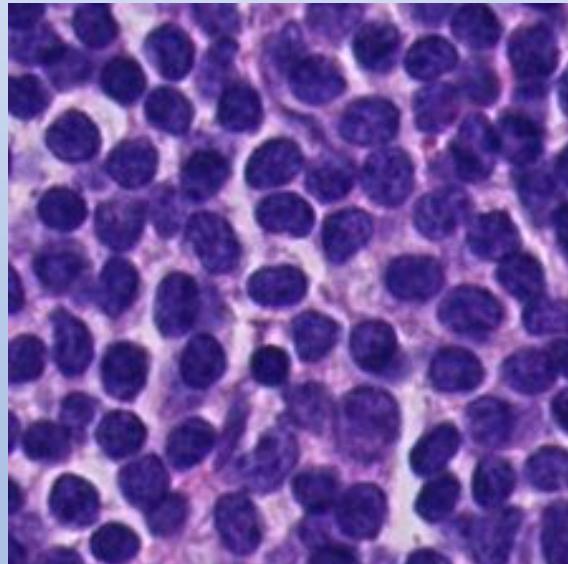


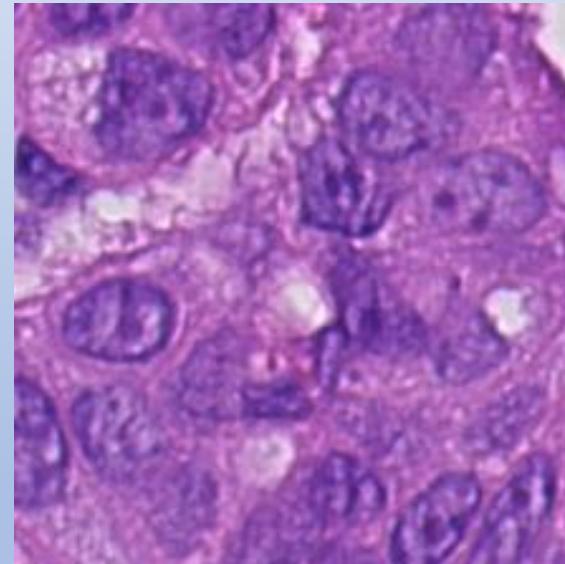
# IsThisMetastasis

Machine learning methods for  
tissue classification



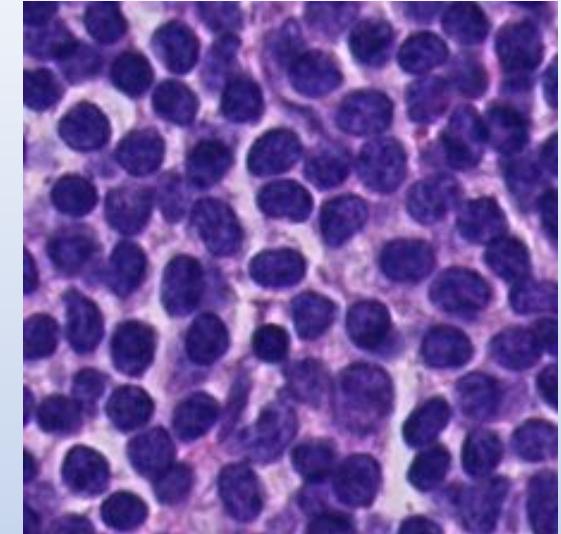
Peyton Rose

Consulting project  
for HistoWiz



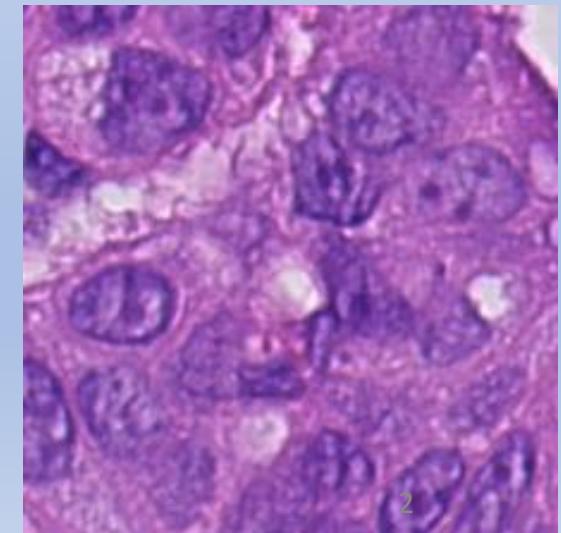
[www.IsThisMetastasis.info](http://www.IsThisMetastasis.info)

