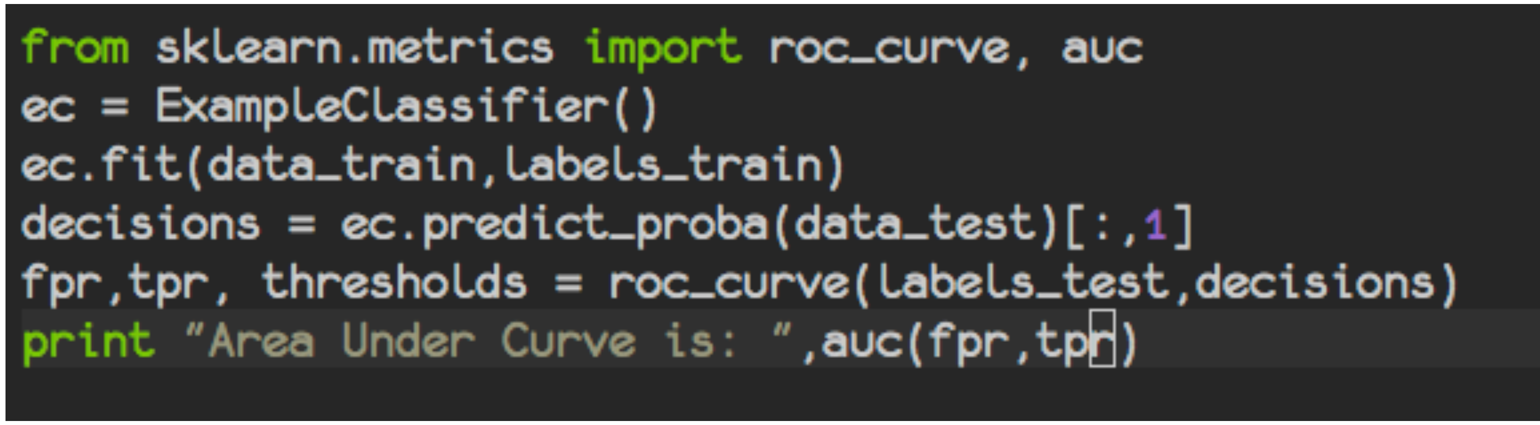
Classification pt. 2

Laura.Hangard@fysik.su.se,
Knut.Mora@fysik.su.se

Forgotten point!



```
from sklearn.metrics import roc_curve, auc
ec = ExampleClassifier()
ec.fit(data_train,labels_train)
decisions = ec.predict_proba(data_test)[:,1]
fpr,tpr, thresholds = roc_curve(labels_test,decisions)
print "Area Under Curve is: ",auc(fpr,tpr)
```

Last time, we used ROC curves to measure performance of classifiers. If you wish to optimize a classifier, you can also use the area under the ROC curve to compute this. A perfect classifier will have AUC=1.

Dataset

- The dataset contains 14 magnitudes for different bands, which can be subtracted to produce 91 colors

- In addition, photometric redshift and error are included

- The target will be to classify galaxies into ~ellipticals- those with 0.5<“elliptical”, and ~spirals, with “elliptical”<0.5

- Missing values are set to -9999

Column #	Name	Description
0	counter	dummy var
1	name	SDSS galaxy ID
2	RA	Coordinates
3	DEC	same
4	elliptical	score of how elliptical
5	spiral	1-elliptical
6	photoz	photom. redshift
7	photozErr	error on photoz
8	FUV	Magnitude, far UV
9	NUV	Magnitude, near UV
10	U	Magnitude U band
11	G	G band (optical)
12	R	R band (optical)
13	I	I band (optical)
14	Z	Z band (optical)
15	J	J band (near IR)
16	H	H band (near IR)
17	K	K band (near IR)
18	W1	Magnitude W1-4
19	W2	(mid IR)
20	W3	
21	W4	

Parsing/conditioning

- To save time, a script/class called "Classify_Galaxies_Parser.py" is included
- To load the data, initialise a Galaxy_Parser("filename")
- Options may be set- see next slide

Galaxy_Parser member	description
data_train	training data: one galaxy per row, one feature per column
data_test	test dataset
labels_train	array of labels for training data: 1 if spiral, 0 else
labels_test	array of labels for test data
datanames	array of name for each feature

When initialising, some options may be set:

- precondition: if True, scale each feature vector to have 0 mean and stdev =1. Default=False

- replaceMean: if True, replace missing features of a galaxy with the average of that feature. Default = False

- ellipticity_threshold: float: if ellipticity is above this value, it will be considered a "true" elliptical galaxy. Default = 0.5

- trainfrac : float: fraction of data to use for training. The remainder will be used for test dataset Default =0.8

Decision tree task

- Classify the galaxies using a decision tree, for different tree depths.
- Find the optimal tree depth using cross-validation
- Plot an ROC curve for the best tree depth
- explore the graph produced by the DT- for a first start, have a look at the .tree_ member of the Decision tree Classifier
- What variables are important?
- Plot two of the most important variables, as well as the cut on each
- color the points according to true spiral/elliptical
- Experiment with preconditioning the data, or allowing the sparse data.

Random Forest task

- Classify the galaxies using a decision tree, for different tree depths.
- Find the number of trees where the forest classifier converges
- Plot an ROC curve for the best forest
- What variables are important? (hint: see documentation for RandomForestClassifier.feature_importances_
- Plot two of the most important variables, as well as the cut on each
- color the points according to true spiral/elliptical
- Experiment with preconditioning the data, or allowing the sparse data.
- Check http://scikit-learn.org/stable/modules/ensemble.html#forest and experiment with different forest/ensemble classifiers

Support Vector Machine task

- Classify the galaxies using a Support Vector Classifier
- What is the probability for a false and a true positive identification?
- What variables are important? (hint: what direction does the support vector point?)
- Plot two of the most important variables, color the points according to true spiral/elliptical
- Try allowing the sparse data
- Experiment with using kernels- consult http://scikit-learn.org/stable/modules/svm.html#svm
- Experiment with weighing the elliptical and spiral galaxies differently to the classifier. Can you construct an ROC curve from this, or otherwise?