Credit Card Fraud Detection - Support Vector Machines

Import Libraries

In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline
```

Get the Data ¶

In [2]:

```
# loading the dataset to a Pandas DataFrame
credit_card_data = pd.read_csv('creditcard.csv')
```

In [3]:

```
credit_card_data.keys()
```

Out[3]:

```
Index(['Time', 'V1', 'V2', 'V3', 'V4', 'V5', 'V6', 'V7', 'V8', 'V9', 'V1
0',
       'V11', 'V12', 'V13', 'V14', 'V15', 'V16', 'V17', 'V18', 'V19', 'V2
0',
       'V21', 'V22', 'V23', 'V24', 'V25', 'V26', 'V27', 'V28', 'Amount',
       'Class'],
      dtype='object')
```

In [ ]:

```
# first 5 rows of the dataset
credit_card_data.head()
```

Out[4]:

	Time	V1	V2	V3	V4	V5	V6	V7	V8
0	0.0	-1.359807	-0.072781	2.536347	1.378155	-0.338321	0.462388	0.239599	0.098698
1	0.0	1.191857	0.266151	0.166480	0.448154	0.060018	-0.082361	-0.078803	0.085102
2	1.0	-1.358354	-1.340163	1.773209	0.379780	-0.503198	1.800499	0.791461	0.247676
3	1.0	-0.966272	-0.185226	1.792993	-0.863291	-0.010309	1.247203	0.237609	0.377436
4	2.0	-1.158233	0.877737	1.548718	0.403034	-0.407193	0.095921	0.592941	-0.270533

In [ ]:

```
credit_card_data.tail()
```

Out[5]:

	Time	V1	V2	V3	V4	V5	V6	V7
284802	172786.0	-11.881118	10.071785	-9.834783	-2.066656	-5.364473	-2.606837	-4.91821
284803	172787.0	-0.732789	-0.055080	2.035030	-0.738589	0.868229	1.058415	0.02433
284804	172788.0	1.919565	-0.301254	-3.249640	-0.557828	2.630515	3.031260	-0.29682
284805	172788.0	-0.240440	0.530483	0.702510	0.689799	-0.377961	0.623708	-0.68618
284806	172792.0	-0.533413	-0.189733	0.703337	-0.506271	-0.012546	-0.649617	1.57700

In [ ]:

```
# dataset informations
credit_card_data.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 284807 entries, 0 to 284806
Data columns (total 31 columns):
 #   Column  Non-Null Count   Dtype  
---  ------  --------------   -----  
 0   Time    284807 non-null  float64
 1   V1      284807 non-null  float64
 2   V2      284807 non-null  float64
 3   V3      284807 non-null  float64
 4   V4      284807 non-null  float64
 5   V5      284807 non-null  float64
 6   V6      284807 non-null  float64
 7   V7      284807 non-null  float64
 8   V8      284807 non-null  float64
 9   V9      284807 non-null  float64
 10  V10     284807 non-null  float64
 11  V11     284807 non-null  float64
 12  V12     284807 non-null  float64
 13  V13     284807 non-null  float64
 14  V14     284807 non-null  float64
 15  V15     284807 non-null  float64
 16  V16     284807 non-null  float64
 17  V17     284807 non-null  float64
 18  V18     284807 non-null  float64
 19  V19     284807 non-null  float64
 20  V20     284807 non-null  float64
 21  V21     284807 non-null  float64
 22  V22     284807 non-null  float64
 23  V23     284807 non-null  float64
 24  V24     284807 non-null  float64
 25  V25     284807 non-null  float64
 26  V26     284807 non-null  float64
 27  V27     284807 non-null  float64
 28  V28     284807 non-null  float64
 29  Amount  284807 non-null  float64
 30  Class   284807 non-null  int64  
dtypes: float64(30), int64(1)
memory usage: 67.4 MB
```

In [ ]:

```
# checking the number of missing values in each column
credit_card_data.isnull().sum()
```

Out[7]:

```
Time      0
V1        0
V2        0
V3        0
V4        0
V5        0
V6        0
V7        0
V8        0
V9        0
V10       0
V11       0
V12       0
V13       0
V14       0
V15       0
V16       0
V17       0
V18       0
V19       0
V20       0
V21       0
V22       0
V23       0
V24       0
V25       0
V26       0
V27       0
V28       0
Amount    0
Class     0
dtype: int64
```

In [ ]:

```
# distribution of legit transactions & fraudulent transactions
credit_card_data['Class'].value_counts()
```

Out[8]:

```
0    284315
1       492
Name: Class, dtype: int64
```

In [4]:

```
credit_card_data = credit_card_data.drop("Time", axis=1)
```

In [5]:

```
from sklearn import preprocessing
scaler = preprocessing.StandardScaler()
```

In [6]:

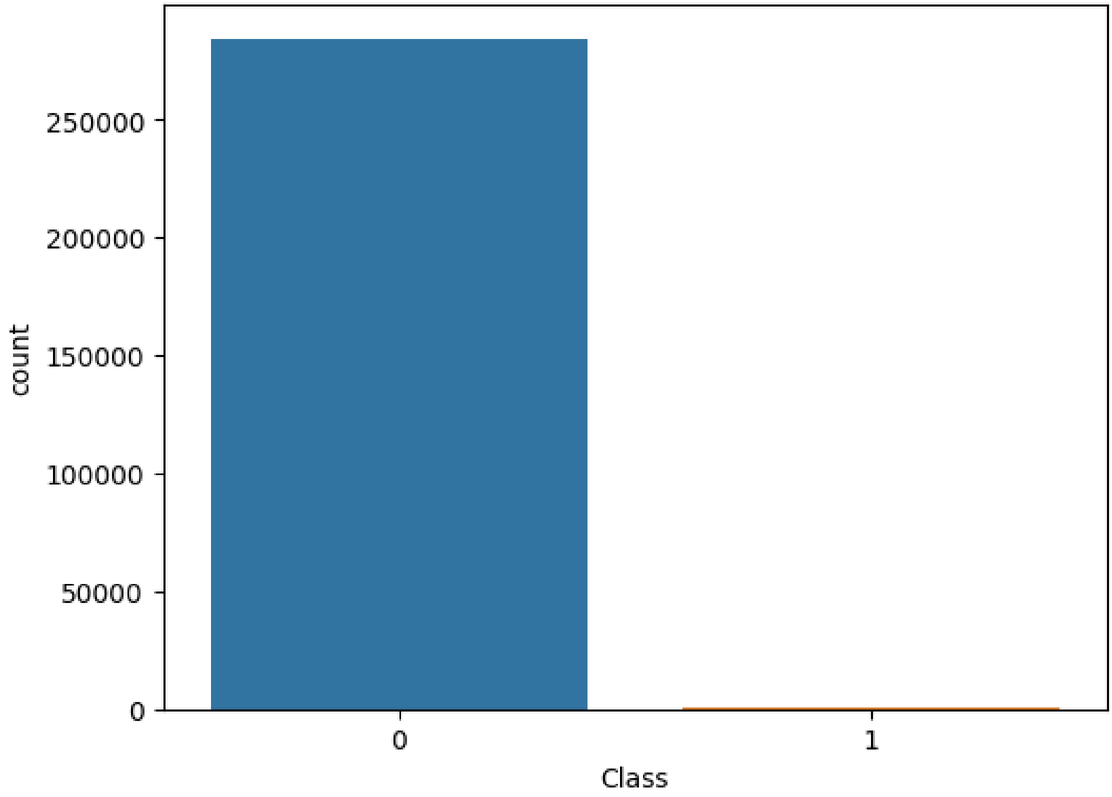
```
#standard scaling
credit_card_data['std_Amount'] = scaler.fit_transform(credit_card_data['Amount'].values.

