Maximum   Margin   Classifier

$X_1$   $X_2$   $y$

| | | |
|---|---|---|
| | | 1 |
| | | 0 |
| | | 0 |
| | | 0 |
| | | 1 |
| | | 0 |
| | | 1 |
| | | 0 |
| | | 0 |
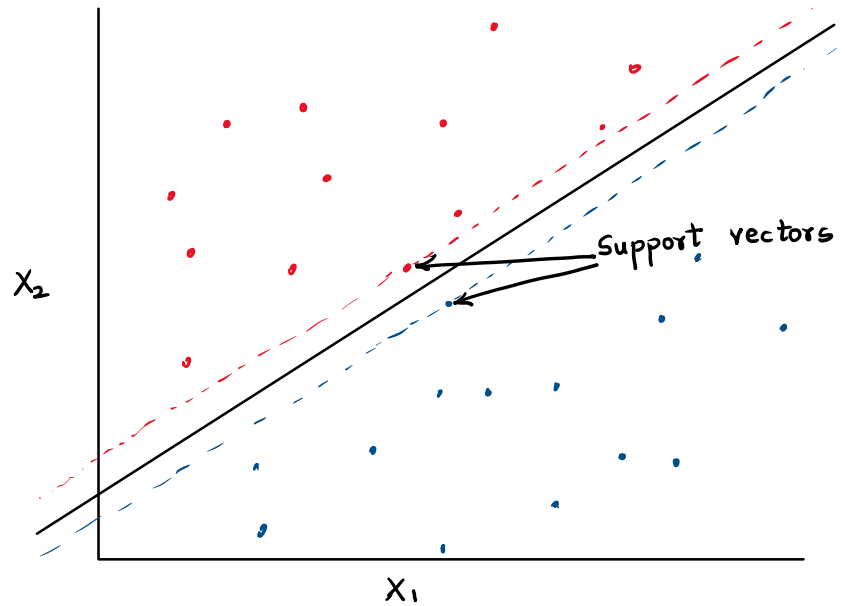


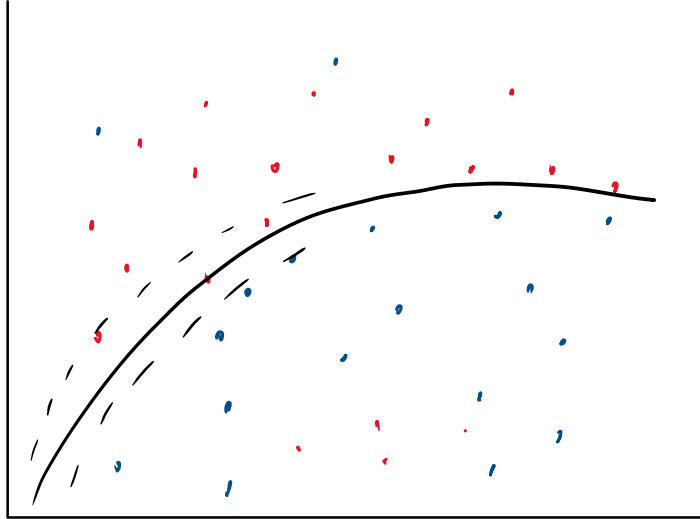$$C \propto \frac{1}{margin}$$
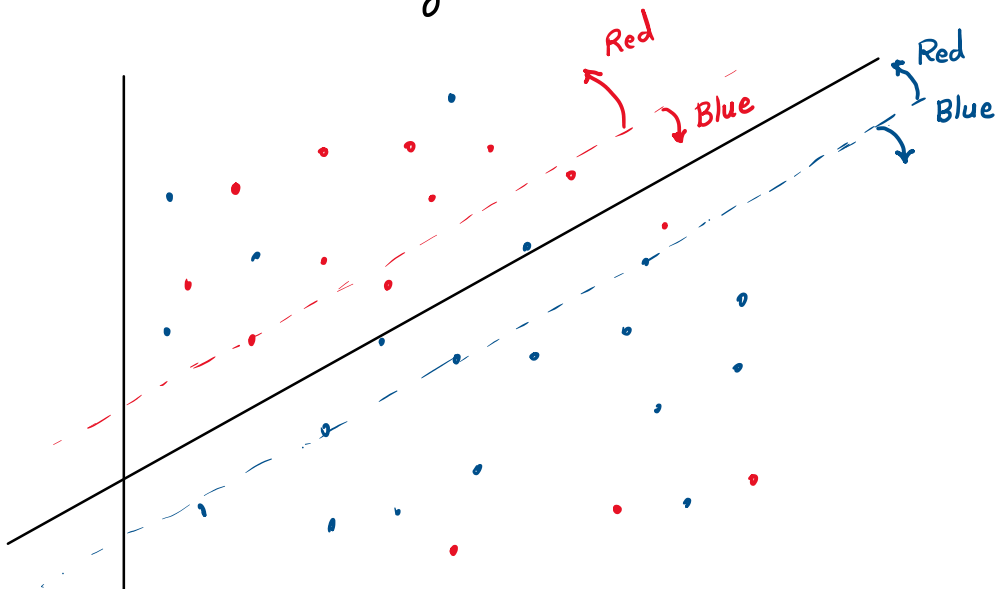


w/o scaling
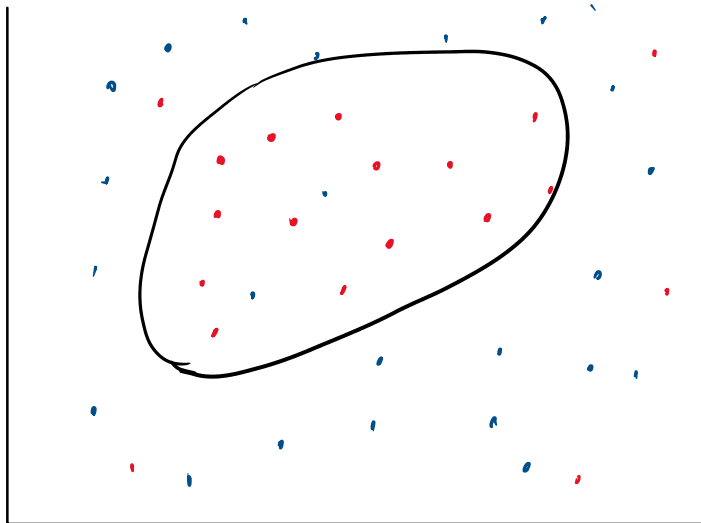{'C': 0.5357894736842106}
0.6075786282682835

With scaling
{'SCL': StandardScaler(), 'SVM__C': 10.0}
0.6278684833407471

Polynomial: $a_0 + a_1 x + a_2 x^2 + a_3 x^3 + \ldots + a_n x^n$

3rd degree: $a_0 + a_1 x + a_2 x^2 + a_3 x^3$

$$\nu \propto \frac{1}{size}$$

Training

$$\underline{y} \quad X_1 \quad X_2 \cdots X_p$$

A
A
$\cdots$  } 40 obs
A

B
B  } 30 obs
B

C
$\cdots$  } 50 obs
C

**1) OVO : One Vs One classification**

| $y \quad X_1 \cdots X_p$ | $y \quad X_1 \cdots X_p$ | $y \quad X_1 \cdots X_p$ |
|---|---|---|
| A | A | B |
| B    70 obs | C    90 obs | C    80 obs |
| $SVM_{AB}$ | $SVM_{AC}$ | $SVM_{BC}$ |

m categories $\rightarrow$ $^mC_2$ SVMs
$SVM_{AB}$  $SVM_{AC}$  $SVM_{BC}$

Testing

| $X_1 \quad X_2 \cdots X_p$ | $\hat{y}_{AB}$ | $\hat{y}_{AC}$ | $\hat{y}_{BC}$ | $\hat{y}$ |
|---|---|---|---|---|
| 1) | A | A | B | A |
| 2) | B | C | C | C |
| 3) | A | C | B | A |

$$\underline{y} \quad X_1 \quad X_2 \cdots X_p$$

A
A
$\cdots$  } 40 obs
A

B
B  } 30 obs
B

C
$\cdots$  } 50 obs
C

**2) OVR : One Vs Rest of All**

| $y \quad X_1 \cdots X_p$ | $y \quad X_1 \cdots X_p$ | $y \quad X_1 \cdots X_p$ |
|---|---|---|
| A | B | C |
| non : B or C  A | non : A or C  B | non : B or A  C |
| $SVM_A$ | $SVM_B$ | $SVM_C$ |

Testing

| $X_1 \quad X_2 \cdots X_p$ | $P(y=A)$ | $P(y=B)$ | $P(y=C)$ | $\hat{y}$ |
|---|---|---|---|---|
| | 0.8 | 0.2 | 0.9 | C |

SVR :- epsilon
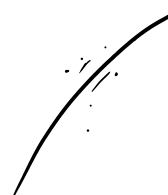
**Linear Kernel Results:**
Params: {'SCL': None, 'SVM__C': 0.26410526315789473}
Score: -0.46079499942791546
**Polynomial Kernel Results:**
Params: {'SCL': MinMaxScaler(), 'SVM__C': 0.26410526315789473, 'SVM__coef0': 3.0, 'SVM__degree': 2}
Score: -0.5097130472240468
**Radial Kernel Results:**
Params: {'SCL': MinMaxScaler(), 'SVM__C': 0.26410526315789473, 'SVM__gamma': 1.2507499999999998}
Score: -0.4809688740028147


Linear Kernel Results:
Params: {'SCL': None, 'SVM__C': 0.7903157894736842, 'SVM__decision_function_shape': 'ovo'}
Score: -0.9312604498988577
Polynomial Kernel Results:
Params: {'SCL': StandardScaler(), 'SVM__C': 0.26410526315789473, 'SVM__coef0': 3.0, 'SVM__decision_function_shape': 'ovo', 'SVM__degree': 3}
Score: -0.8912631607153948
Radial Kernel Results:
Params: {'SCL': None, 'SVM__C': 1.5796315789473683, 'SVM__decision_function_shape': 'ovo', 'SVM__gamma': 1.2507499999999998}
Score: -0.7937284699511382