Dataset A (Crime Rates) + SVM

Hannah LeBlanc CISC873

SVR to SVC

pandas.qcut

`pandas.qcut`(*x*, *q*, *labels=None*, *retbins=False*, *precision=3*, *duplicates='raise'*) [source]

> Quantile-based discretization function. Discretize variable into equal-sized buckets based on rank or based on sample quantiles. For example 1000 values for 10 quantiles would produce a Categorical object indicating quantile membership for each data point.

[6.2   165.55 301.75 536.6   1777.]

4 Classes

Property Crime

	precision	recall	f1-score	support
1	0.64	0.39	0.49	126
2	0.33	0.37	0.35	126
3	0.31	0.46	0.37	126
4	0.53	0.44	0.48	126
avg / total	0.46	0.41	0.42	504

Accuracy: 0.4146825396825397

Burglary

	precision	recall	f1-score	support
1	0.61	0.56	0.59	126
2	0.37	0.17	0.24	126
3	0.34	0.62	0.44	126
4	0.60	0.48	0.54	126
avg / total	0.48	0.46	0.45	504

Accuracy: 0.4603174603174603

Larceny Theft

	precision	recall	f1-score	support
1	0.56	0.57	0.56	126
2	0.30	0.20	0.24	126
3	0.32	0.23	0.27	126
4	0.46	0.73	0.57	126
avg / total	0.41	0.43	0.41	504

Accuracy: 0.43253968253968256

Motor Vehicle

	precision	recall	f1-score	support
1	0.55	0.50	0.52	126
2	0.29	0.40	0.34	126
3	0.34	0.37	0.35	126
4	0.56	0.37	0.45	126
avg / total	0.44	0.41	0.42	504

Accuracy: 0.4087301587301587

Robbery

	precision	recall	f1-score	support
1	0.64	0.54	0.58	127
2	0.36	0.21	0.26	125
3	0.36	0.72	0.48	127
4	0.79	0.46	0.58	125
avg / total	0.54	0.48	0.48	504

Accuracy: 0.4801587301587302

Feature Selection & Grid Search

	Features	Parameters	Results

Robbery	14	{'C': 100, 'kernel': 'linear'}	Accuracy: 0.58
			
			           precision recall f1-score support
			    1 0.75 0.73 0.74 41
			    2 0.47 0.56 0.51 39
			    3 0.42 0.37 0.39 38
			    4 0.69 0.65 0.67 34
			
			avg / total 0.58 0.58 0.58 152
			
			`[[30  9  2  0]`
			`[ 9 22  6  2]`
			`[ 1 15 14  8]`
			`[ 0  1 11 22]]`

Property	8	{'C': 10, 'kernel': 'linear'}	Accuracy: 0.43
			
			           precision recall f1-score support
			    1 0.59 0.46 0.52 41
			    2 0.36 0.32 0.34 37
			    3 0.31 0.35 0.33 40
			    4 0.50 0.62 0.55 34
			
			avg / total 0.44 0.43 0.43 152
			
			`[[19 11  9  2]`
			`[ 8 12 13  4]`
			`[ 5  6 14 15]`
			`[ 0  4  9 21]]`

Larceny	19	{'C': 10, 'kernel': 'linear'}	Accuracy: 0.48
			
			           precision recall f1-score support
			    1 0.57 0.60 0.59 40
			    2 0.37 0.38 0.38 34
			    3 0.45 0.35 0.39 43
			    4 0.50 0.60 0.55 35
			
			avg / total 0.48 0.48 0.48 152
			
			`[[24  8  6  2]`
			`[11 13  3  7]`
			`[ 5 11 15 12]`
			`[ 2  3  9 21]]`

Motor Vehicle	67	{'C': 10, 'kernel': 'linear'}	Accuracy: 0.53
			
			           precision recall f1-score support
			    1 0.55 0.67 0.60 36
			    2 0.39 0.42 0.41 38
			    3 0.52 0.44 0.47 39
			    4 0.68 0.59 0.63 39
			
			avg / total 0.53 0.53 0.53 152
			
			`[[24  6  4  2]`
			`[12 16  6  4]`
			`[ 4 13 17  5]`
			`[ 4  6  6 23]]`

Burglary	5	{'C': 10, 'kernel': 'linear'}	Accuracy: 0.45
			
			           precision recall f1-score support
			    1 0.56 0.59 0.57 34
			    2 0.52 0.33 0.40 43
			    3 0.32 0.35 0.33 40
			    4 0.44 0.57 0.50 35
			
			avg / total 0.46 0.45 0.44 152
			
			`[[20  9  3  2]`
			`[12 14 13  4]`
			`[ 4  3 14 19]`
			`[ 0  1 14 20]]`

3 Classes

Property Crime

	precision	recall	f1-score	support
1	0.65	0.54	0.59	168
2	0.41	0.47	0.44	168
3	0.61	0.62	0.61	168
avg / total	0.56	0.54	0.55	504

