



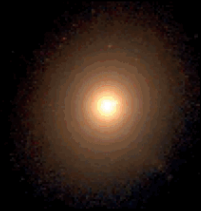
# Classifying Galaxies in the Sloan Digital Sky Survey

Lori Beerman



# The Hubble “Tuning Fork” Diagram

Elliptical



Elliptical



Irregular



Lenticular



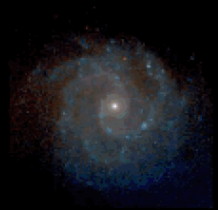
Spiral



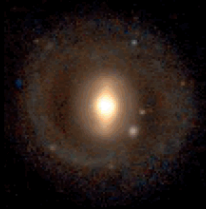
Spiral



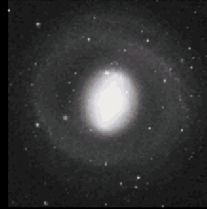
Spiral



Barred  
Lenticular



Barred  
Spiral



Barred  
Spiral



Barred  
Spiral



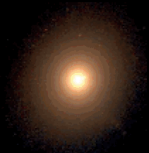
# Data



# Classifications



Elliptical



Elliptical



Irregular



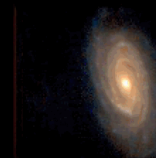
Lenticular



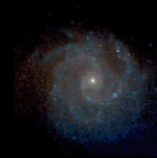
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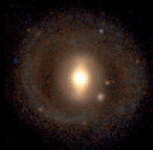
Spiral



