In [585]:
```
from sklearn.datasets import load_iris
from sklearn.tree import DecisionTreeClassifier

iris = load_iris()
X = iris.data[:, 2:]
y = iris.target_names

y
```

Out[585]:
```
array(['setosa', 'versicolor', 'virginica'], dtype='<U10')
```

In [485]:
```
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
import numpy as np
from scipy.stats import norm
from sklearn.preprocessing import StandardScaler
from sklearn.decomposition import PCA
from scipy import stats
import warnings
import matplotlib.pyplot as plt


#warnings.filterwarnings('ignore')
%matplotlib inline
```

In [531]:
```
df_train = pd.read_csv('train.csv')
df_test = pd.read_csv('test.csv')
```

In [532]:
```
df_train.shape

```

Out[532]:
```
(891, 12)
```

In [533]:
```
df_test.shape
```

Out[533]:
```
(418, 11)
```

In [534]:
```
#number of rows with missing values in the dataframe!
df_train.isnull().values.ravel().sum()

```

Out[534]:
```
866
```

In [535]:
```
1 df_train.isna().sum()
```

Out[535]:
```
PassengerId      0
Survived         0
Pclass           0
Name             0
Sex              0
Age            177
SibSp            0
Parch            0
Ticket           0
Fare             0
Cabin          687
Embarked         2
dtype: int64
```

In [536]:
```
1 df_train.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 891 entries, 0 to 890
Data columns (total 12 columns):
PassengerId    891 non-null int64
Survived       891 non-null int64
Pclass         891 non-null int64
Name           891 non-null object
Sex            891 non-null object
Age            714 non-null float64
SibSp          891 non-null int64
Parch          891 non-null int64
Ticket         891 non-null object
Fare           891 non-null float64
Cabin          204 non-null object
Embarked       889 non-null object
dtypes: float64(2), int64(5), object(5)
memory usage: 83.6+ KB
```

In [537]:
```
1 def missing_percentage(series):
2     num = series.isnull().sum()
3     den = series.count()
4     return 100*(num/den)
```

In [538]:
```
1 missing_percentage(df_train)
```

Out[538]:
```
PassengerId      0.000000
Survived         0.000000
Pclass           0.000000
Name             0.000000
Sex              0.000000
Age             24.789916
SibSp            0.000000
Parch            0.000000
Ticket           0.000000
Fare             0.000000
Cabin          336.764706
Embarked         0.224972
dtype: float64
```

In [ ]:
```
1
```

In [539]:
```
1 df_train['Ticket'].value_counts()
```

Out[539]:
```
347082               7
1601                 7
CA. 2343             7
3101295              6
CA 2144              6
347088               6
382652               5
S.O.C. 14879         5
W./C. 6608           4
347077               4
17421                4
2666                 4
19950                4
349909               4
113760               4
113781               4
4133                 4
LINE                 4
PC 17757             4
F.C.C. 13529         3
C.A. 34651           3
PC 17760             3
248727               3
239853               3
35273                3
230080               3
13502                3
347742               3
29106                3
PC 17755             3
                   ..
A/4. 34244           1
349216               1
PC 17595             1
14311                1
348121               1
347063               1
SOTON/O.Q. 392087    1
SOTON/OQ 392086      1
347468               1
250653               1
3474                 1
7553                 1
A/4 45380            1
226593               1
2648                 1
CA. 2314             1
11753                1
28665                1
PC 17756             1
113804               1
2677                 1
2662                 1
SC/AH 29037          1
367232               1
```

```
349212                1
C.A. 29566            1
A/5 2817              1
113050                1
350060                1
363592                1
Name: Ticket, Length: 681, dtype: int64
```

In [540]:
```
df_train.loc[df_train['Ticket'] == '2666']

```

Out[540]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
448	449	1	3	Baclini, Miss. Marie Catherine	female	5.00	2	1	2666	19.2583	NaN
469	470	1	3	Baclini, Miss. Helene Barbara	female	0.75	2	1	2666	19.2583	NaN
644	645	1	3	Baclini, Miss. Eugenie	female	0.75	2	1	2666	19.2583	NaN
858	859	1	3	Baclini, Mrs. Solomon (Latifa Qurban)	female	24.00	0	3	2666	19.2583	NaN

In [ ]:
```

```

In [541]:
```
df_train.loc[df_train['Ticket'] == '347082']

```

Out[541]:

	PassengerId	Survived	Pclass	Name	Sex	Age	SibSp	Parch	Ticket	Fare	Cabin
13	14	0	3	Andersson, Mr. Anders Johan	male	39.0	1	5	347082	31.275	NaN
119	120	0	3	Andersson, Miss. Ellis Anna Maria	female	2.0	4	2	347082	31.275	NaN
541	542	0	3	Andersson, Miss. Ingeborg Constanzia	female	9.0	4	2	347082	31.275	NaN
542	543	0	3	Andersson, Miss. Sigrid Elisabeth	female	11.0	4	2	347082	31.275	NaN
610	611	0	3	Andersson, Mrs. Anders Johan (Alfrida Konstant...	female	39.0	1	5	347082	31.275	NaN
813	814	0	3	Andersson, Miss. Ebba Iris Alfrida	female	6.0	4	2	347082	31.275	NaN
850	851	0	3	Andersson, Master. Sigvard Harald Elias	male	4.0	4	2	347082	31.275	NaN

In [ ]:
```

```

In [542]:
```
#df_train = df_train.drop('Cabin', axis = 1)
```

In [543]:
```
len(df_train['Name'].str.split(',').str[0])
```

Out[543]: 891

In [544]:
```
len(set(df_train['Name'].str.split(',').str[0]))
```

Out[544]: 667

In [545]:
```
df_train['Name'] = df_train['Name'].str.split(',').str[0]#.value_count(
```

In [546]:
```
#df_train['Name'].value_counts()
```

In [547]:
```
#df_train = df_train.drop(labels = 'Name', axis = 1)
```

In [548]:
```
#len(df_train['Cabin'])
```

In [549]:
```
y = df_train['Survived']
y = y.astype('int64')
```

In [550]:
```
le = preprocessing.LabelEncoder()
df_train['Sex'] = le.fit_transform(df_train.Sex.values)
df_train['Ticket'] = le.fit_transform(df_train.Ticket.values)
df_train['Name'] = le.fit_transform(df_train.Name.values)
df_train['Embarked'] = le.fit_transform(df_train['Embarked'].astype(str
```

In [551]:
```
df_train =  df_train.drop(labels = 'Cabin', axis = 1 )
```

In [552]:
```
x = df_train.drop(labels = 'Survived', axis = 1 )
```

In [555]:
```
from sklearn.impute import SimpleImputer
imp = SimpleImputer(missing_values=np.nan, strategy='mean')
x = imp.fit_transform(x)
#x
```

In [556]:
```
from sklearn.decomposition import PCA
import numpy as np

pca = PCA(n_components=2)
x_transformed = pca.fit_transform(x)

```

In [557]:
```
print(pca.explained_variance_ratio_)
```

```
[0.45487329 0.27775175]
```

