

Detecting Prostate Cancer Using MRI Data

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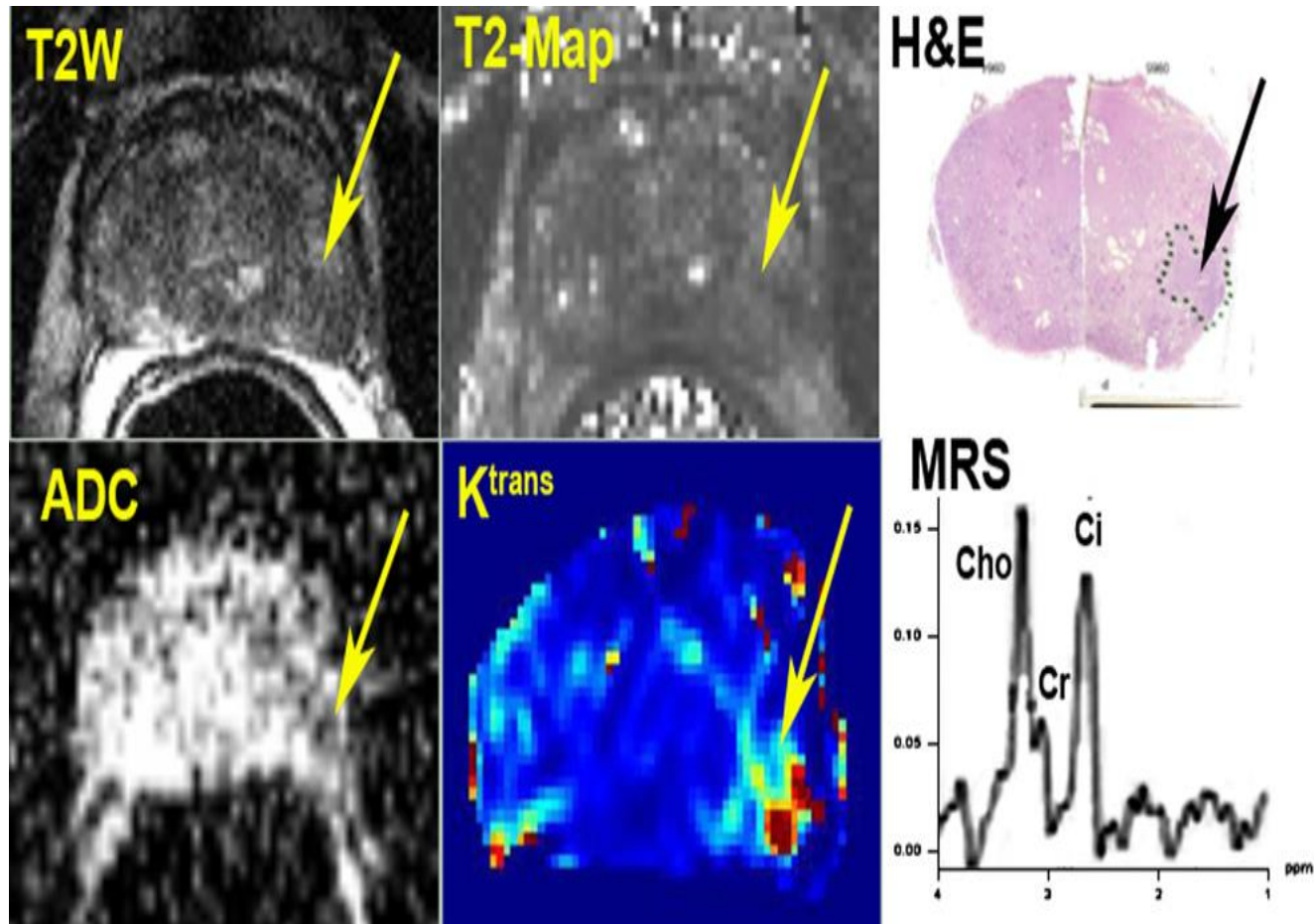
Prostate Cancer

- ▶ The NCI estimates that 15% of men born today will be diagnosed with prostate cancer
- ▶ Average costs of \$10,000 in the first year after diagnosis
- ▶ Hard to diagnose

Prostate Cancer Diagnosis Methods

- ▶ PSA Test
 - Non-intrusive
 - High false positive rate
- ▶ Digital Exam
 - Inconsistent
- ▶ Biopsy
 - Painful
 - Expensive
 - Possibly severe side-effects

MRIs to the Rescue?