Accuracy: 0.5436507936507936

Burglary

	precision	recall	f1-score	support
1	0.71	0.62	0.66	168
2	0.40	0.55	0.47	168
3	0.62	0.47	0.54	168
avg / total	0.58	0.55	0.55	504

Accuracy: 0.5476190476190477

Larceny Theft

	precision	recall	f1-score	support
1	0.62	0.62	0.62	168
2	0.42	0.27	0.33	168
3	0.54	0.73	0.62	168
avg / total	0.53	0.54	0.53	504

Accuracy: 0.5436507936507936

Motor Vehicle

	precision	recall	f1-score	support
1	0.66	0.53	0.59	168
2	0.38	0.51	0.43	168
3	0.55	0.46	0.50	168
avg / total	0.53	0.50	0.51	504

Accuracy: 0.501984126984127

Robbery

	precision	recall	f1-score	support
1	0.68	0.50	0.58	168
2	0.44	0.69	0.54	168
3	0.78	0.54	0.63	168
avg / total	0.63	0.58	0.58	504

Accuracy: 0.5753968253968254

Feature Selection & Grid Search

	Features	Parameters	Results

Robbery	11	{'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}	Accuracy: 0.69
			<pre> precision recall f1-score support
			       1 0.80 0.75 0.78 53
			       2 0.55 0.63 0.59 51
			       3 0.75 0.69 0.72 48
			avg / total 0.70 0.69 0.69 152</pre> `[[40 11  2]`
			`[10 32  9]`
			`[ 0 15 33]]`

Property	16	{'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}	Accuracy: 0.55
			<pre> precision recall f1-score support
			       1 0.67 0.67 0.67 54
			       2 0.36 0.33 0.35 48
			       3 0.59 0.64 0.62 50
			avg / total 0.55 0.55 0.55 152</pre> `[[36 12  6]`
			`[16 16 16]`
			`[ 2 16 32]]`

Larceny	21	{'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}	Accuracy: 0.52
			<pre> precision recall f1-score support
			       1 0.63 0.58 0.61 53
			       2 0.33 0.32 0.32 47
			       3 0.58 0.63 0.61 52
			avg / total 0.52 0.52 0.52 152</pre> `[[31 17  5]`
			`[13 15 19]`
			`[ 5 14 33]]`

Motor Vehicle	97	{'C': 100, 'gamma': 0.001, 'kernel': 'rbf'}	Accuracy: 0.57
			<pre> precision recall f1-score support
			       1 0.70 0.67 0.69 52
			       2 0.40 0.48 0.44 48
			       3 0.64 0.56 0.60 52
			avg / total 0.59 0.57 0.58 152</pre> `[[35 15  2]`
			`[11 23 14]`
			`[ 4 19 29]]`

Burglary	10	{'C': 1000, 'kernel': 'linear'}	Accuracy: 0.61
			<pre> precision recall f1-score support
			       1 0.71 0.73 0.72 48
			       2 0.55 0.49 0.52 59
			       3 0.56 0.62 0.59 45
			avg / total 0.60 0.61 0.60 152</pre> `[[35  8  5]`
			`[13 29 17]`
			`[ 1 16 28]]`

2 Classes

Robbery

	precision	recall	f1-score	support
1	0.78	0.75	0.76	252
2	0.76	0.79	0.77	252
avg / total	0.77	0.77	0.77	504

Accuracy: 0.7658730158730159

Larceny Theft

	precision	recall	f1-score	support
1	0.74	0.65	0.69	252
2	0.69	0.77	0.73	252
avg / total	0.71	0.71	0.71	504

Accuracy: 0.7103174603174603

Burglary

	precision	recall	f1-score	support
1	0.80	0.69	0.74	252
2	0.73	0.82	0.77	252
avg / total	0.76	0.76	0.76	504

Accuracy: 0.7579365079365079

Property Crime

	precision	recall	f1-score	support
1	0.77	0.67	0.71	252
2	0.71	0.80	0.75	252
avg / total	0.74	0.73	0.73	504

