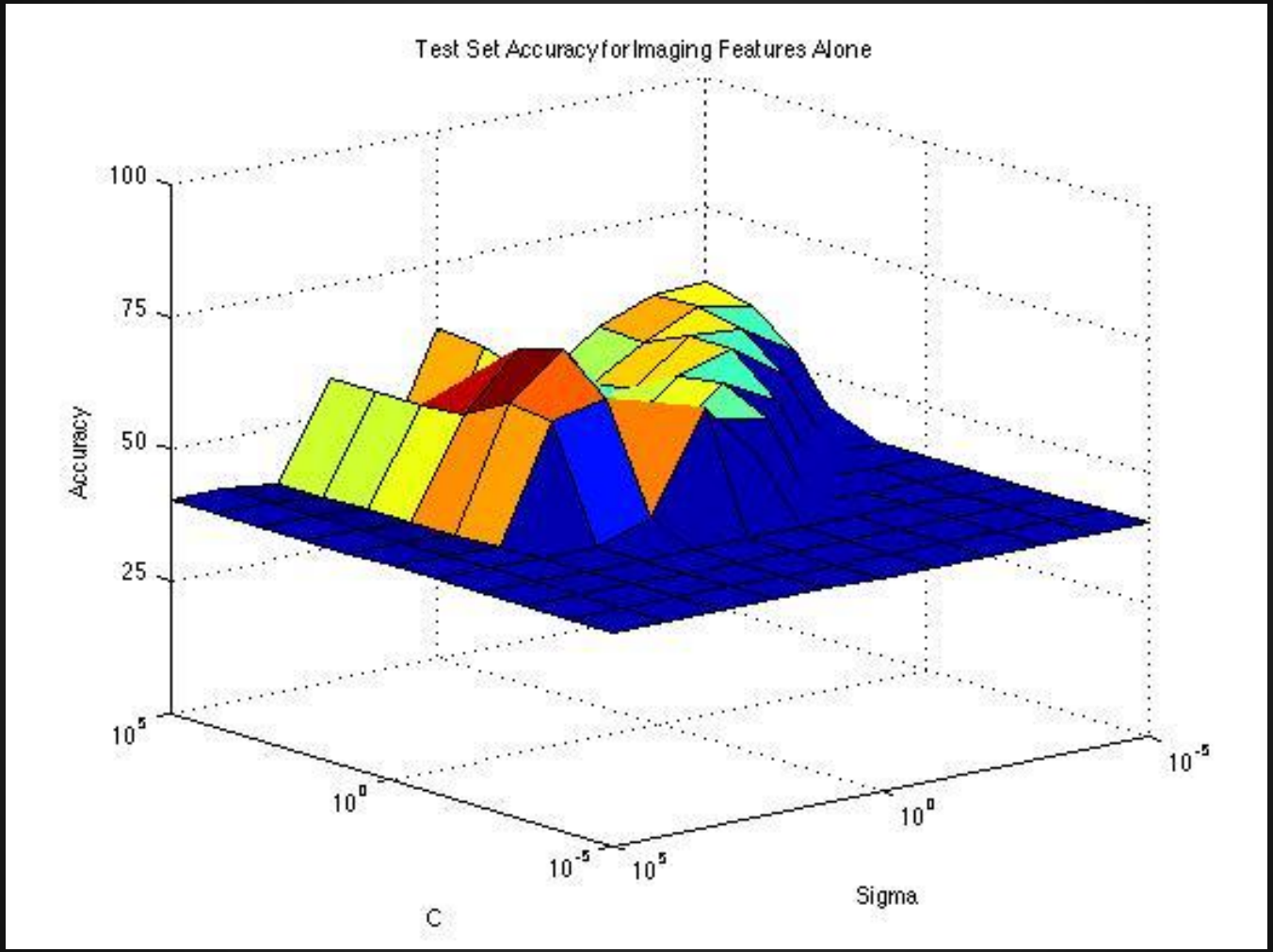
4. Selected best features by cross validating features individually and selecting the best