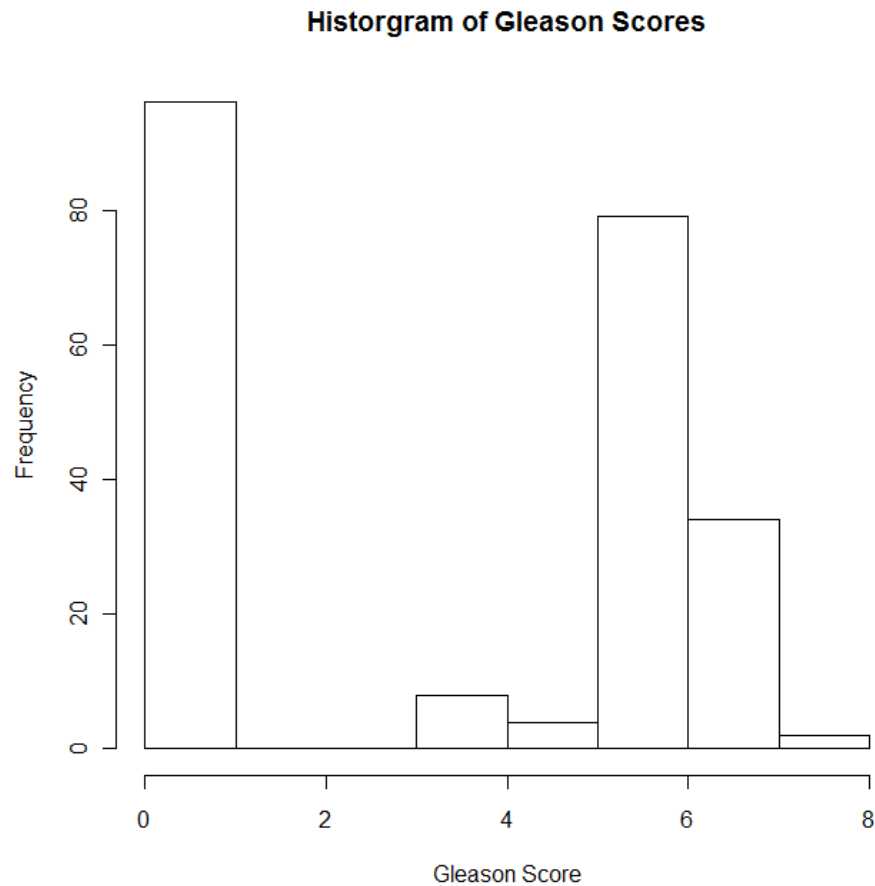
Research Question

- ▶ Can we use MRIs to screen for prostate cancer?
 - Will doing so be more cost effective than the current system?

Data

- ▶ 223 slices of prostates from radical prostatectomy patients
- ▶ 3 types of MRIs on each slice (Dynamic Contrast Enhanced, Diffusion Weighted, and Magnetic Resonance Spectroscopic Imaging)
- ▶ 119 had cancer (Gleason score ≥ 5)