Accuracy: 0.7341269841269841

Motor Vehicle

	precision	recall	f1-score	support
1	0.70	0.69	0.69	252
2	0.69	0.70	0.70	252
avg / total	0.69	0.69	0.69	504

Accuracy: 0.6944444444444444

Property Crime Feature Selection & Grid Search

Optimal number of features : 31

Property_crime_rate
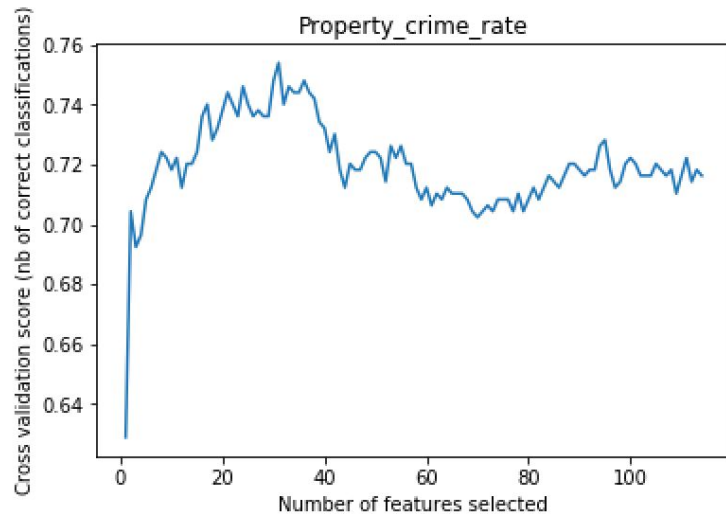
```
Accuracy:   0.76
                precision     recall    f1-score     support

          1        0.78        0.76        0.77          78
          2        0.75        0.77        0.76          74

avg / total        0.76        0.76        0.76         152

[[59 19]
 [17 57]]
```
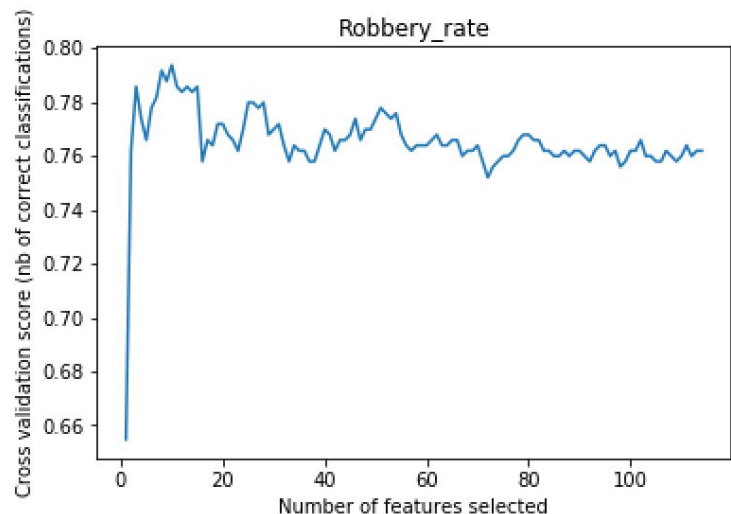
```
{'C': 1000, 'kernel': 'linear'}
```

Robbery Feature Selection & Grid Search

Optimal number of features : 10


```
Accuracy:  0.82
                 precision      recall   f1-score    support

             1     0.79          0.89      0.84          80
             2     0.85          0.74      0.79          72

avg / total        0.82          0.82      0.81         152

[[71  9]
 [19 53]]
```
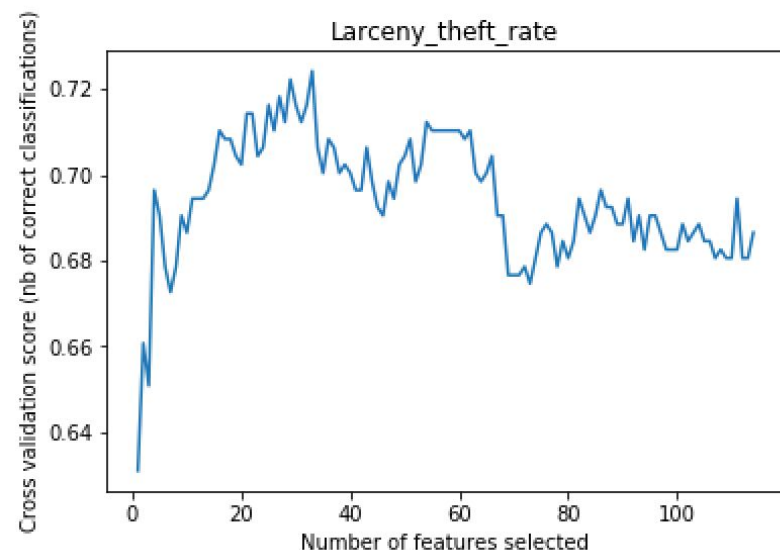
{'C': 100, 'kernel': 'linear'}