Normal



Automated identification of regions of interest in tissue slides will save biomedical researchers considerable time and effort

Metastatic

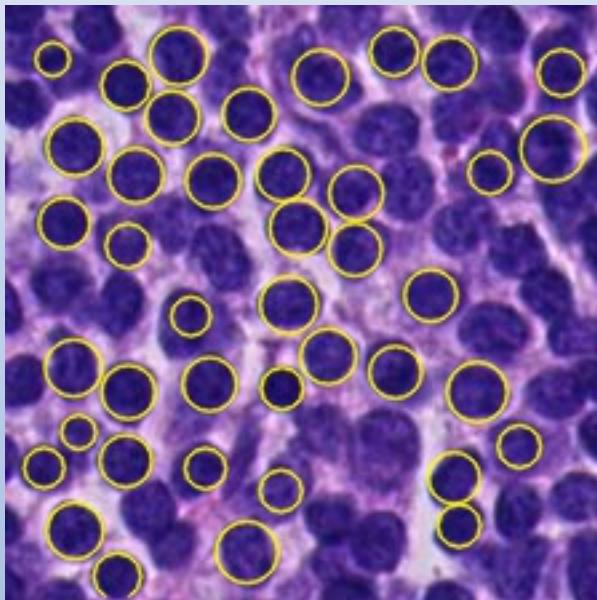


A screenshot of a digital histology slide viewer application. The main window displays a large tissue section with a prominent red-stained area. A scale bar of 2 mm is visible in the bottom left corner. A zoomed-in view of a specific area is shown in a smaller window on the right, with a scale bar of 50 µm. The interface includes a toolbar at the top with various magnification options (1x, 2x, 4x, 10x, 20x, 40x) and a navigation bar at the bottom.