#removing Amount
credit_card_data = credit_card_data.drop("Amount", axis=1)
```

In [7]:

```
sns.countplot(x="Class", data=credit_card_data)
```

Out[7]:

```
<Axes: xlabel='Class', ylabel='count'>
```



In [9]:

```
import imblearn
from imblearn.under_sampling import RandomUnderSampler

undersample = RandomUnderSampler(sampling_strategy=0.5)
```

In [10]:

```
cols = credit_card_data.columns.tolist()
cols = [c for c in cols if c not in ["Class"]]
target = "Class"
```

In [11]:

```
#define X and Y
X = credit_card_data[cols]
Y = credit_card_data[target]

#undersample
X_under, Y_under = undersample.fit_resample(X, Y)
```

In [12]:

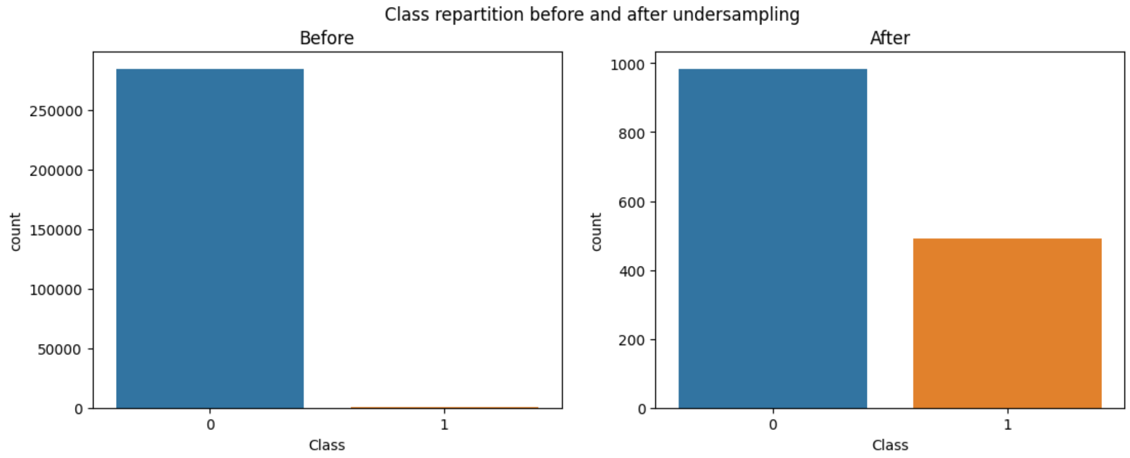
```
from pandas import DataFrame
test = pd.DataFrame(Y_under, columns = ['Class'])
```

In [14]:

```
#visualizing undersampling results
fig, axs = plt.subplots(ncols=2, figsize=(13,4.5))
sns.countplot(x="Class", data=credit_card_data, ax=axs[0])
sns.countplot(x="Class", data=test, ax=axs[1])

fig.suptitle("Class repartition before and after undersampling")
a1=fig.axes[0]
a1.set_title("Before")
a2=fig.axes[1]
a2.set_title("After")
```

Out[14]:

```
Text(0.5, 1.0, 'After')
```



Train Test Split

In [15]:

```
from sklearn.model_selection import train_test_split

X_train, X_test, y_train, y_test = train_test_split(X_under, Y_under, test_size=0.2, rar
```

Support Vector Machine

In [22]:

```
from sklearn.svm import SVC

from sklearn import metrics
from sklearn.metrics import confusion_matrix
from sklearn.metrics import roc_curve
from sklearn.metrics import roc_auc_score
from sklearn.metrics import auc
from sklearn.metrics import precision_recall_curve
```

In [23]:

```
model = SVC()
```

In [24]:

```
model.fit(X_train,y_train)
```

Out[24]:

```
SVC()
```

In a Jupyter environment, please rerun this cell to show the HTML representation or trust the notebook.
On GitHub, the HTML representation is unable to render, please try loading this page with nbviewer.org.

In [25]:

```
#train the model
model2 = SVC(probability=True, random_state=2)
svm = model2.fit(X_train, y_train)
```

In [26]:

```
#predictions
y_pred_svm = model2.predict(X_test)
```

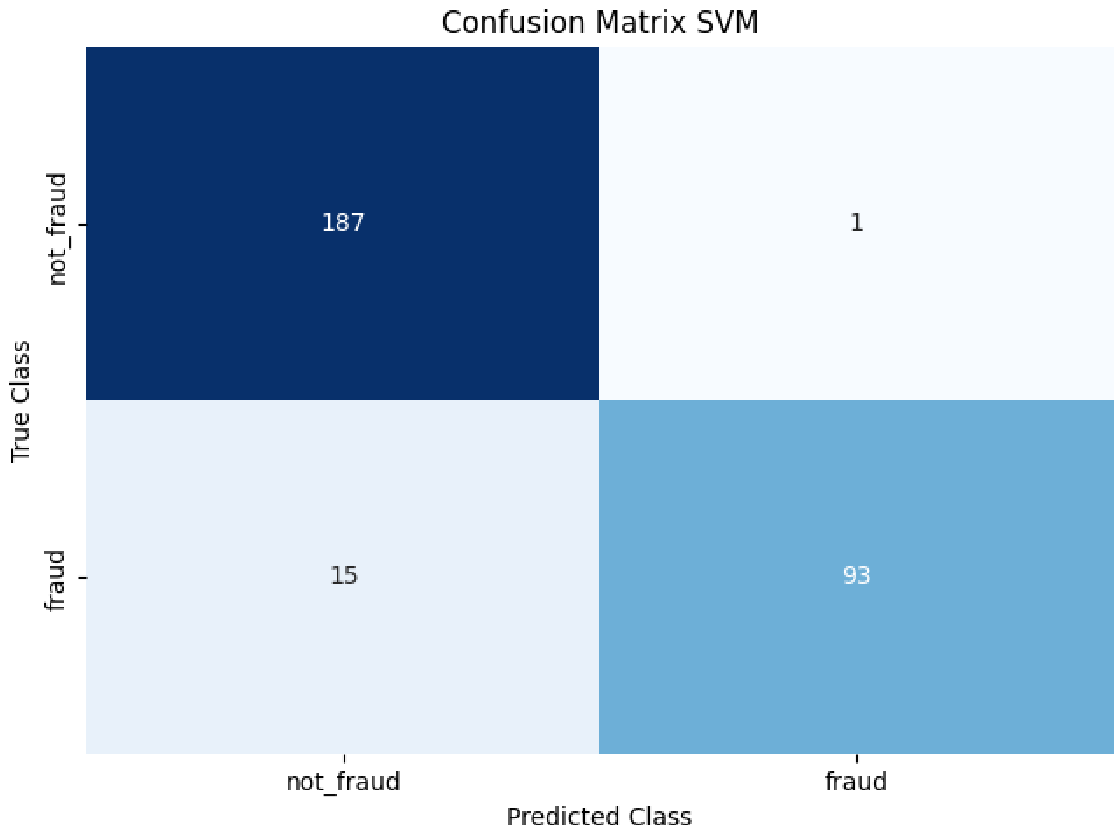
In [27]:

```
#scores
print("Accuracy SVM:",metrics.accuracy_score(y_test, y_pred_svm))
print("Precision SVM:",metrics.precision_score(y_test, y_pred_svm))
print("Recall SVM:",metrics.recall_score(y_test, y_pred_svm))
print("F1 Score SVM:",metrics.f1_score(y_test, y_pred_svm))
```

```
Accuracy SVM: 0.9459459459459459
Precision SVM: 0.9893617021276596
Recall SVM: 0.8611111111111112
F1 Score SVM: 0.9207920792079208
```

In [28]:

```
#CM matrix
matrix_svm = confusion_matrix(y_test, y_pred_svm)
cm_svm = pd.DataFrame(matrix_svm, index=['not_fraud', 'fraud'], columns=['not_fraud', 'f

sns.heatmap(cm_svm, annot=True, cbar=None, cmap="Blues", fmt = 'g')
plt.title("Confusion Matrix SVM"), plt.tight_layout()
plt.ylabel("True Class"), plt.xlabel("Predicted Class")
plt.show()
```



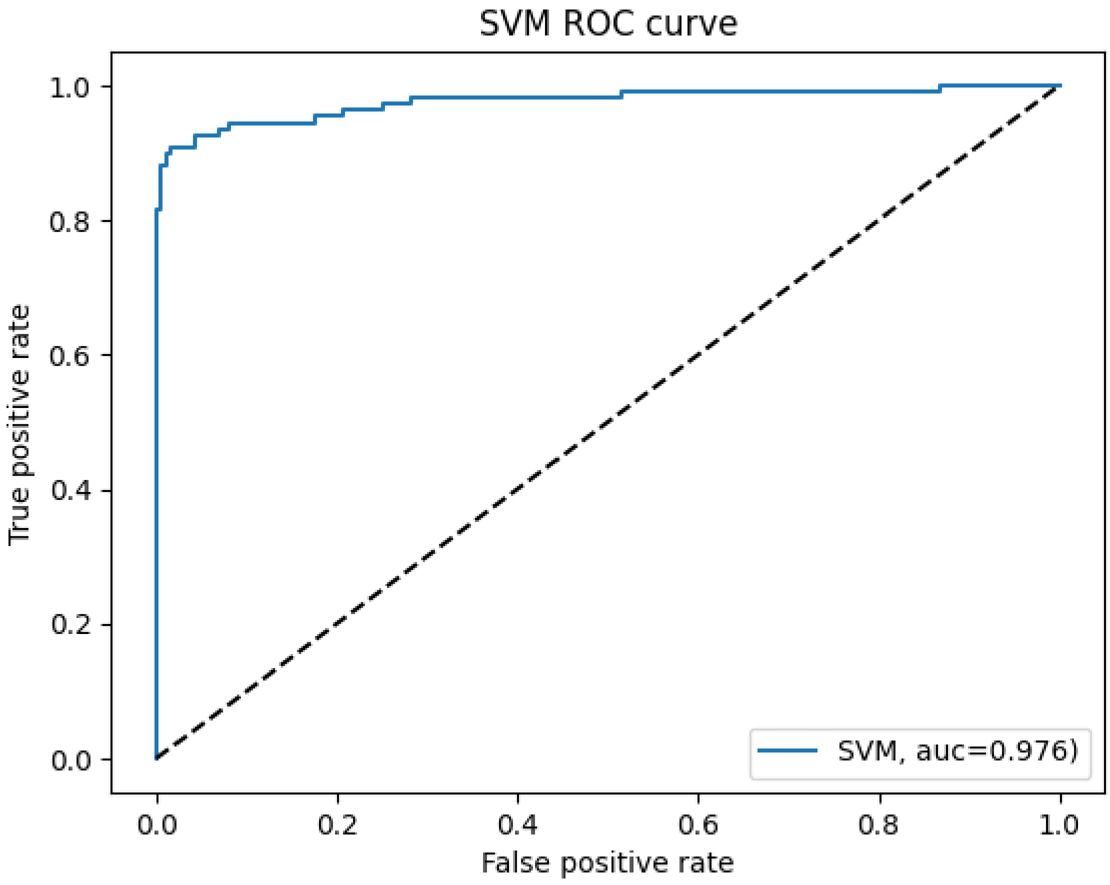
In [29]:

```
#AUC
y_pred_svm_proba = model2.predict_proba(X_test)[::,1]
fpr_svm, tpr_svm, _ = metrics.roc_curve(y_test,  y_pred_svm_proba)
auc_svm = metrics.roc_auc_score(y_test, y_pred_svm_proba)
print("AUC SVM :", auc_svm)
```