Larceny Feature Selection & Grid Search

Optimal number of features : 33

Larceny_theft_rate

```
Accuracy:  0.77
                precision    recall   f1-score    support

            1       0.77       0.74       0.76        74
            2       0.77       0.79       0.78        78

avg / total         0.77       0.77       0.77       152

[[55 19]
 [16 62]]
```
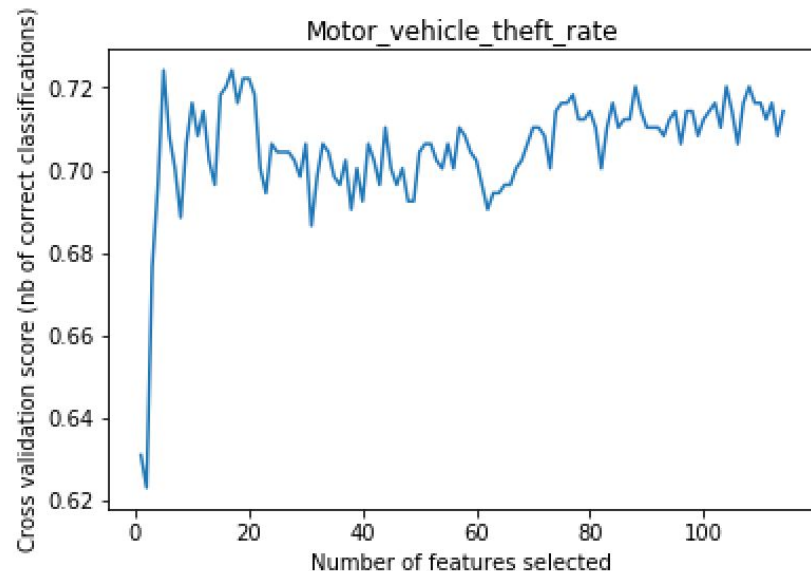
```
{'C': 10, 'kernel': 'linear'}
```

Motor Theft Feature Selection & Grid Search

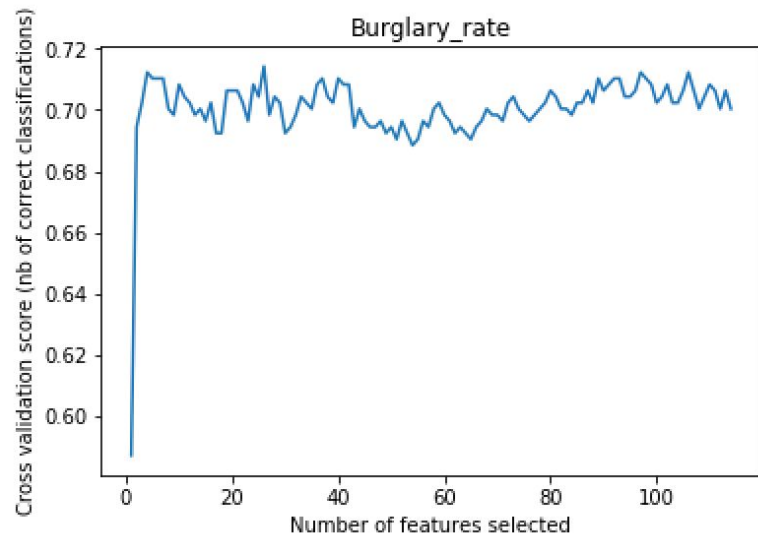Optimal number of features : 17

Accuracy: 0.78

	precision	recall	f1-score	support
1	0.76	0.80	0.78	74
2	0.80	0.76	0.78	78
avg / total	0.78	0.78	0.78	152

```
[[59 15]
 [19 59]]
```

{'C': 100, 'kernel': 'linear'}

Burglary Feature Selection & Grid Search

Optimal number of features : 26

Burglary_rate

```
Accuracy:   0.84
              precision     recall   f1-score     support

         1        0.91       0.77       0.83          77
         2        0.79       0.92       0.85          75

avg / total        0.85       0.84       0.84         152

[[59 18]
 [ 6 69]]
```

```
{'C': 1000, 'gamma': 0.001, 'kernel': 'rbf'}
```