<https://histowiz.com/app/slides/10257/viewer/>

Computer vision techniques can identify key features in slide frame images

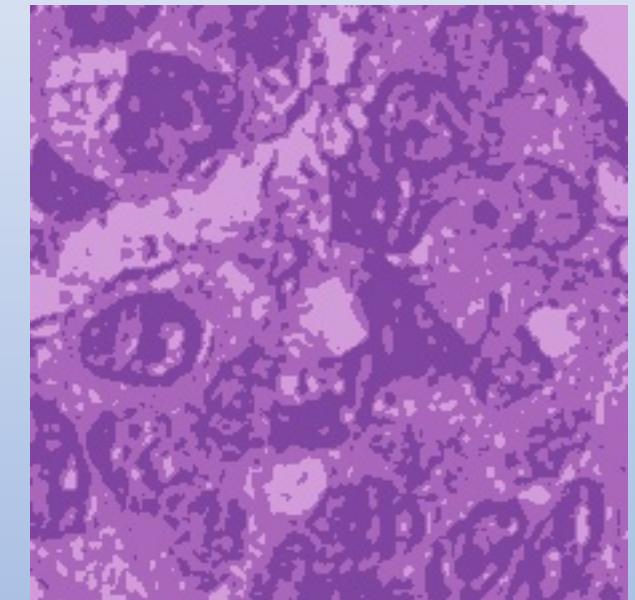
nuclei density



tissue discontinuity



color compactness



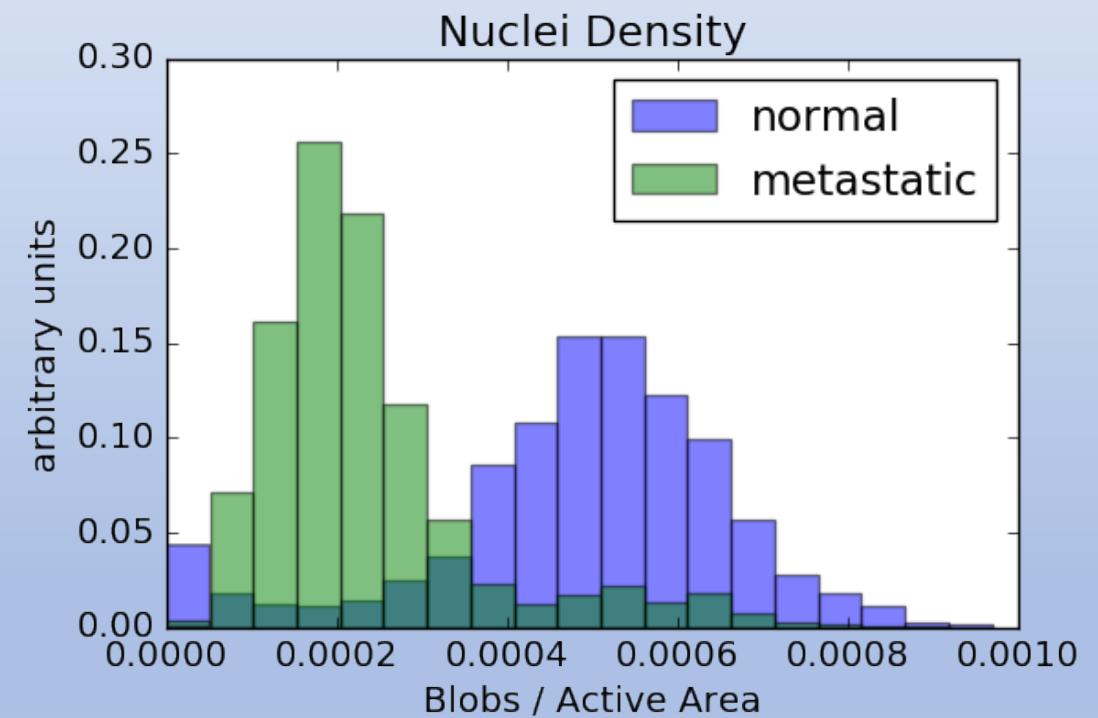
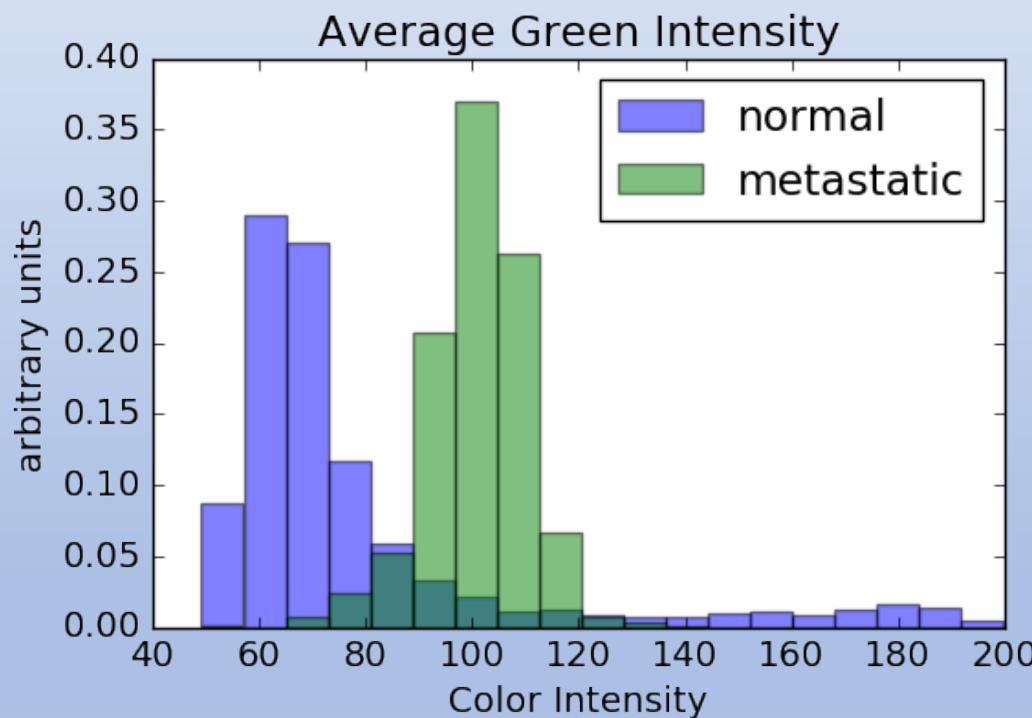
blob detection