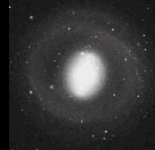
Spiral



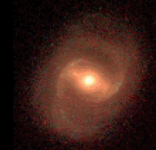
Barred  
Lenticular



Barred  
Spiral



Barred  
Spiral



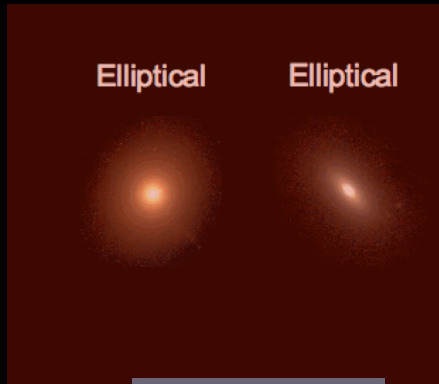
Barred  
Spiral



# Data



Elliptical



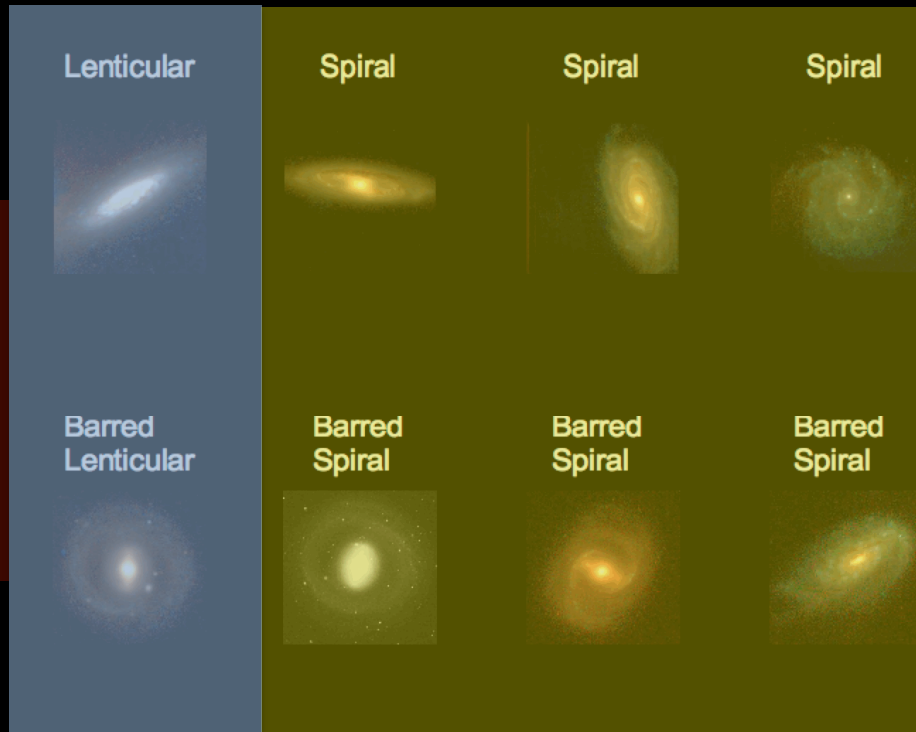
Elliptical

Elliptical

Irregular



# Classifications



Lenticular

Spiral

Spiral