In [558]:
```
y = df_train['Survived']
set(y.values)
```

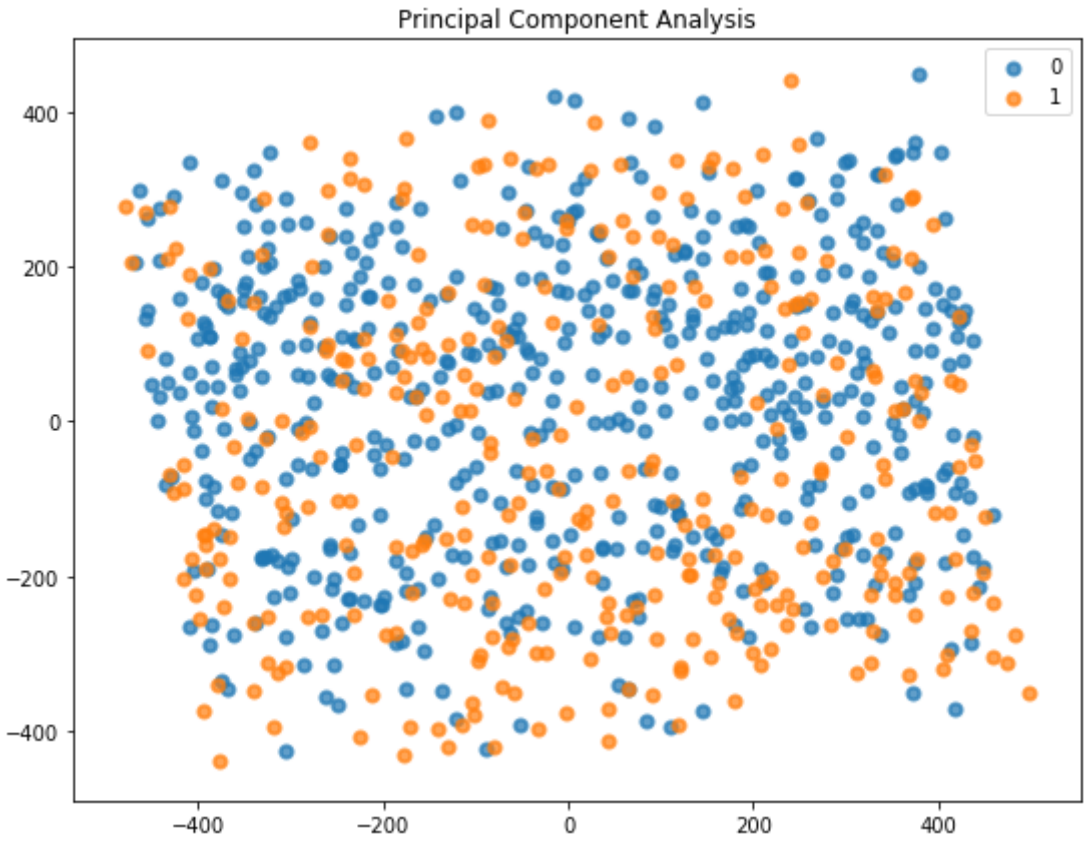
Out[558]:
```
{0, 1}
```

In [559]:
```
x_transformed.shape
```

Out[559]:
```
(891, 2)
```

In [560]:
```
import numpy as np
import matplotlib.pyplot as plt
from mpl_toolkits.mplot3d import Axes3D

```

In [561]:
```
1
2  plt.figure(figsize=(9,7))
3  lw = 2
4
5  for i, target_name in zip([0, 1], np.unique(y)):
6      plt.scatter(x_transformed[y == i, 0], x_transformed[y == i, 1], alp
7                  label=target_name)
8  plt.legend(loc = 'best', shadow = False, scatterpoints = 1)
9  plt.title('Principal Component Analysis')
10 plt.show()
11
```

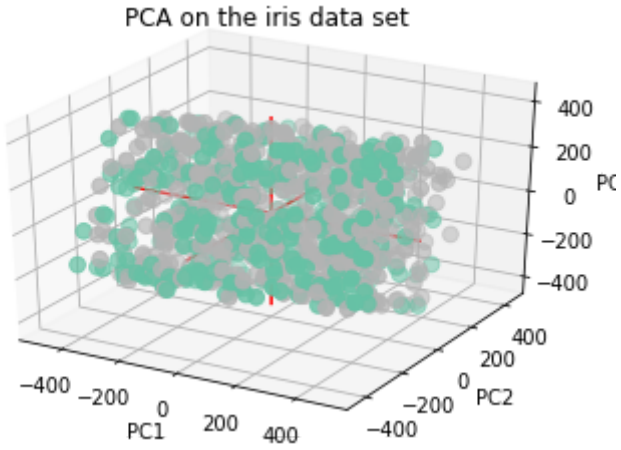


In [562]:
```
1  #from sklearn.manifold import TSNE
```

In [564]:
```
1  #result=pd.DataFrame(x_transformed, columns=['PCA%i' % i for i in range
2  #result
```

In [565]:
```
# Plot initialisation
fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')
ax.scatter(result['PCA0'], result['PCA1'], result['PCA2'], c=my_color,

# make simple, bare axis lines through space:
xAxisLine = ((min(result['PCA0']), max(result['PCA0'])), (0, 0), (0,0))
ax.plot(xAxisLine[0], xAxisLine[1], xAxisLine[2], 'r')
yAxisLine = ((0, 0), (min(result['PCA1']), max(result['PCA1'])), (0,0))
ax.plot(yAxisLine[0], yAxisLine[1], yAxisLine[2], 'r')
zAxisLine = ((0, 0), (0,0), (min(result['PCA2']), max(result['PCA2'])))
ax.plot(zAxisLine[0], zAxisLine[1], zAxisLine[2], 'r')

# label the axes
ax.set_xlabel("PC1")
ax.set_ylabel("PC2")
ax.set_zlabel("PC3")
ax.set_title("PCA on the iris data set")
#plt.show()

```

Out[565]: Text(0.5, 0.92, 'PCA on the iris data set')

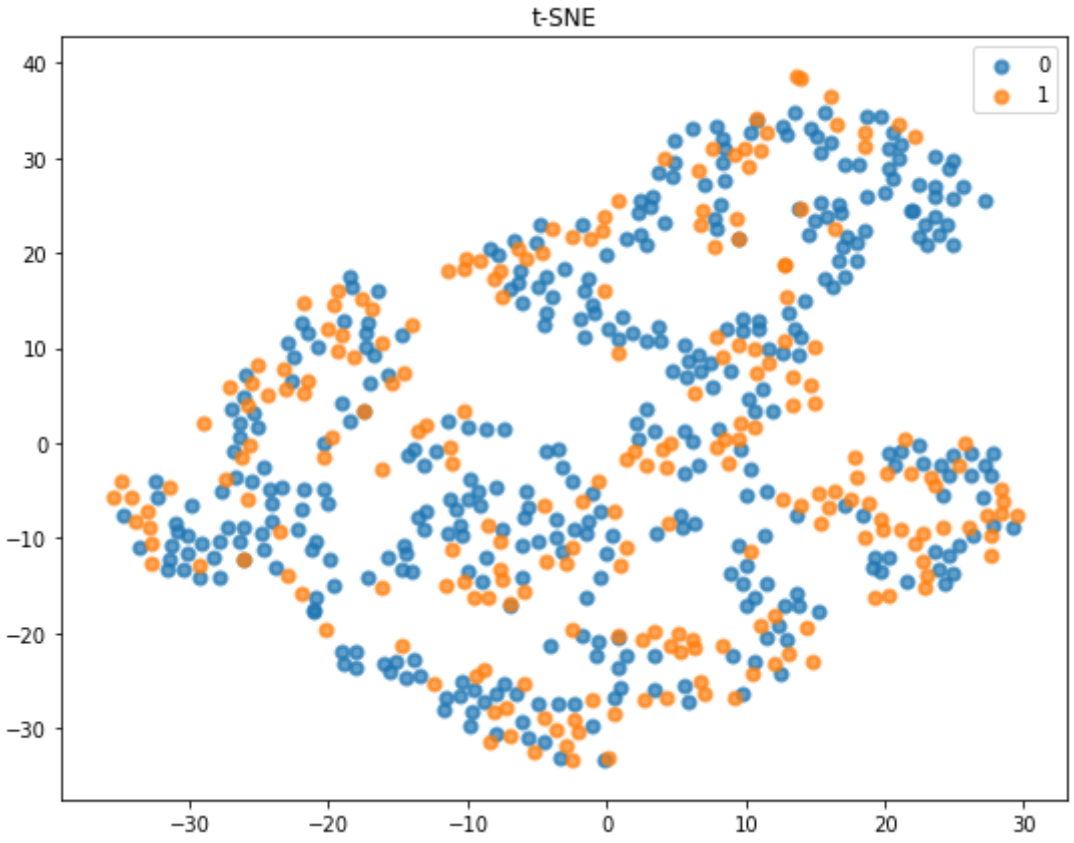


In [566]:
```
from sklearn import tree
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(x, y, test_size=0.3

```

In [567]:
```
from sklearn.manifold import TSNE
tsne = TSNE(n_components=2)
X_embedded = tsne.fit_transform(X_train)
X_embedded
```

Out[567]:
```
array([[ -6.9513154, -17.071068 ],
       [  9.500626 ,  21.470192 ],
       [  8.347942 ,  32.102566 ],
       ...,
       [ 20.496828 ,  27.774937 ],
       [ 10.424785 , -24.273827 ],
       [-13.52143  ,  -7.786212 ]], dtype=float32)
```

In [568]:
```
plt.figure(figsize=(9,7))
lw = 2

for i, target_name in zip([0, 1], np.unique(y_train)):
    plt.scatter(X_embedded[y_train == i, 0], X_embedded[y_train == i, 1
                label=target_name)
plt.legend(loc = 'best', shadow = False, scatterpoints = 1)
plt.title('t-SNE')
plt.show()

```



In [569]:
```
clf = tree.DecisionTreeClassifier(max_depth =3)
clf = clf.fit(X_train, y_train)
```

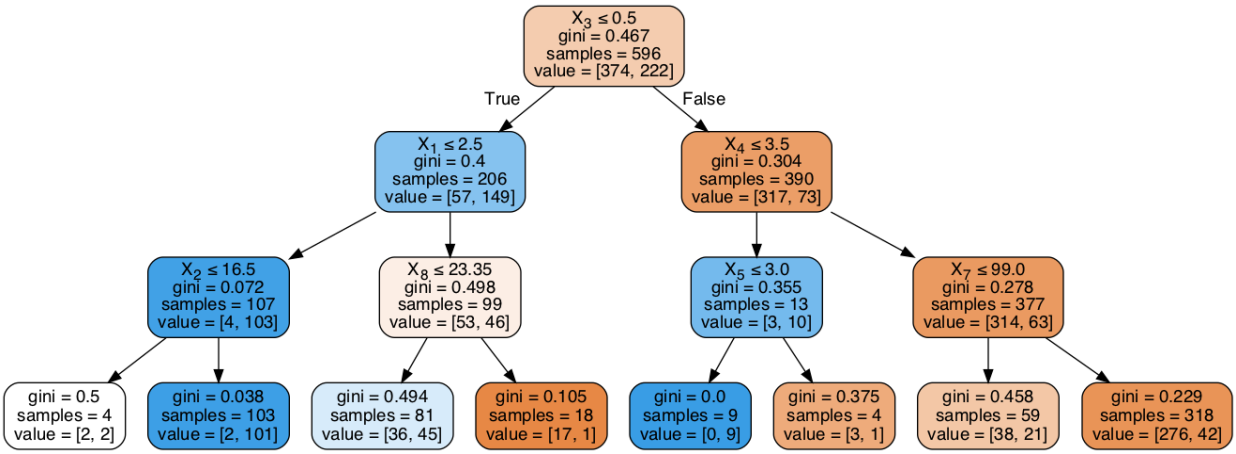
In [570]:
```
y_pred = clf.predict(X_test)
```

In [571]:
```
from sklearn.metrics import accuracy_score
accuracy_score(y_test, y_pred)

```

Out[571]: 0.8203389830508474

In [572]:
```
from sklearn.externals.six import StringIO
from IPython.display import Image
from sklearn.tree import export_graphviz
import pydotplus
dot_data = StringIO()
export_graphviz(clf, out_file=dot_data,
                filled=True, rounded=True,
                special_characters=True)
graph = pydotplus.graph_from_dot_data(dot_data.getvalue())
Image(graph.create_png())
```

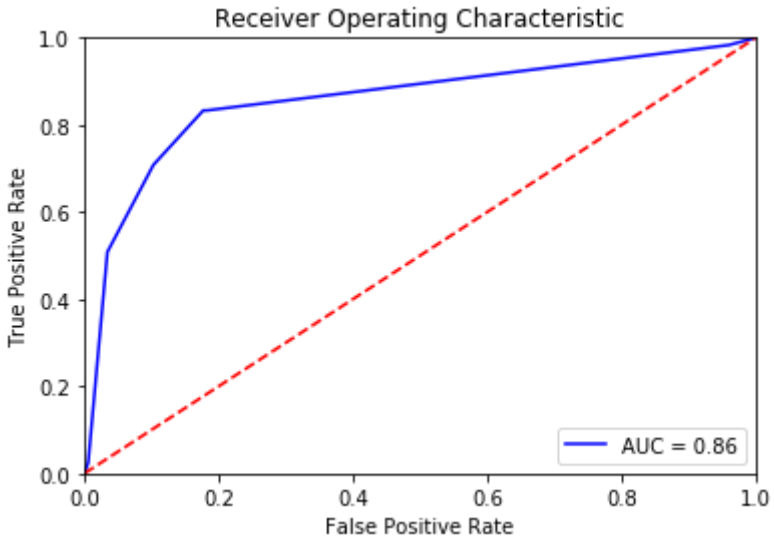
Out[572]:



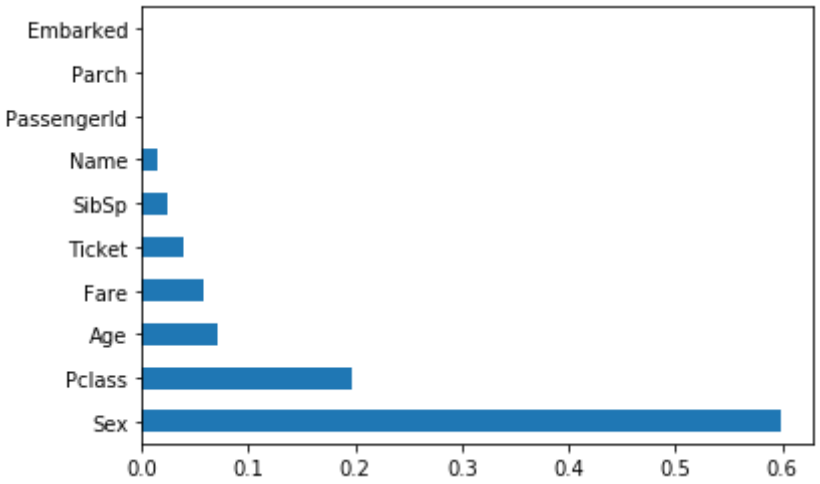
In [438]:
```
import sklearn.metrics as metrics
# calculate the fpr and tpr for all thresholds of the classification
probs = clf.predict_proba(X_test)
preds = probs[:,1]
fpr, tpr, threshold = metrics.roc_curve(y_test, preds)
roc_auc = metrics.auc(fpr, tpr)


