

TO START

```
# IMPORT DATA LIBRARIES
import pandas as pd
import numpy as np

# IMPORT VIS LIBRARIES
import matplotlib.pyplot as plt
import seaborn as sns
%matplotlib inline

# IMPORT MODELLING LIBRARIES
from sklearn.model_selection import train_test_split
from sklearn.svm import SVC
from sklearn.metrics import classification_report, confusion_matrix
```

TRAIN MODEL

□ SPLIT DATASET

```
X = df[['col1','col2',etc.]]          create df features
y = df['col']                        create df var to predict
X_train, X_test, y_train, y_test =   split df in train and test df
train_test_split(
    X,
    y,
    test_size=0.3)
```

... FIT THE MODEL

```
svc= SVC()                          instantiate model
svc.fit(X_train,y_train)             train/fit the model
```

◎ MAKE PREDICTIONS

```
pred = svm.predict(X_test)
```

✓ EVALUATE MODEL

```
print(confusion_matrix(y_test,pred))
print(classification_report(y_test,pred))
```

GRID SEARCH EXPLANATION

Finding the right parameters (like what C or gamma values to use) is a tricky task! But luckily, we can be a little lazy and just try a bunch of combinations and see what works best! This idea of creating a 'grid' of parameters and just trying out all the possible combinations is called a Gridsearch, this method is common enough that Scikit-learn has this functionality built-in with GridSearchCV! The CV stands for cross-validation which is the GridSearchCV takes a dictionary that describes the parameters that should be tried and a model to train. The grid of parameters is defined as a dictionary, where the keys are the parameters and the values are the settings to be tested..

C is the parameter for the soft margin cost function, which controls the influence of each individual support vector; this process involves trading error penalty for stability. C is the **cost of misclassification of training examples** against the simplicity of the decision surface. A **large C** gives low bias and high variance. Low bias because you penalize the cost of misclassification a lot. A **small C** gives you higher bias and lower variance.

Gamma is the parameter of a **Gaussian Kernel** (to handle non-linear classification). Gamma **controls the shape of the "peaks"** where you raise the points. A small gamma gives a pointed bump in the higher dimensions, a large gamma gives a softer, broader bump. So a **small gamma** will give you low bias and high variance while a **large gamma** will give you higher bias and low variance. You usually find the best C and Gamma hyper-parameters using Grid-Search.

Kernel will decide the hyperplane you will use to divide the points.

Refit an estimator using the best-found parameters on the whole dataset.

Verbose controls the verbosity: the higher, the more messages.

SVM parameters

Following table should sum up the explanation for an SVM-

| | Large Gamma | Small Gamma | Large C | Small C |
|----------|-------------|-------------|---------|---------|
| Variance | Low | High | High | Low |
| Bias | High | Low | Low | High |

The art is to choose a model with optimum variance and bias. Therefore you need to choose the values of C and Gamma accordingly.



By [DarioPittera \(aggialavura\)](#)

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cheatography.com/aggialavura/
www.dariopittera.com

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GRID SEARCH

```
from sklearn.model_selection import GridSearchCV
import GridSearch

param_grid = {
    'C': [0.1, 1, 10, 100, 1000],
    'gamma': [1, 0.1, 0.01, 0.001, 0.0001],
    'kernel': ['rbf']}

grid = GridSearchCV(
    SVC(),
    param_grid,
    refit=True,
    verbose=3)

grid.fit(X_train, y_train)

grid.best_params_

grid.best_estimator_

grid_predictions = grid.predict(X_test)

print(confusion_matrix(y_test, grid_predictions))

print(classification_report(y_test, grid_predictions))
```



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