Spiral

Barred  
Lenticular

Barred  
Spiral

Barred  
Spiral

Barred  
Spiral

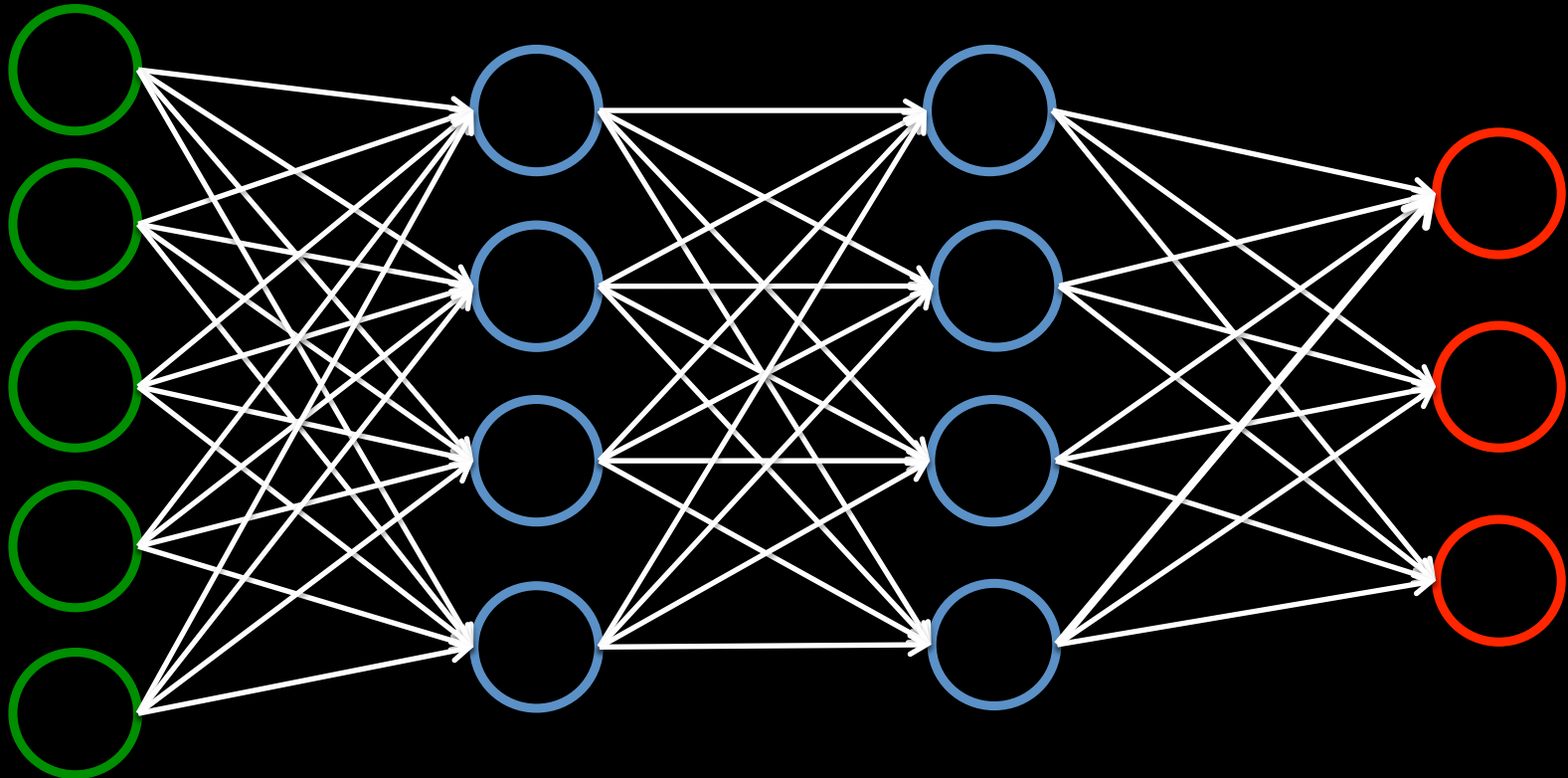
Uncertain

Spiral



# Neural Network Model

Input Layer      Hidden Layer      Hidden Layer      Output Layer



10,000  
Pixels

512  
Nodes

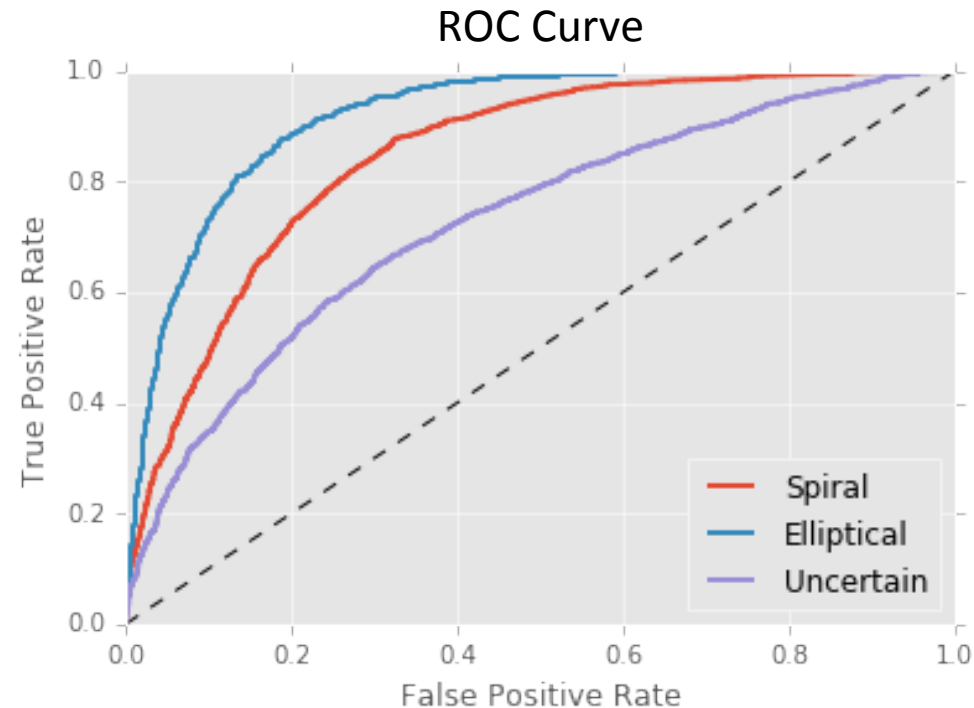
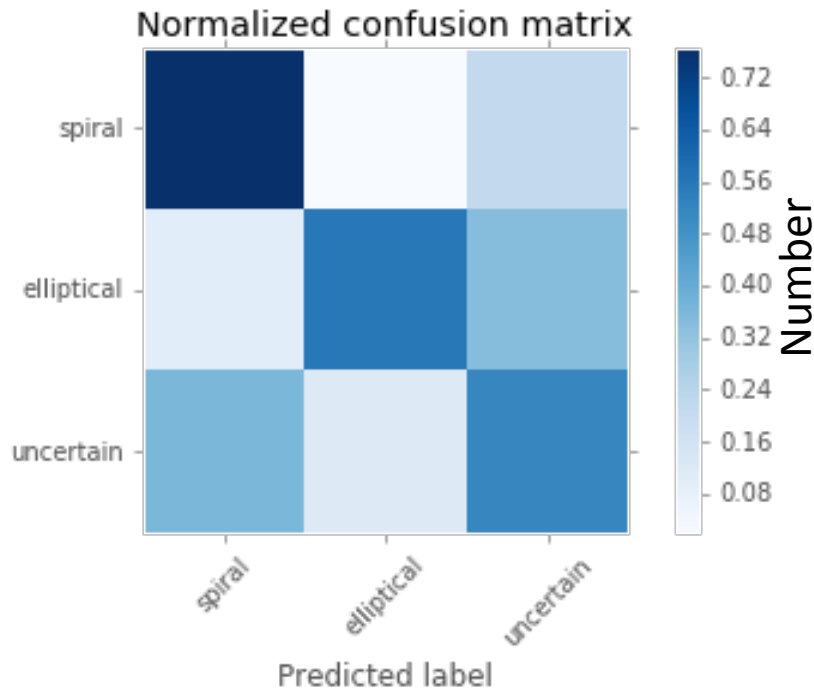
512  
Nodes