```

In [439]:

```
# method I: plt
import matplotlib.pyplot as plt
plt.title('Receiver Operating Characteristic')
plt.plot(fpr, tpr, 'b', label = 'AUC = %0.2f' % roc_auc)
plt.legend(loc = 'lower right')
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0, 1])
plt.ylim([0, 1])
plt.ylabel('True Positive Rate')
plt.xlabel('False Positive Rate')
plt.show()
```



In [404]:
```
feat_importances = pd.Series(clf.feature_importances_,index=df_train.dr
feat_importances.nlargest(25).plot(kind='barh')
plt.show()
```

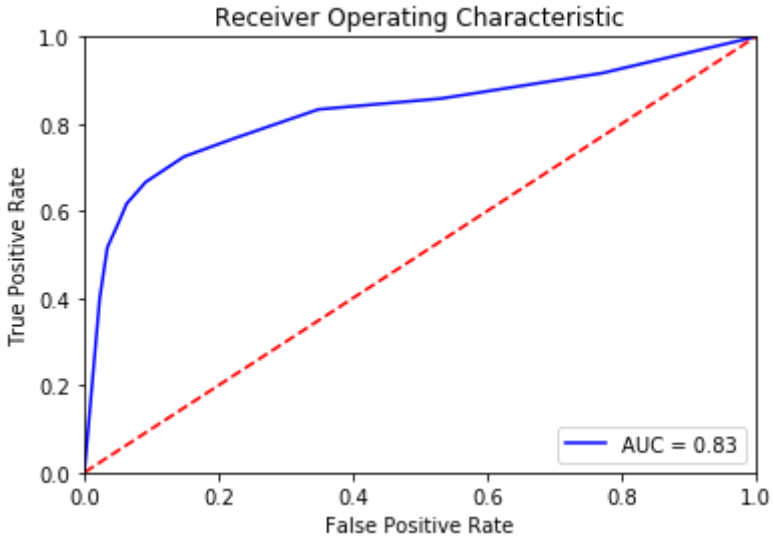


In [415]:
```
from sklearn.ensemble import ExtraTreesClassifier, GradientBoostingClas
model = ExtraTreesClassifier()
model.fit(X_train, y_train)
```

Out[415]:
```
ExtraTreesClassifier(bootstrap=False, class_weight=None, criterion='gin
i',
                     max_depth=None, max_features='auto', max_leaf_nodes=
None,
                     min_impurity_decrease=0.0, min_impurity_split=None,
                     min_samples_leaf=1, min_samples_split=2,
                     min_weight_fraction_leaf=0.0, n_estimators=10, n_job
s=None,
                     oob_score=False, random_state=None, verbose=0,
                     warm_start=False)
```

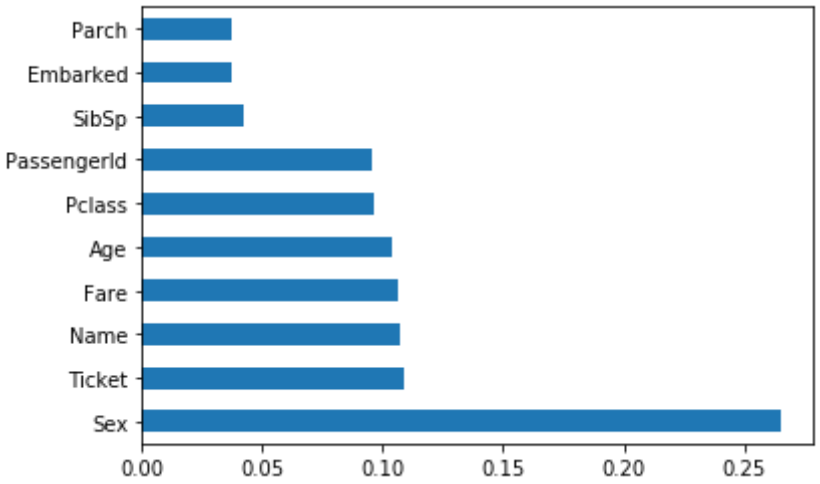
In [450]:
```
#probs#[:,1]
```

In [446]:
```
import sklearn.metrics as metrics
# calculate the fpr and tpr for all thresholds of the classification
probs = model.predict_proba(X_test)
#preds = probs[:,1]
fpr, tpr, threshold = metrics.roc_curve(y_test, preds)
roc_auc = metrics.auc(fpr, tpr)


# method I: plt
plt.title('Receiver Operating Characteristic')
plt.plot(fpr, tpr, 'b', label = 'AUC = %0.2f' % roc_auc)
plt.legend(loc = 'lower right')
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0, 1])
plt.ylim([0, 1])
plt.ylabel('True Positive Rate')
plt.xlabel('False Positive Rate')
plt.show()
```