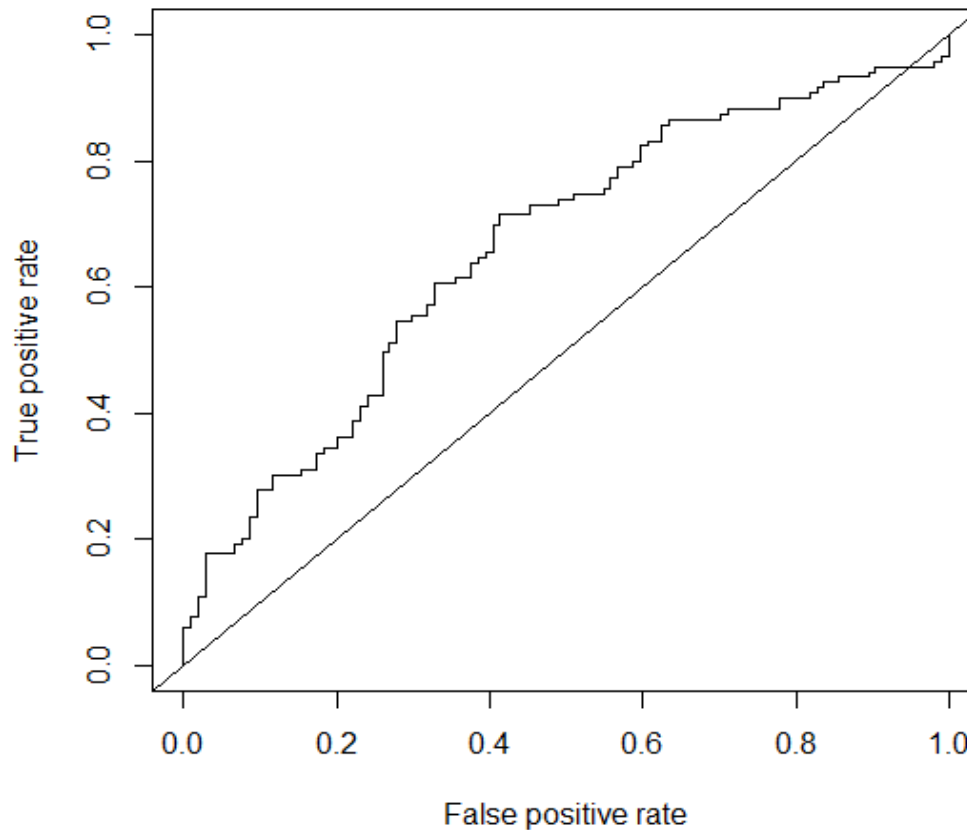
Distribution of Cancer



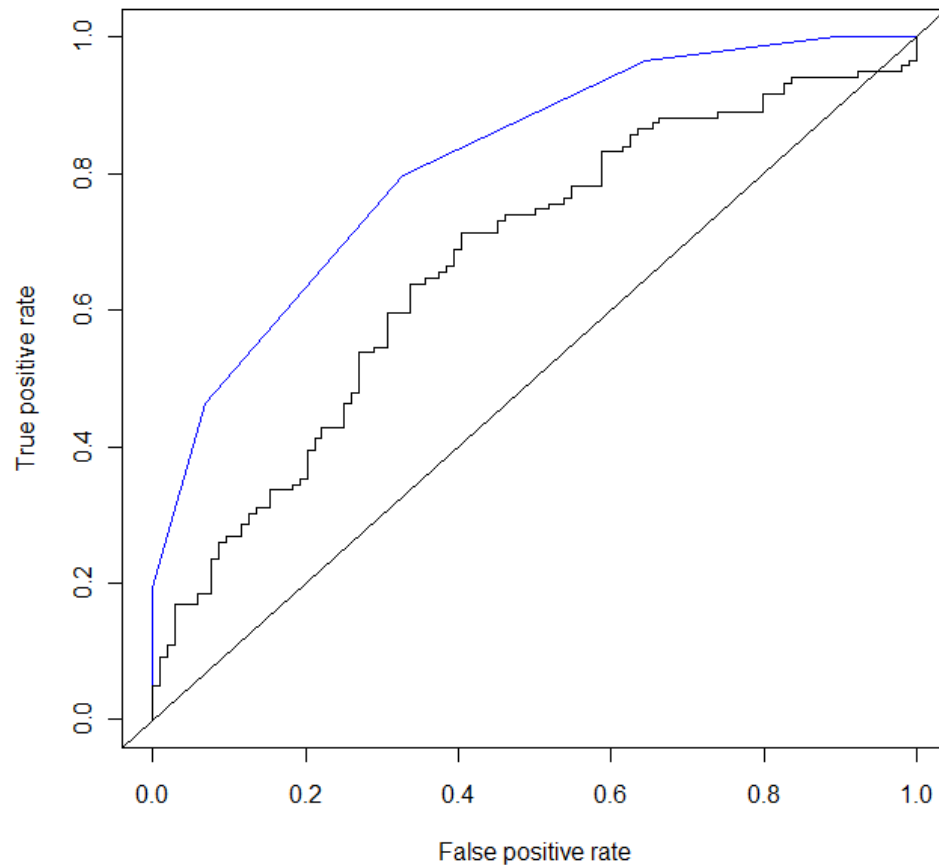
Three Methods

- ▶ Logistic Regression
- ▶ Nearest Neighbors Clustering
- ▶ Augmented Logistic Regression