edge finding

k-means clustering

Plus, individual RGB intensities averaged over all pixels in the frame

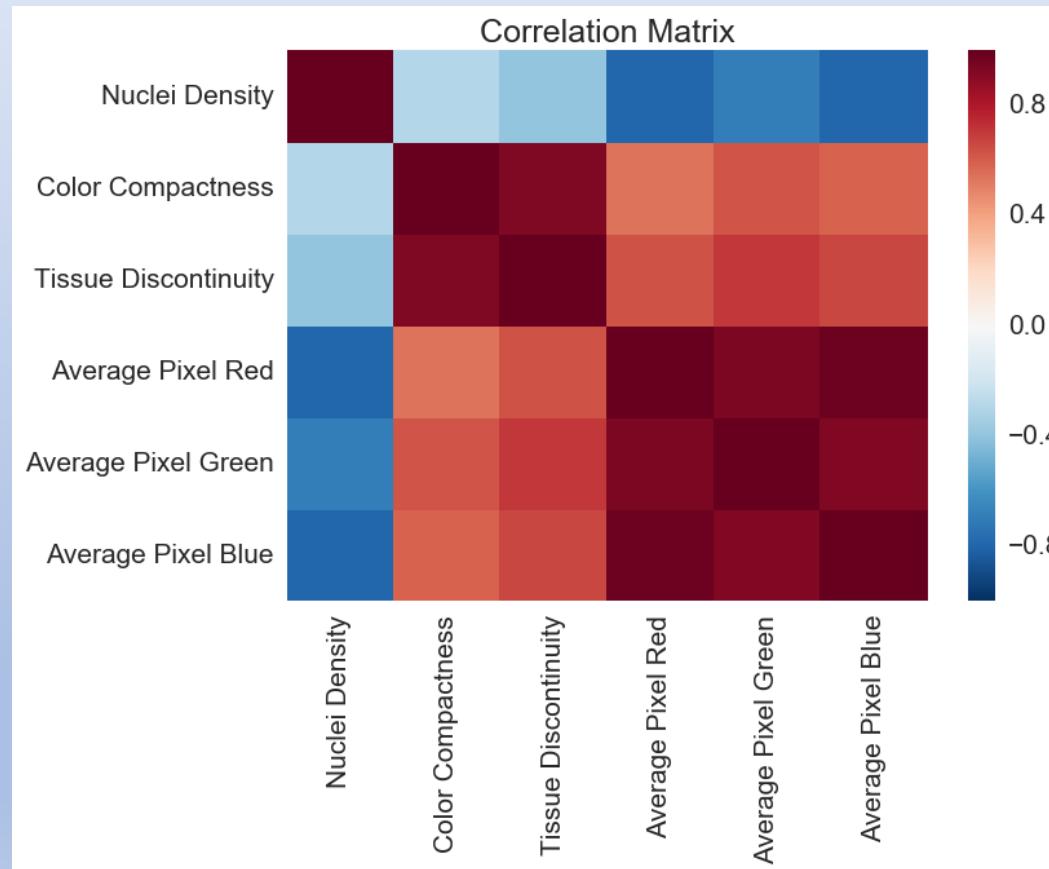
6372 pre-classified images have been split into separate groups for training and cross validation



# Logistic regression provides a simple approach plus model interpretability

## Feature Importance

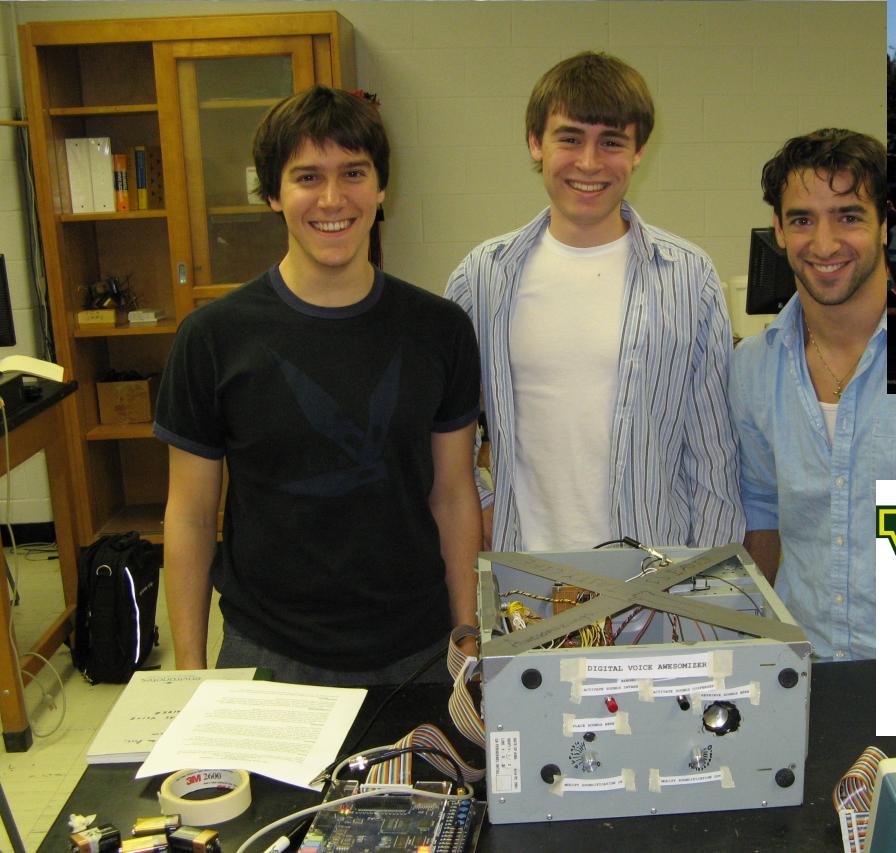
Rank	Feature
1	Avg. Red
2	Avg. Green
3	Avg. Blue
4	Tiss. Disc.
5	Color comp.
6	Nuclei density



**Cross-validation accuracy :**

Logistic regression :  
94.6 %

Transfer learning with Inception-v3:  
97.4 %

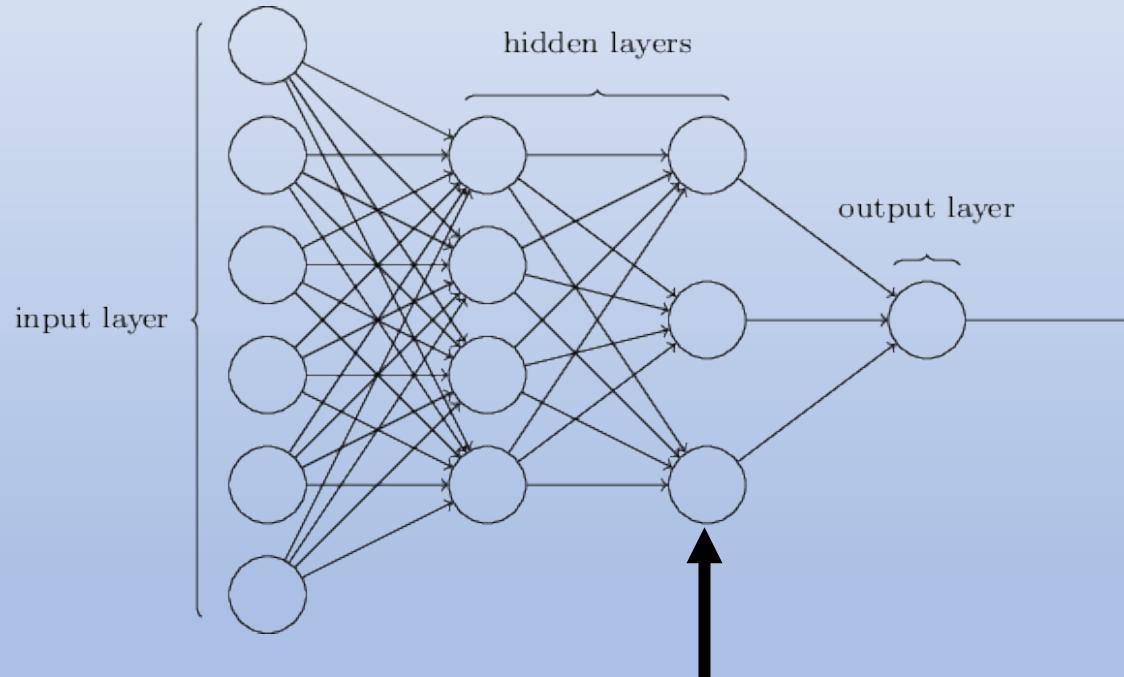


# BACKUP

# Transfer learning offers an alternative method without the need for feature engineering

## Inception-v3

Trained on 1 million images across 1000 categories (not by me)



"pool\_3" layer outputs 2048 features which can be used as inputs to a new classifier

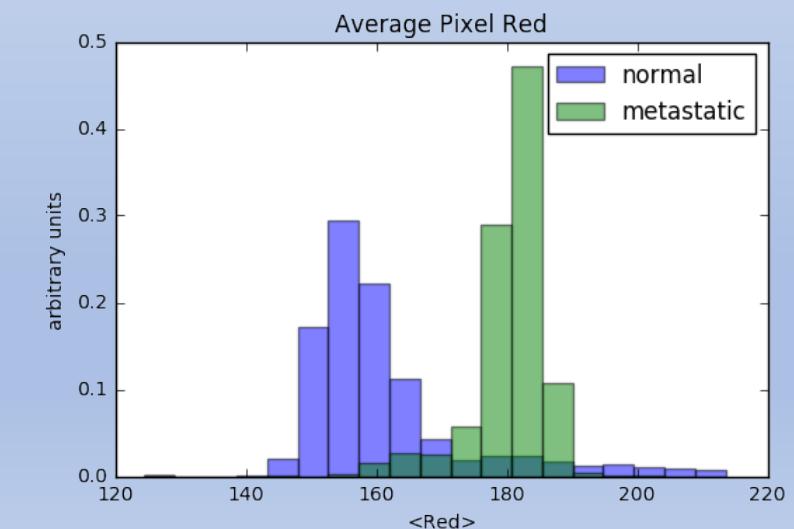
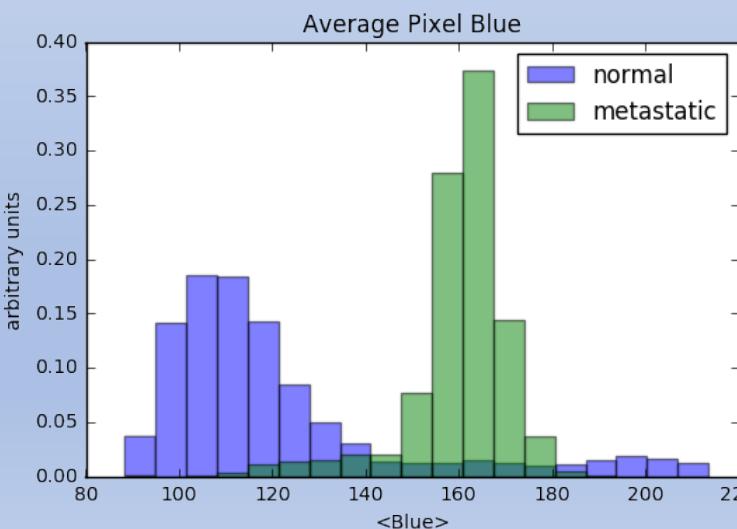
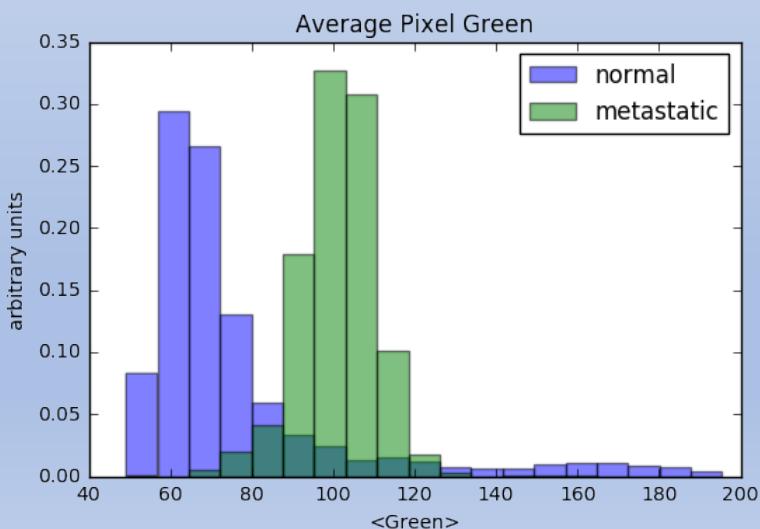
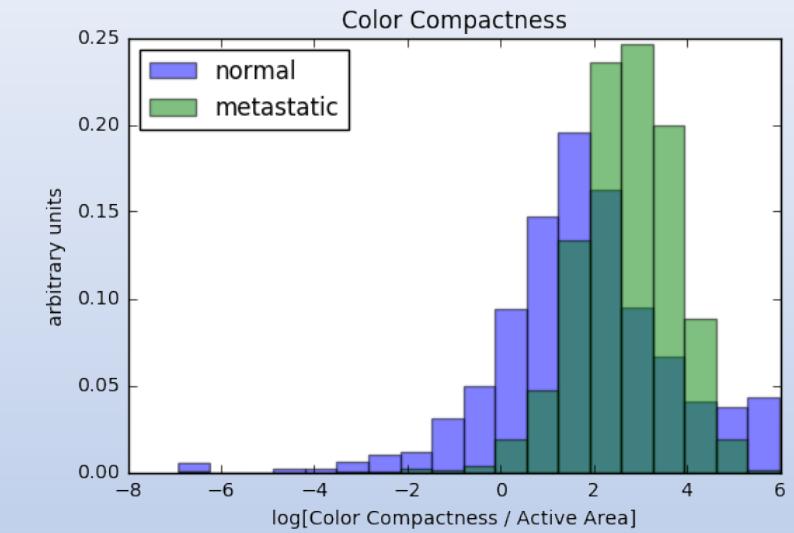
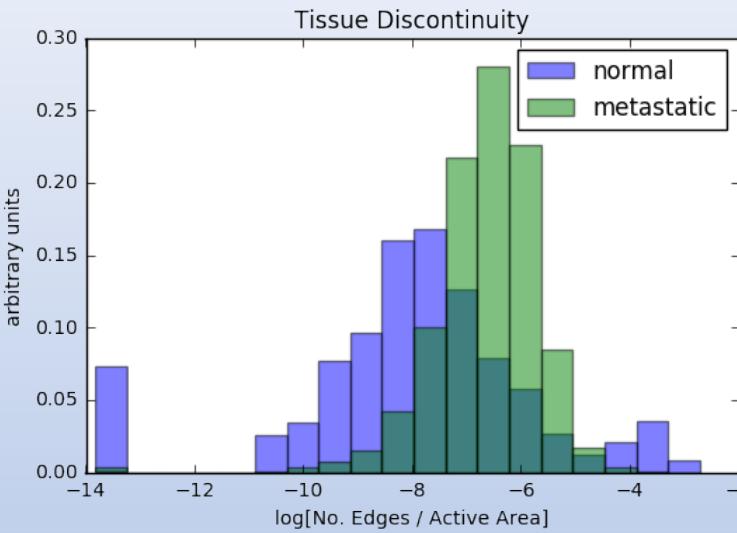
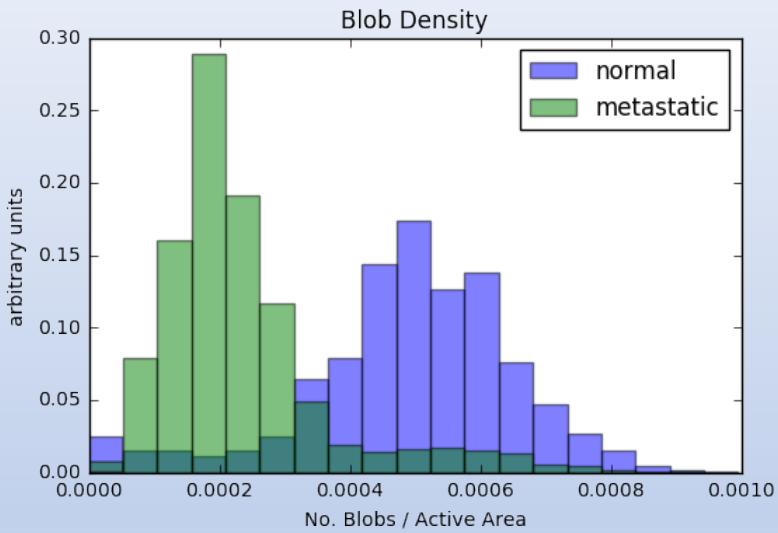
Cross-validation accuracy :