```
AUC SVM : 0.9758668242710796
```

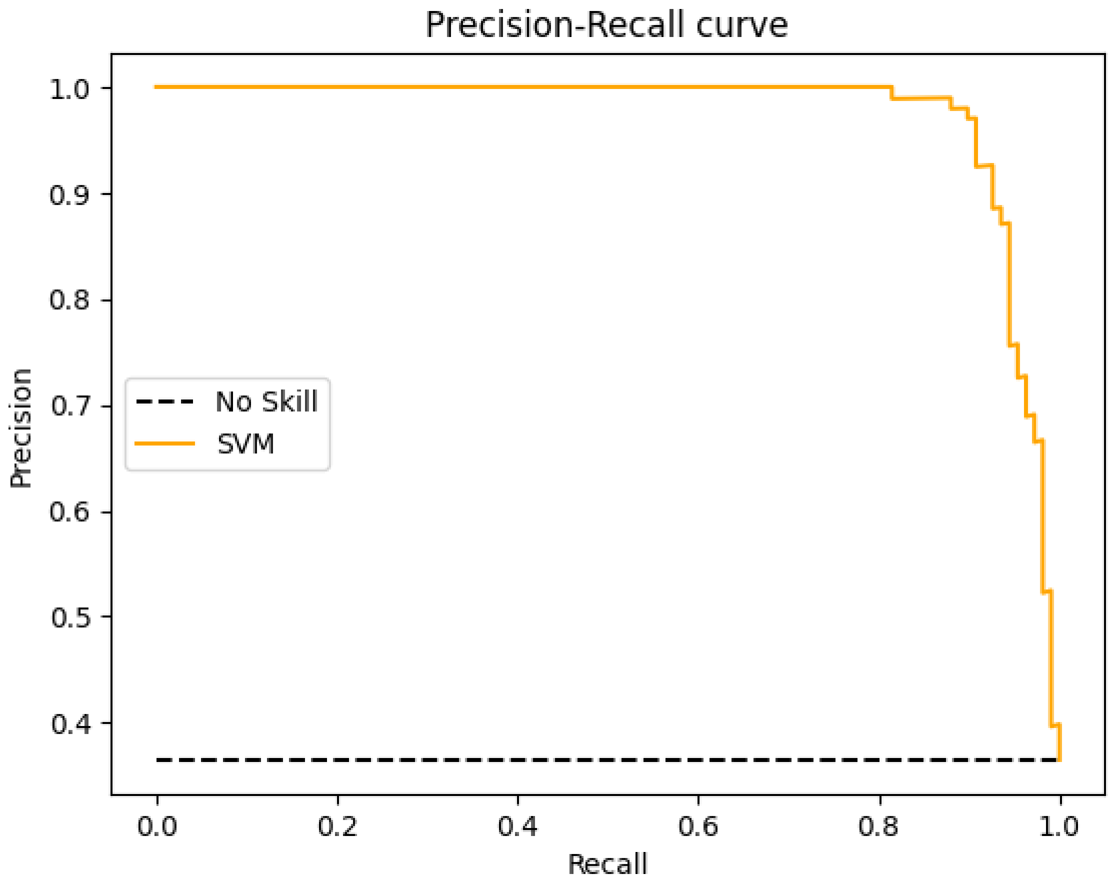
In [30]:

```
#ROC
plt.plot(fpr_svm,tpr_svm,label="SVM, auc={:.3f})".format(auc_svm))
plt.plot([0, 1], [0, 1], 'k--')
plt.xlabel('False positive rate')
plt.ylabel('True positive rate')
plt.title('SVM ROC curve')
plt.legend(loc=4)
plt.show()
```



In [31]:

```
svm_precision, svm_recall, _ = precision_recall_curve(y_test, y_pred_svm_proba)
no_skill = len(y_test[y_test==1]) / len(y_test)
plt.plot([0, 1], [no_skill, no_skill], linestyle='--', color='black', label='No Skill')
plt.plot(svm_recall, svm_precision, color='orange', label='SVM')
plt.xlabel('Recall')
plt.ylabel('Precision')
plt.title('Precision-Recall curve')
plt.legend()
plt.show()
```



In [ ]: