Gastrointestinal Lesion Classifiers

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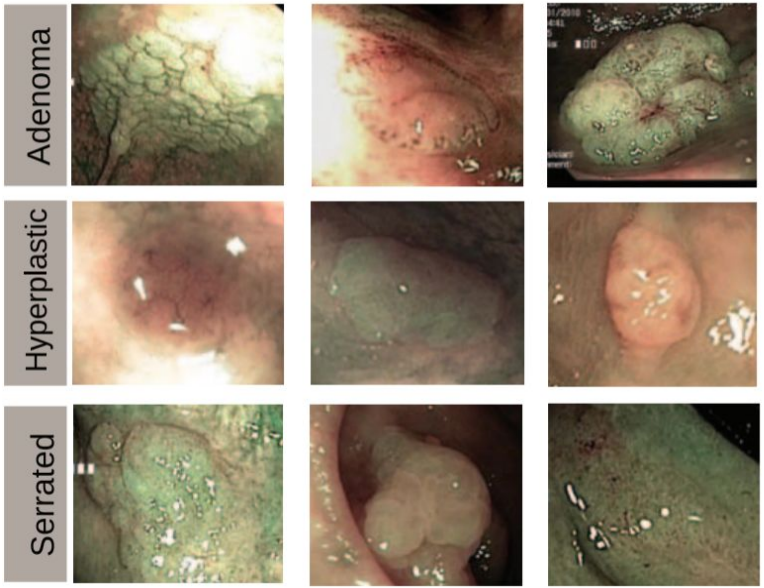
Motivations for classification

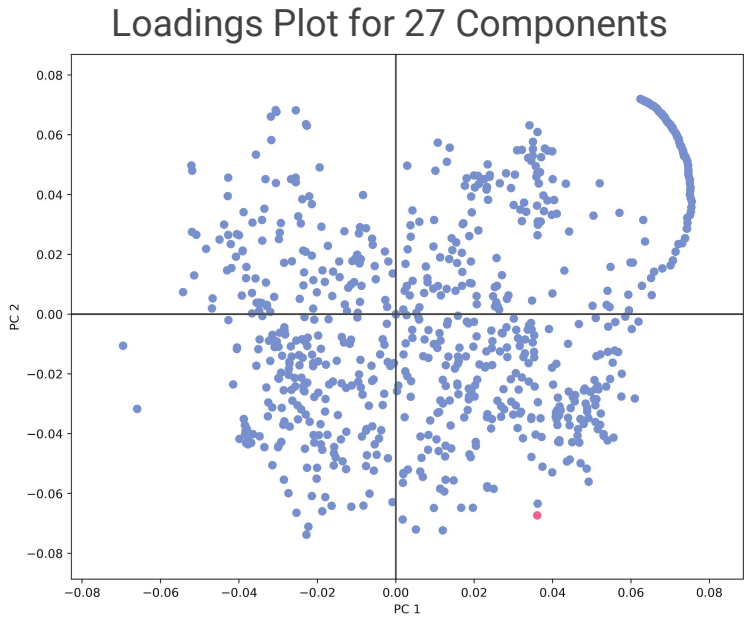
- Colorectal cancer is one of the most commonly diagnosed malignant tumor (10% of cases)
- Standard course of diagnosis is: colonoscopy, biopsy, endoscopic resection.
- Speed = more comfort for patients with benign ‘Hyperplasic’ conditions
- Want to maintain detection of malignant types ‘(serrated) adenoma’
- Will improve patient comfort, and quicken learning curve for med students

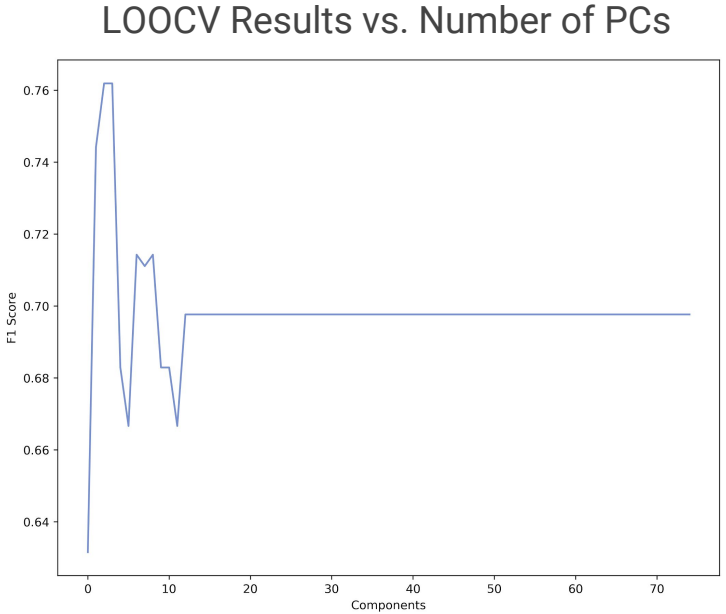
Structure and origin of data

- Data was extracted from 76 patients, videos using NBI (narrow band imaging) and white light.
- 698 features were extracted from the videos
  - 422 were 2D texture
  - 76 were 2D color
  - 200 were 3D shape
    - Created from structure-from-motion computer-vision algorithms



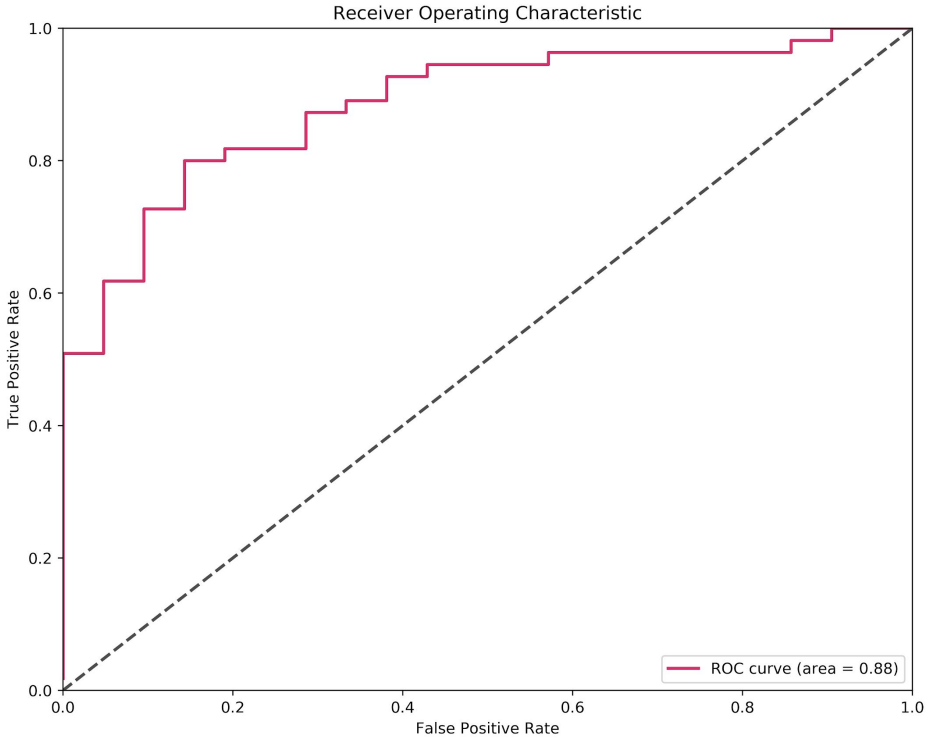
Using PLS to classify data





Brereton, R. G. and Lloyd, G. R. (2014), Partial least squares discriminant analysis: taking the magic away. J. Chemometrics, 28: 213–225. doi:10.1002/cem.2609

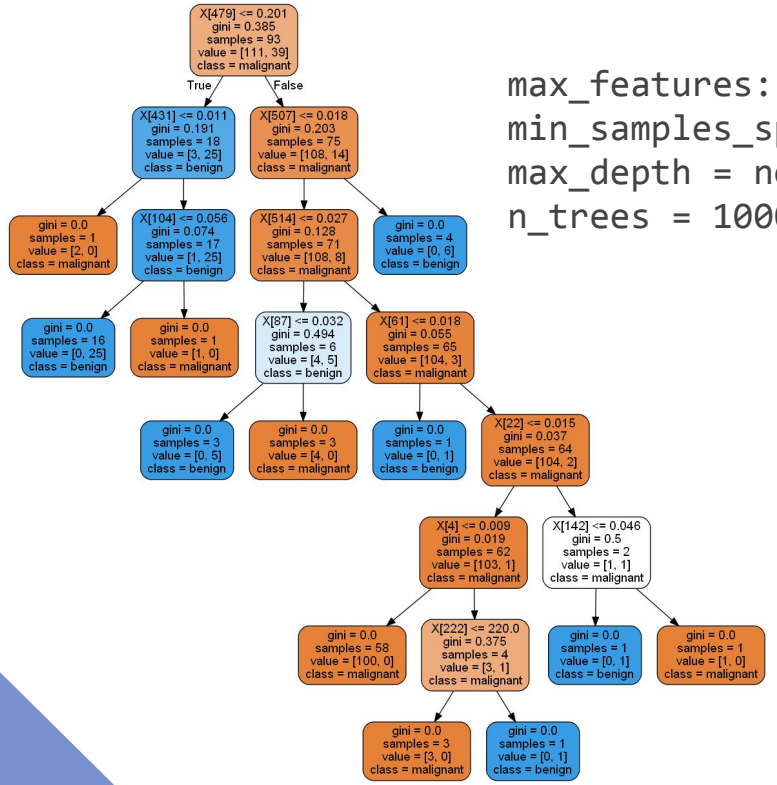
PLS-DA binary classification results



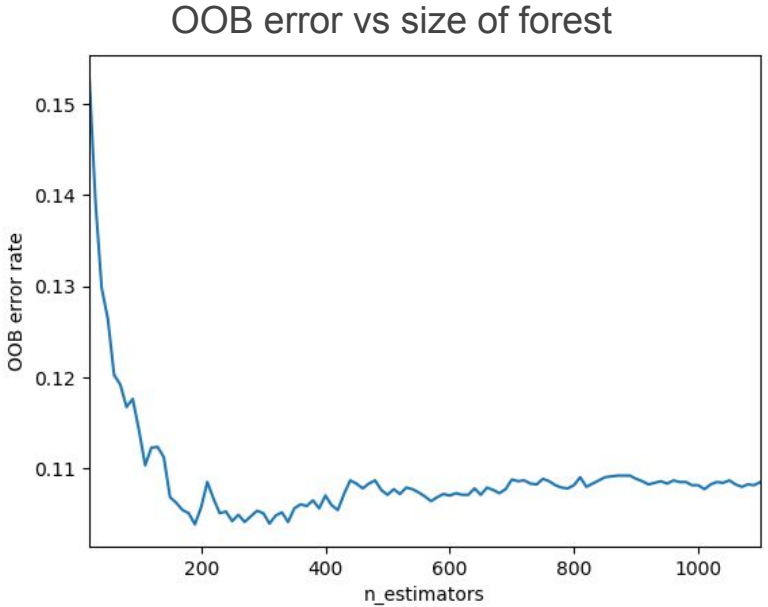
Accuracy: 82.89%
Specificity: 87.27%
Sensitivity: 71.43%
F1 Score: 0.7

Ground Truth	Predicted	
	Malignant	Benign
Malignant	48	7
Benign	6	15

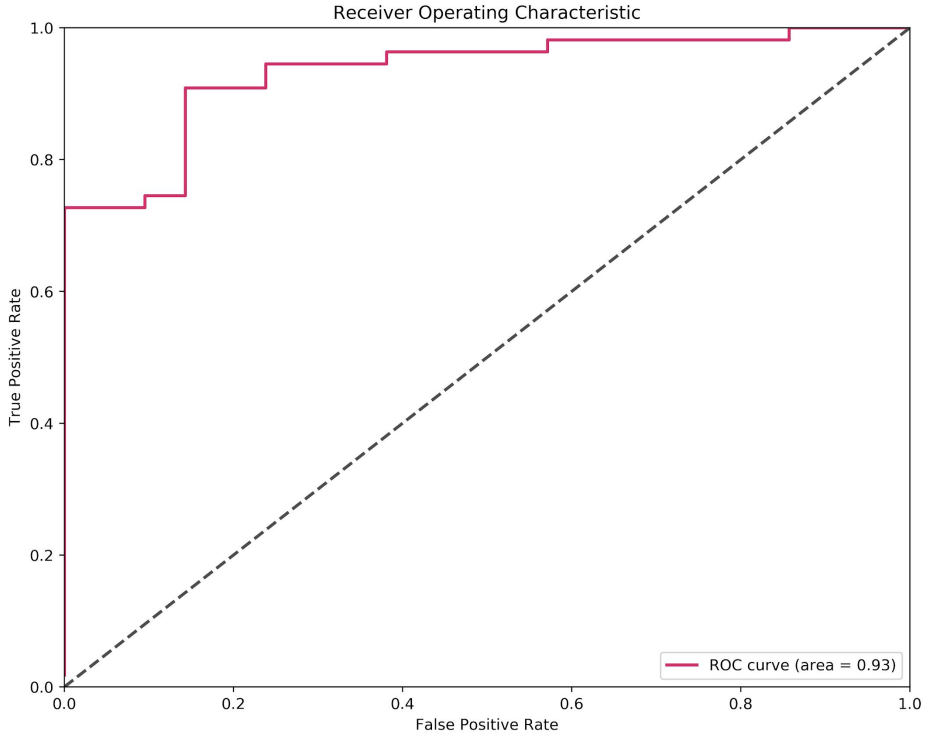
How our forest works




```
max_features: 'sqrt'
min_samples_split = 2
max_depth = none
n_trees = 1000
```



Random Forest binary classification results



Accuracy: 89.47%
Specificity: 94.55%
Sensitivity: 76.19%
F1-Score = 0.8

Ground Truth	Predicted	
	Malignant	Benign
Malignant	52	3
Benign	5	16

Conclusion

- PLS-DA performed worse than random-forest, as expected
- Average Expert Accuracy: 79.6%
- Average Novice Accuracy: 79.4%
- Multi-class classification is possible, but more difficult

Ground Truth	Predicted	
	Malignant	Benign
Malignant	52	3
Benign	5	16

	Hyperplasic	Serrated	Adenoma
Hyperplasic	18	0	3
Serrated	2	9	4
Adenoma	7	4	29

P. Mesejo et al., 'Computer-Aided Classification of Gastrointestinal Lesions in Regular Colonoscopy,' in IEEE Transactions on Medical Imaging, vol. 35, no. 9, pp. 2051-2063, Sept. 2016.