In [416]:
```
feat_importances = pd.Series(model.feature_importances_,index=df_train.
#len(df_train.columns)
#model.feature_importances_
#df_train.drop(labels= 'Survived', axis = 1).columns

```

In [417]:
```
#feat_importances = pd.Series(model.feature_importances_,index=df_trai
feat_importances.nlargest(25).plot(kind='barh')
plt.show()
```



In [463]:
```
y_pred = model.predict(X_test)
accuracy_score(y_test, y_pred)

```

Out[463]:
```
0.8101694915254237
```

In [454]:
```
modelgc = GradientBoostingClassifier()
modelgc.fit(X_train, y_train)

```

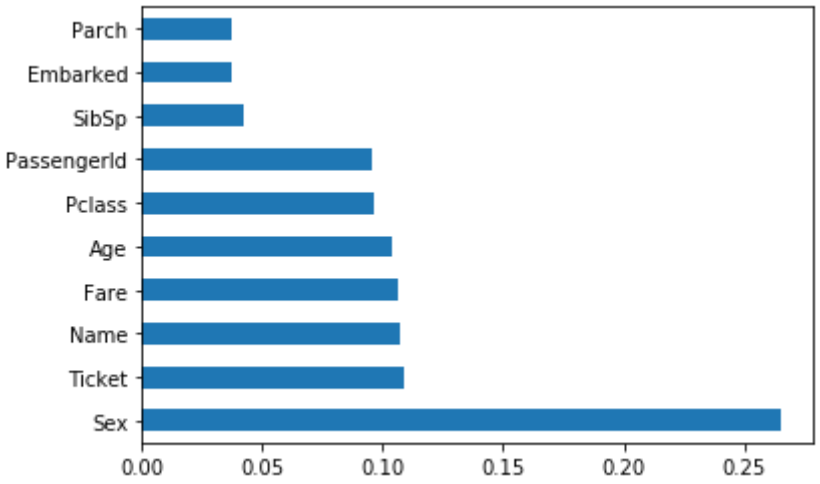
Out[454]:
```
GradientBoostingClassifier(criterion='friedman_mse', init=None,
                           learning_rate=0.1, loss='deviance', max_depth=
3,
                           max_features=None, max_leaf_nodes=None,
                           min_impurity_decrease=0.0, min_impurity_split=
None,
                           min_samples_leaf=1, min_samples_split=2,
                           min_weight_fraction_leaf=0.0, n_estimators=10
0,
                           n_iter_no_change=None, presort='auto',
                           random_state=None, subsample=1.0, tol=0.0001,
                           validation_fraction=0.1, verbose=0,
                           warm_start=False)
```

In [482]:
```
y_predgc = modelgc.predict(X_test)
accuracy_score(y_test, y_pred)

```

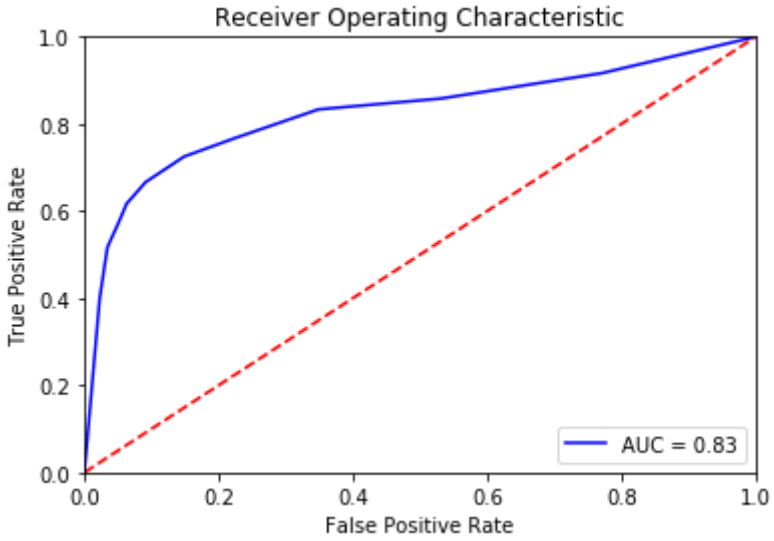
Out[482]: 0.8101694915254237

In [484]:
```
#feat_importances = pd.Series(modelgc.feature_importances_,index=df_tra
#df_train
```