Logistic regression :  
92.5 %

MLP classifier :  
97.4 %

**Transfer learning with Inception-v3:**  
**97.4 %**

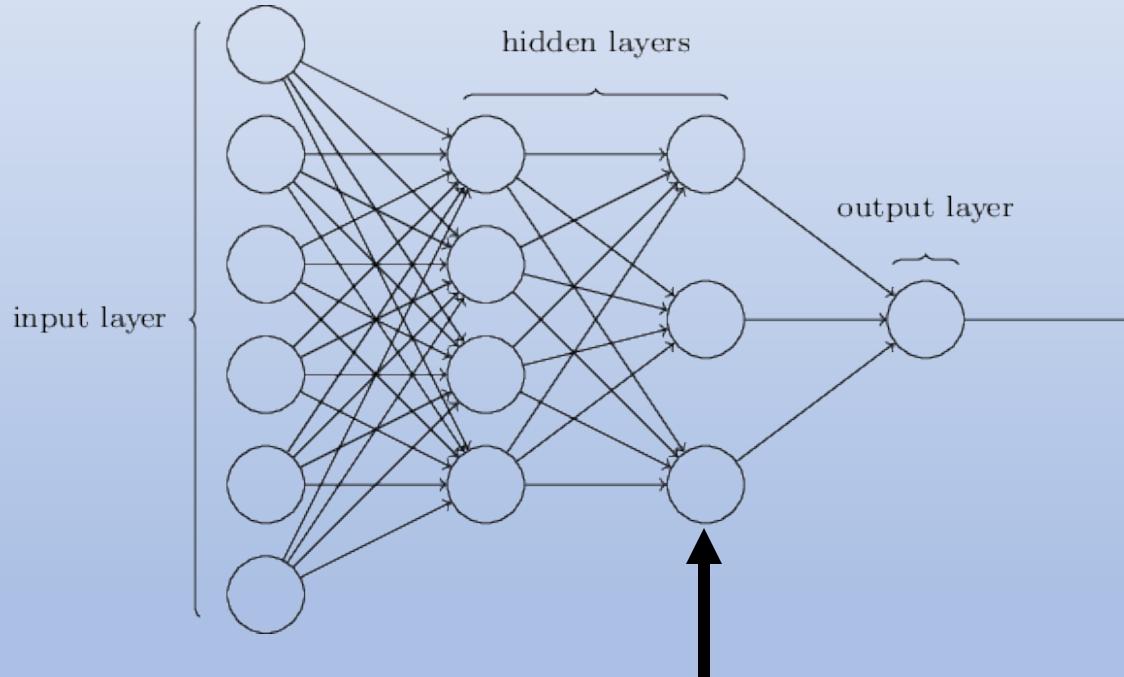
I used 6372 pre-classified images for training and cross-validating my model