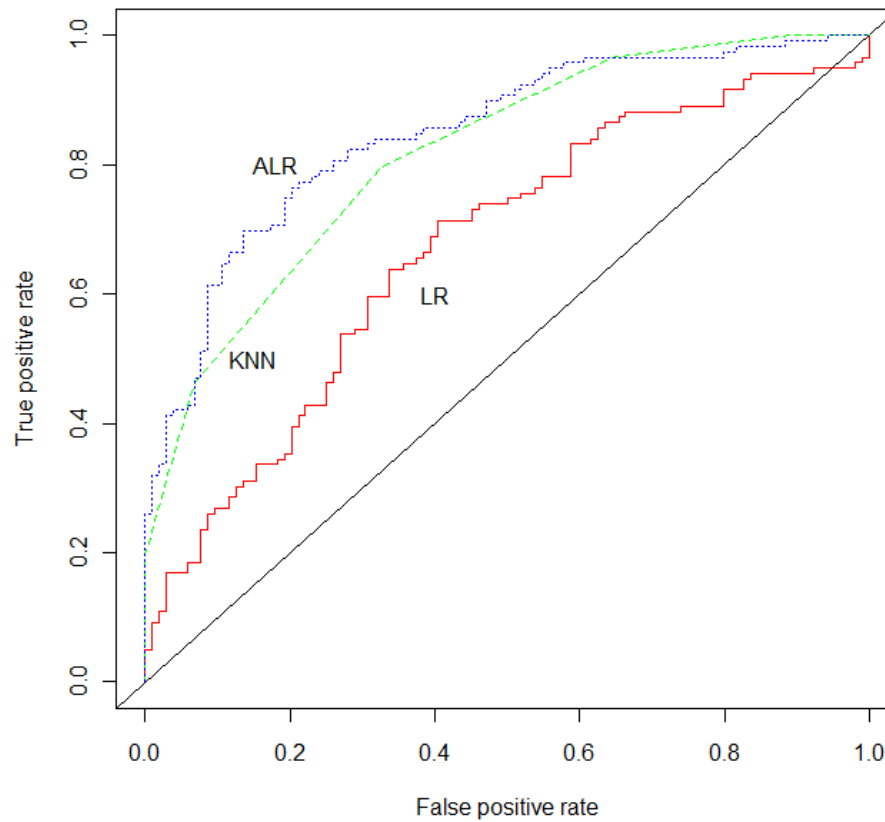
Results – Logistic Regression



Results – Nearest Neighbors



Combined Results



Combined Results

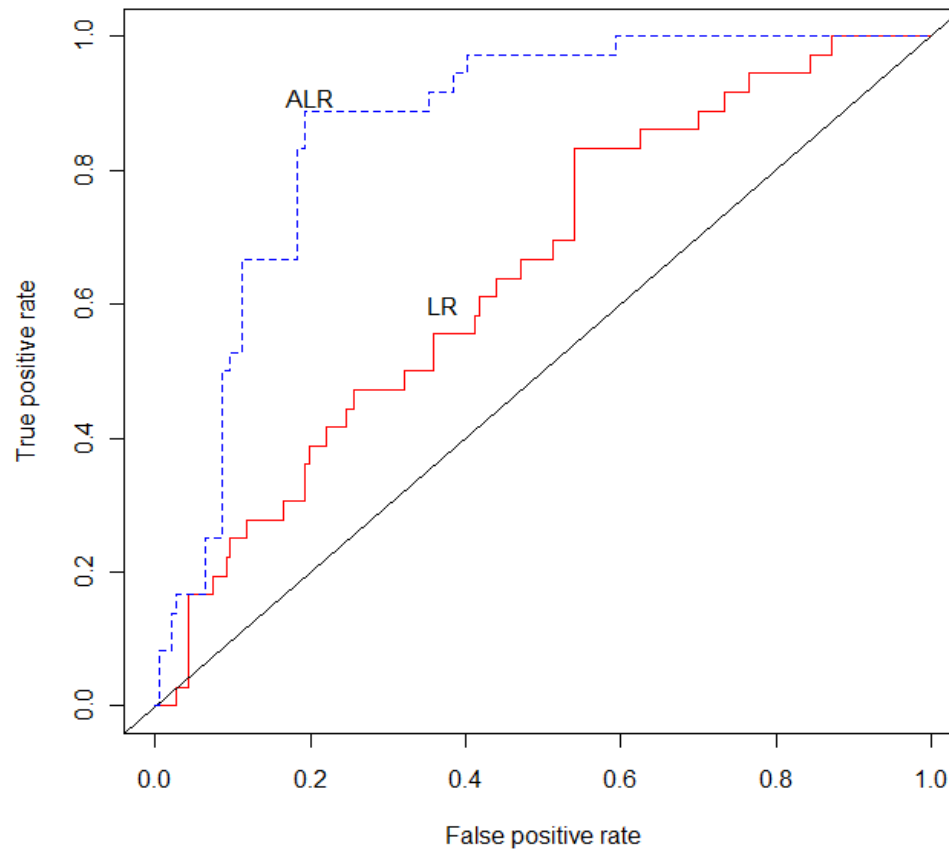
	Gleason Score	
	0 – 4	5 – 8
Predicted Healthy	79	22
Predicted Cancer	25	97

The combined model achieves 82% sensitivity and 76% specificity

High Severity Cancer

- ▶ Many prostate cancers are slow growing
 - “More people die ‘with’ prostate cancer than ‘from’ it”
- ▶ Identifying high severity cancers is important

High Severity Results



High Severity Results

	Gleason Score	
	0 – 6	7 – 8
Predicted Healthy	151	5
Predicted Cancer	36	31

For high severity cancers, the model achieves 81% sensitivity and 86% specificity

Cost Effectiveness

- ▶ Prices for medical services vary widely
 - Biopsies average ~\$2100
 - MRIs average ~\$700
- ▶ If MRIs can reduce the number of biopsies by 1 / 3 they will reduce costs

Conclusions

- ▶ MRIs can be used to identify prostate cancer
- ▶ By looking at each slice of a prostate we can identify where to biopsy
- ▶ MRIs offer possibly better predictive power than PSA tests, and are less invasive than biopsies

Contribution

- ▶ Combine MRI types
- ▶ Automated prediction
- ▶ Distinguish between high and medium severity cancers

Future Work

- ▶ Collect more data
 - Healthy patients and cancerous
- ▶ Build models for whole prostates, not slices
- ▶ Predict specific Gleason scores

Questions?

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