Classification



# How well does the model work?

Overall accuracy is 66%, compared to random guess accuracy of 33%



AUC for Elliptical = 0.92

AUC for Spiral = 0.85

AUC for Uncertain = 0.73

High Probability of Elliptical

High Probability of Spiral



High Probability of Uncertain



High Probability of Elliptical

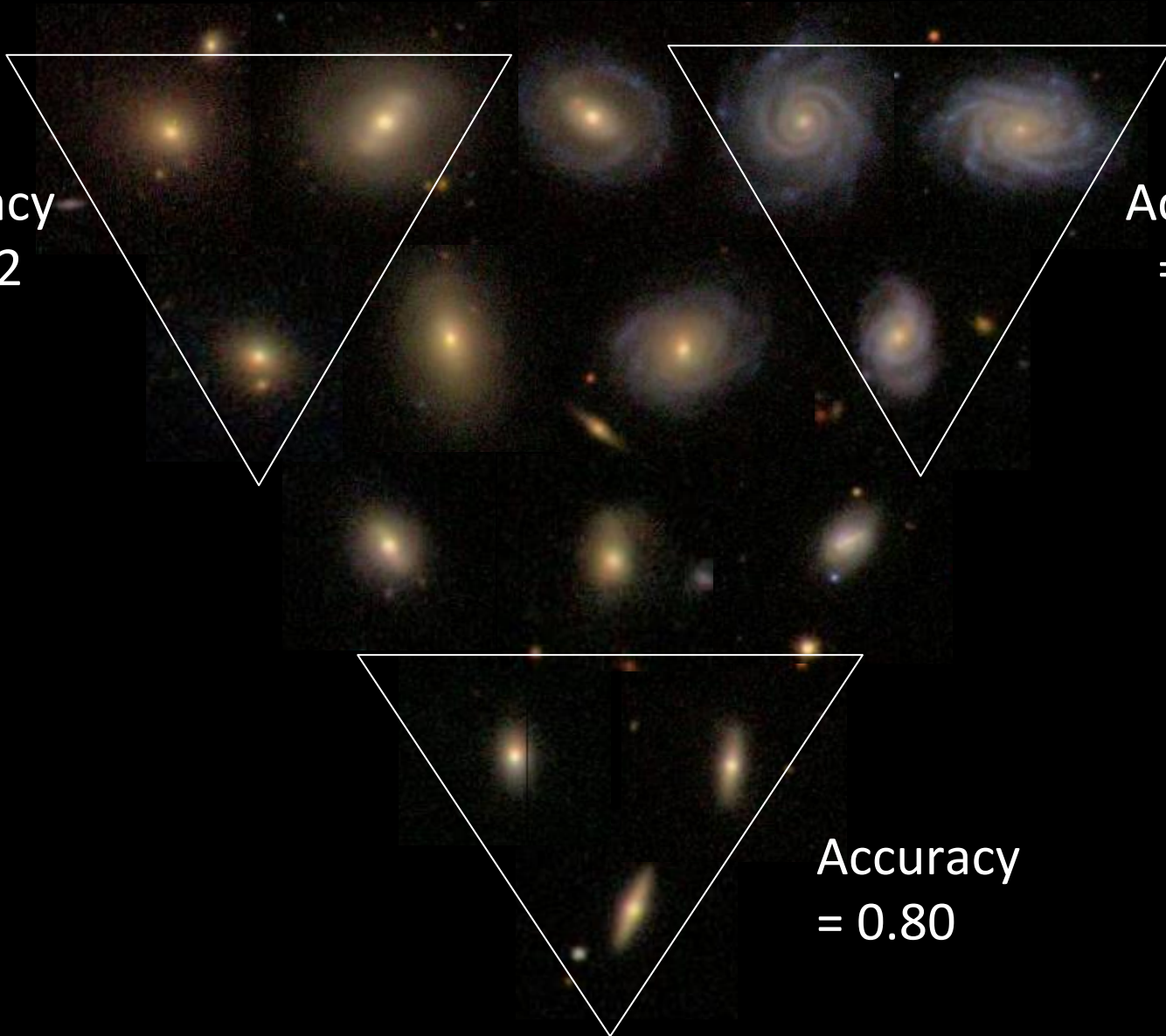
High Probability of Spiral

Accuracy  
= 0.82

Accuracy  
= 0.77

Accuracy  
= 0.80

High Probability of Uncertain



# Conclusions and Next Steps

- ★ Neural network model can accurately predict galaxy classification
- ★ Reduce number of galaxies need to classify by eye
- ★ Next, classify fainter galaxies and include more details such as barred spirals, etc.
- ★ Try convolutional neural network



thank you

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[github.com/loribeerman/galaxy\\_classification](https://github.com/loribeerman/galaxy_classification)