

## **Neural Networks Assignment 3**

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### **Support Vector Machines using Arcene dataset :**

#### **Libraries Used :**

```
from sklearn.svm import SVC
from sklearn.metrics import accuracy_score
from sklearn.preprocessing import MinMaxScaler
from sklearn.decomposition import PCA
from sklearn.model_selection import cross_val_score
from sklearn.model_selection import GridSearchCV
from sklearn.datasets import fetch_mldata
    Fetching the data from MNIST database
import numpy as np
    Numericals
from sklearn.metrics import confusion_matrix
    Confusion matrix
from sklearn.metrics import classification_report
    Classification report
from sklearn.model_selection import train_test_split
    For splitting the data into training, testing, validation of the Arcene dataset
import timeit
    For calculating the time required for the program execution
```

#### **Configuration of the PC :**

Processor - Core i5 6th Gen  
RAM - 12 GB  
Executed on Pycharm

## Output :

```
/home/raghu/PycharmProjects/Ass3/venv/bin/python
/home/raghu/PycharmProjects/Ass3/NN3.py
/home/raghu/PycharmProjects/Ass3/venv/lib/python3.6/site-packages/sklearn/externals/
joblib/externals/cloudpickle/cloudpickle.py:47: DeprecationWarning: the imp module is
deprecated in favour of importlib; see the module's documentation for alternative uses
import imp
# Tuning hyper-parameters for precision
```

```
/home/raghu/PycharmProjects/Ass3/venv/lib/python3.6/site-packages/sklearn/model_se
lection/_search.py:841: DeprecationWarning: The default of the `iid` parameter will
change from True to False in version 0.22 and will be removed in 0.24. This will change
numeric results when test-set sizes are unequal.
```

DeprecationWarning)

Best parameters set found on development set:

```
{'C': 1, 'kernel': 'linear'}
```

Grid scores on development set:

```
0.911 (+/-0.106) for {'C': 1, 'kernel': 'linear'}
0.911 (+/-0.106) for {'C': 10, 'kernel': 'linear'}
0.911 (+/-0.106) for {'C': 100, 'kernel': 'linear'}
0.911 (+/-0.106) for {'C': 1000, 'kernel': 'linear'}
0.911 (+/-0.106) for {'C': 10000, 'kernel': 'linear'}
0.280 (+/-0.012) for {'C': 1, 'gamma': 0.001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 1, 'gamma': 0.0001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 10, 'gamma': 0.001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 10, 'gamma': 0.0001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 100, 'gamma': 0.001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 100, 'gamma': 0.0001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 1000, 'gamma': 0.0001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 10000, 'gamma': 0.001, 'kernel': 'rbf'}
0.280 (+/-0.012) for {'C': 10000, 'gamma': 0.0001, 'kernel': 'rbf'}
```

Detailed classification report:

The model is trained on the full development set.  
The scores are computed on the full evaluation set.

	precision	recall	f1-score	support	
-1	0.82	0.89	0.85	56	
1	0.85	0.75	0.80	44	
micro avg		0.83	0.83	0.83	100
macro avg		0.83	0.82	0.82	100
weighted avg		0.83	0.83	0.83	100

Final accuracy = 0.83

# Tuning hyper-parameters for recall

/home/raghu/PycharmProjects/Ass3/venv/lib/python3.6/site-packages/sklearn/model\_selection/\_search.py:841: DeprecationWarning: The default of the `iid` parameter will change from True to False in version 0.22 and will be removed in 0.24. This will change numeric results when test-set sizes are unequal.

DeprecationWarning)

Best parameters set found on development set:

{'C': 1, 'kernel': 'linear'}

Grid scores on development set:

0.898 (+/-0.112) for {'C': 1, 'kernel': 'linear'}  
0.898 (+/-0.112) for {'C': 10, 'kernel': 'linear'}  
0.898 (+/-0.112) for {'C': 100, 'kernel': 'linear'}  
0.898 (+/-0.112) for {'C': 1000, 'kernel': 'linear'}  
0.898 (+/-0.112) for {'C': 10000, 'kernel': 'linear'}  
0.500 (+/-0.000) for {'C': 1, 'gamma': 0.001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 1, 'gamma': 0.0001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 10, 'gamma': 0.001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 10, 'gamma': 0.0001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 100, 'gamma': 0.001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 100, 'gamma': 0.0001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 1000, 'gamma': 0.0001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 10000, 'gamma': 0.001, 'kernel': 'rbf'}  
0.500 (+/-0.000) for {'C': 10000, 'gamma': 0.0001, 'kernel': 'rbf'}

Detailed classification report:

The model is trained on the full development set.

The scores are computed on the full evaluation set.

	precision	recall	f1-score	support
-1	0.82	0.89	0.85	56
1	0.85	0.75	0.80	44
micro avg		0.83	0.83	100
macro avg		0.83	0.82	100
weighted avg		0.83	0.83	100

Final accuracy = 0.83

Number of support Vectors = 90

Number of support vectors for each class: [52 38]

The margin support vectors = 90

The non-margin support vectors = 0

# Tuning hyper-parameters for precision

Process finished with exit code 137 (interrupted by signal 9: SIGKILL)