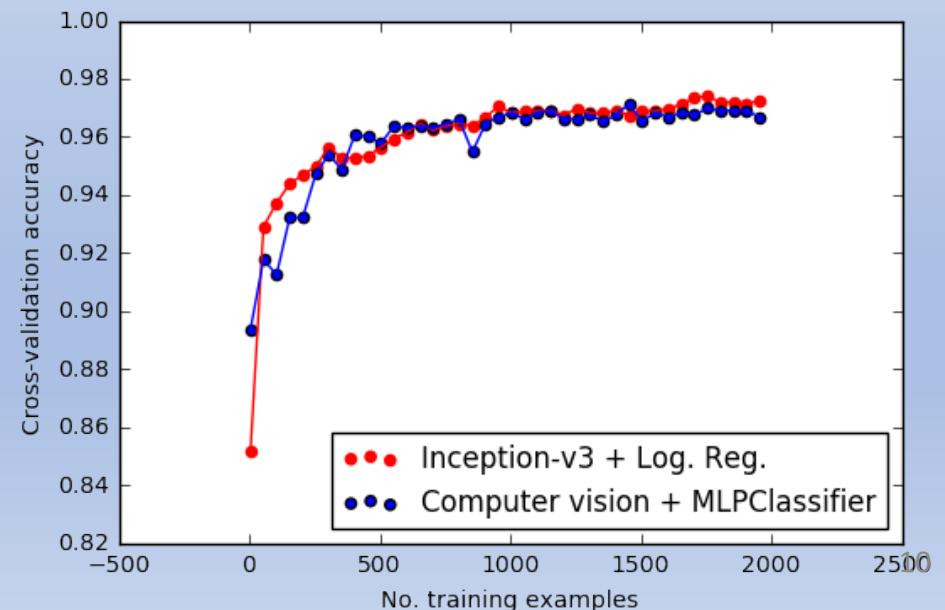
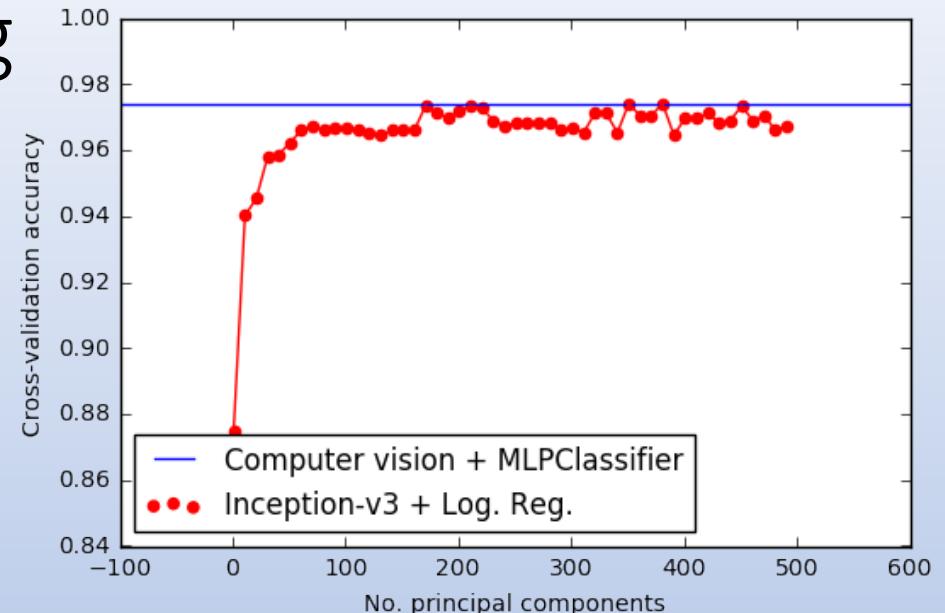
# Transfer learning offers an alternative method without the need for feature engineering

## Inception-v3

Trained on 1 million images across 1000 categories (not by me)



“pool\_3” layer outputs 2048 features which can be used as inputs to a new classifier



# Unsupervised learning!