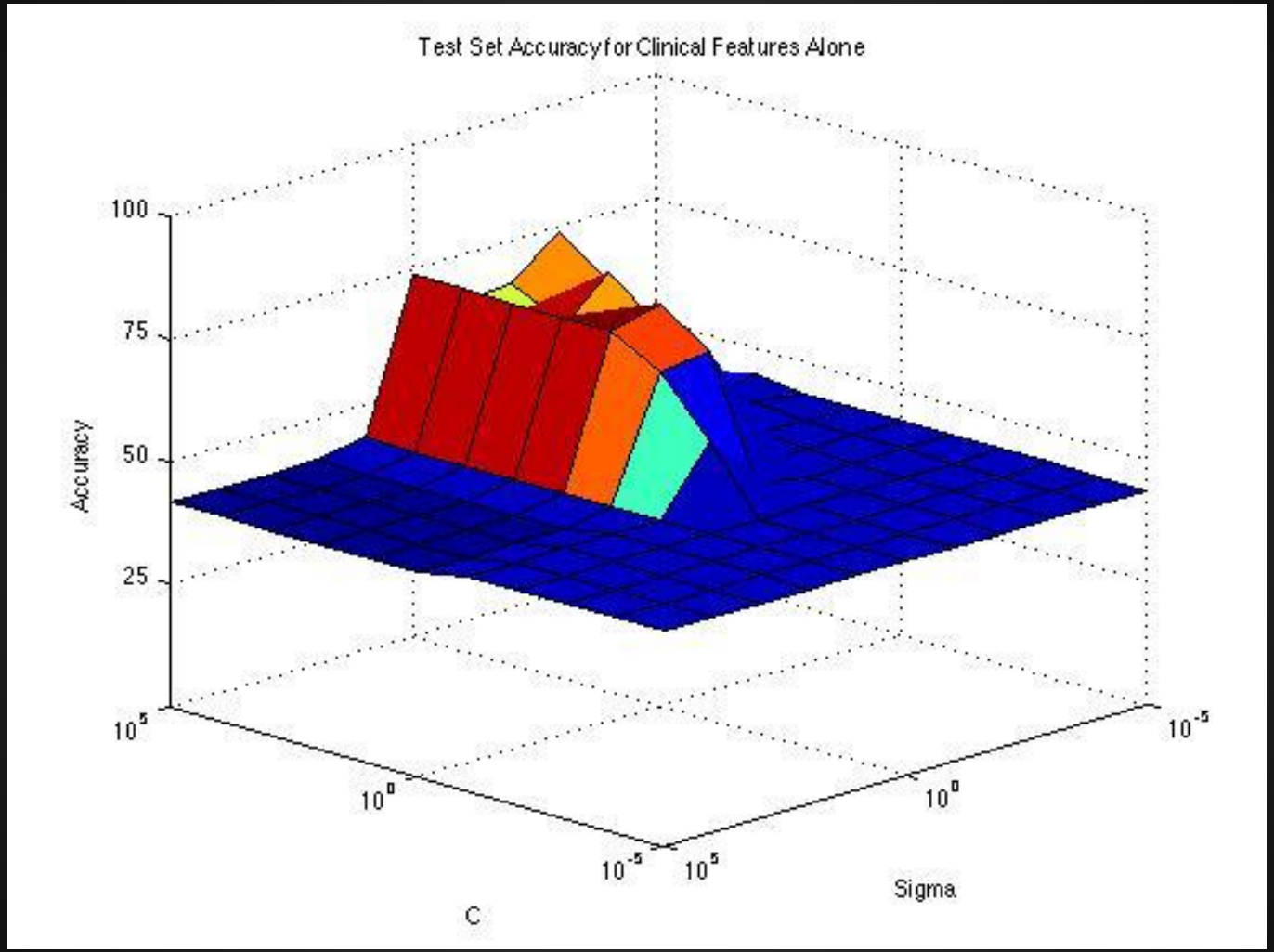
5. Selected the best C and sigma for the Gaussian kernel in a similar manner

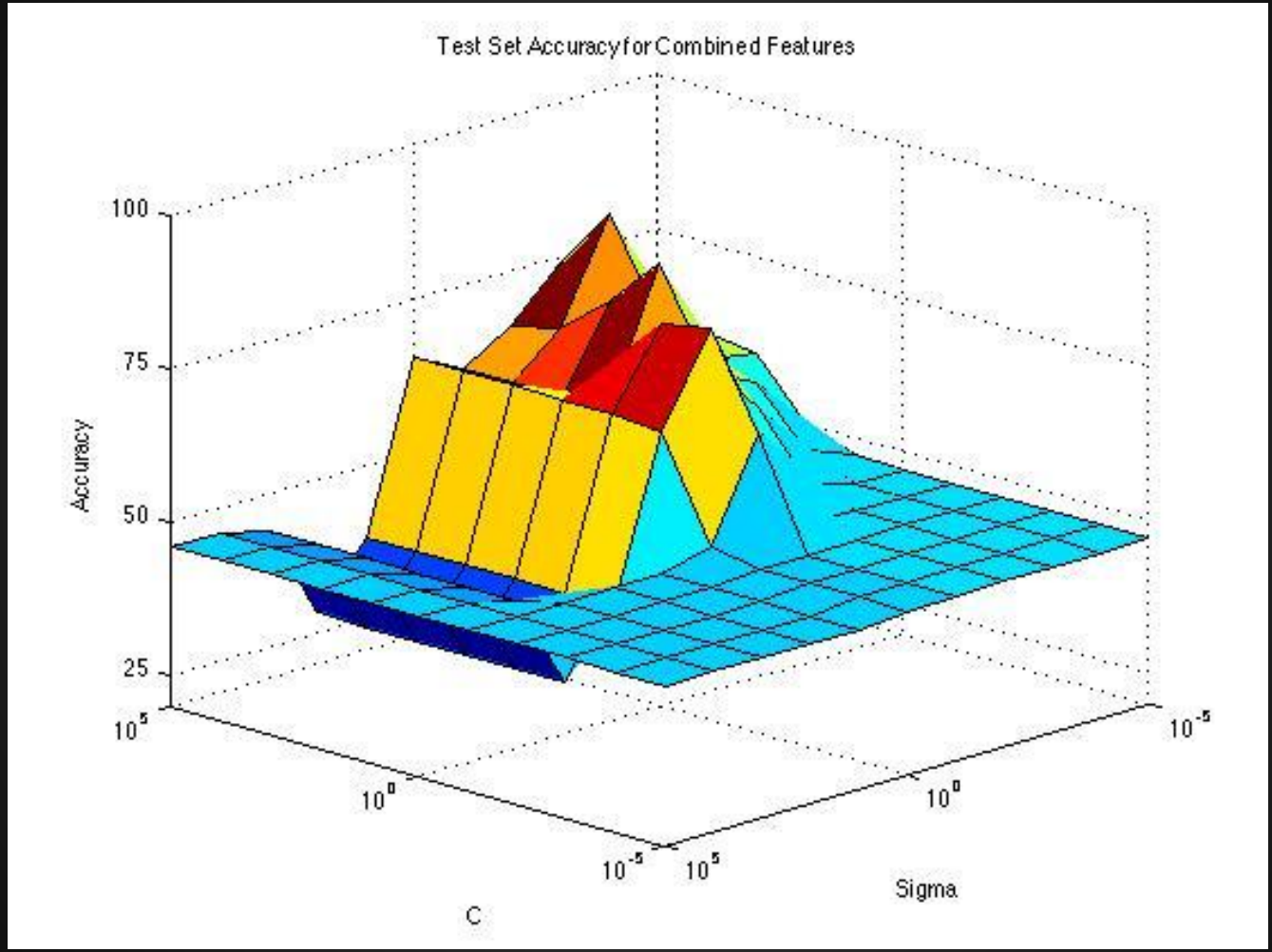
6. Model would classify each slice individually and then do majority vote to classify a patient

Best Features

Clinical Features	Imaging Features
Ratio of CEL and Necrosis Volume	Riesz Energy on Convex Area
NEL Volume	Basic Contrast on Convex Area
CEL Volume	Basic Contrast CEL Area
Ratio of NEL and CEL Volume	

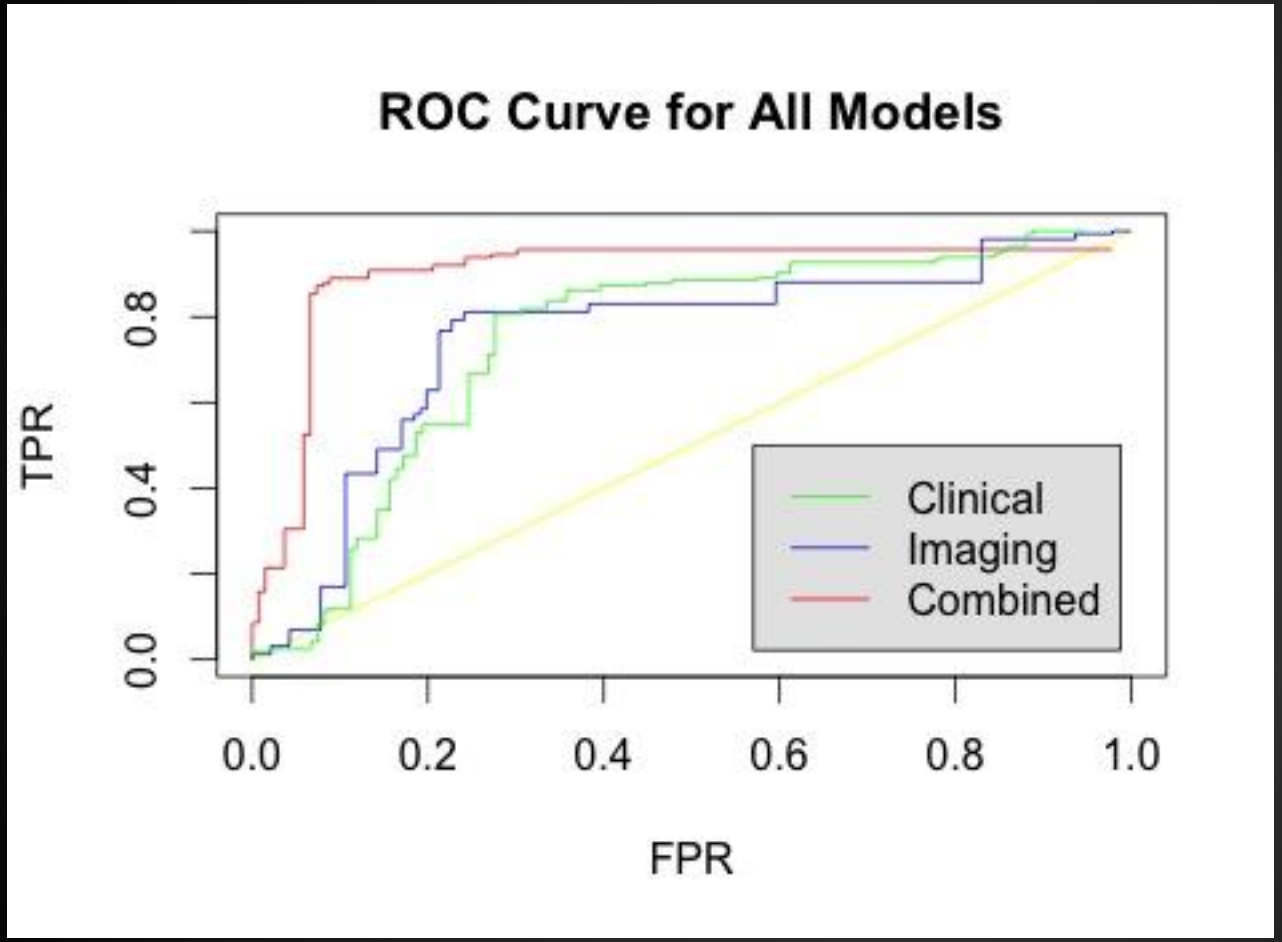

Test Set Accuracy for Imaging Features Alone
100
75
50
25
Accuracy
10^{5}
10^{0}
10^{-5}
C
10^{-5}
10^{0}
10^{5}
Sigma


Test Set Accuracy for Clinical Features Alone
100
75
50
25
Accuracy
10^{5}
10^{0}
10^{-5}
C
10^{-5}
10^{0}
10^{5}
Sigma


Test Set Accuracy for Combined Features
100
75
50
25
Accuracy
10^5
10^0
10^-5
C
10^-5
10^0
10^5
Sigma

Results

	Training Set Accuracy	Test Set Accuracy
Combined	0.9305	0.8767
Best Imaging	0.9280	0.7167
Best Clinical	0.9287	0.7733



Combining imaging and clinical features performs better than either set of features alone

Conclusion

We confirmed our hypothesis that texture features of perfusion images have high potential to be used as a biomarker for patient survival. We also confirmed that integrating clinical and imaging features provide a significant increase in accuracy.

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