In [469]:
```
feat_importances.nlargest(25).plot(kind='barh')
plt.show()
```



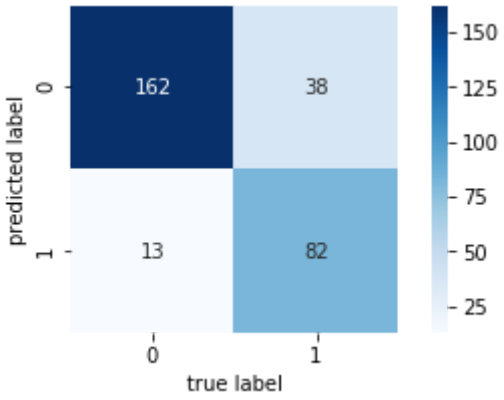
In [470]:
```
import sklearn.metrics as metrics
# calculate the fpr and tpr for all thresholds of the classification
probs = modelgc.predict_proba(X_test)
#preds = probs[:,1]
fpr, tpr, threshold = metrics.roc_curve(y_test, preds)
roc_auc = metrics.auc(fpr, tpr)


# method I: plt
plt.title('Receiver Operating Characteristic')
plt.plot(fpr, tpr, 'b', label = 'AUC = %0.2f' % roc_auc)
plt.legend(loc = 'lower right')
plt.plot([0, 1], [0, 1],'r--')
plt.xlim([0, 1])
plt.ylim([0, 1])
plt.ylabel('True Positive Rate')
plt.xlabel('False Positive Rate')
plt.show()
```



In [472]:
```
y_predgc
```

Out[472]:
```
array([0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 0, 1, 1, 0, 0, 1,
       0, 0, 0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0,
       1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0,
       0, 1, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0,
       0, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0,
       0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0,
       1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 1, 0,
       0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 1,
       0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0,
       0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0,
       1, 0, 1, 1, 0, 0, 1, 1, 0])
```

In [481]:
```
from sklearn.metrics import confusion_matrix,accuracy_score

mat = confusion_matrix(y_test, y_predgc)

plt.figure(figsize=(6, 3))

sns.heatmap(mat.T, xticklabels=np.unique(y_train),
            annot=True,fmt="d",square=True, yticklabels=np.unique(y_tra
plt.xlabel('true label')
plt.ylabel('predicted label');

```



In [580]:
```
from sklearn.metrics import precision_recall_curve
from sklearn.metrics import plot_precision_recall_curve
import matplotlib.pyplot as plt

disp = plot_precision_recall_curve(modelgc, X_test, y_test)
disp.ax_.set_title('2-class Precision-Recall curve: AP={0:0.2f}'.format
```

```
---------------------------------------------------------------------------
--
ImportError                               Traceback (most recent call las
t)
<ipython-input-580-b73fd41f808d> in <module>
      1 from sklearn.metrics import precision_recall_curve
----> 2 from sklearn.metrics import plot_precision_recall_curve
      3 import matplotlib.pyplot as plt
      4
      5 disp = plot_precision_recall_curve(modelgc, X_test, y_test)

ImportError: cannot import name 'plot_precision_recall_curve' from 'sklea
rn.metrics' (/Users/shradhitsubudhi/anaconda3/envs/python37charm/lib/pyth
on3.7/site-packages/sklearn/metrics/__init__.py)
```

In [578]:
```
from sklearn import svm, datasets
from sklearn.model_selection import train_test_split
import numpy as np
random_state = np.random.RandomState(0)

# Create a simple classifier
classifier = svm.LinearSVC(random_state=random_state)
classifier.fit(X_train, y_train)
y_score = classifier.decision_function(X_test)
```

In [581]:
```
from sklearn.metrics import average_precision_score
average_precision = average_precision_score(y_test, y_score)

print('Average precision-recall score: {0:0.2f}'.format(
      average_precision))

```

```
Average precision-recall score: 0.65
```

In [582]:
```
from sklearn.metrics import precision_recall_curve
from sklearn.metrics import plot_precision_recall_curve
import matplotlib.pyplot as plt

disp = plot_precision_recall_curve(modelgc, X_test, y_test)
disp.ax_.set_title('2-class Precision-Recall curve: AP={0:0.2f}'.format
```

```
---------------------------------------------------------------------------
--
ImportError                               Traceback (most recent call las
t)
<ipython-input-582-b73fd41f808d> in <module>
      1 from sklearn.metrics import precision_recall_curve
----> 2 from sklearn.metrics import plot_precision_recall_curve
      3 import matplotlib.pyplot as plt
      4
      5 disp = plot_precision_recall_curve(modelgc, X_test, y_test)

ImportError: cannot import name 'plot_precision_recall_curve' from 'sklea
rn.metrics' (/Users/shradhitsubudhi/anaconda3/envs/python37charm/lib/pyth
on3.7/site-packages/sklearn/metrics/__init__.py)
```

In [ ]:
```

```