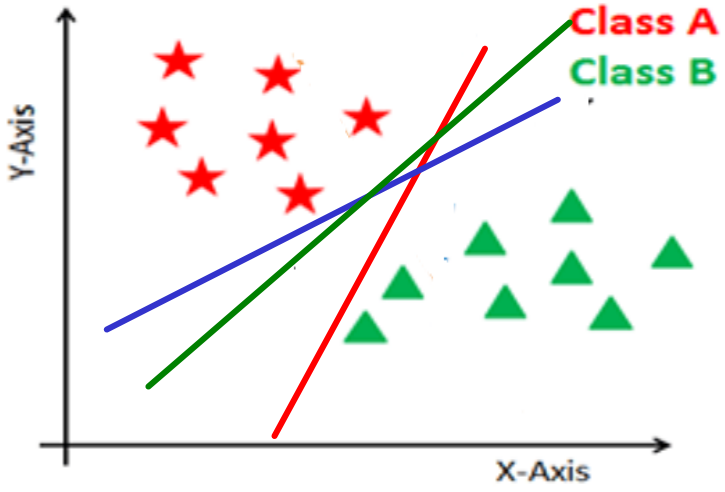
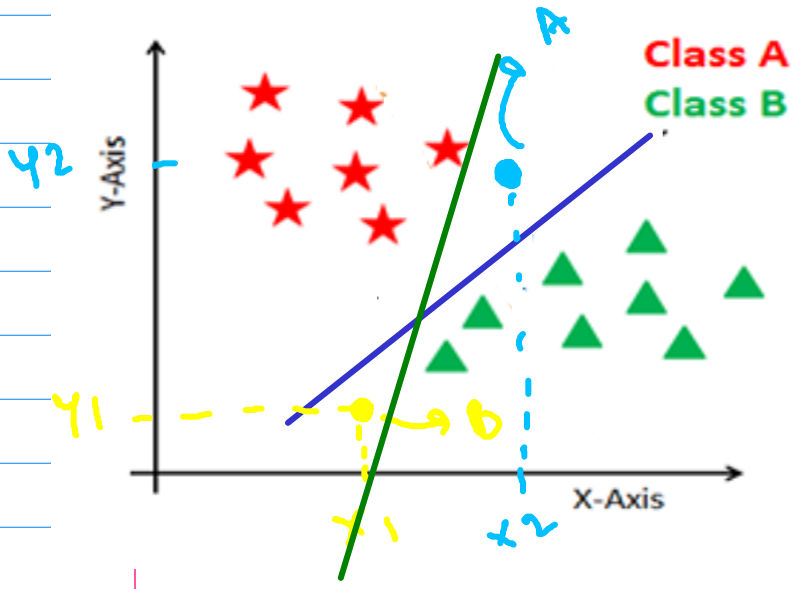
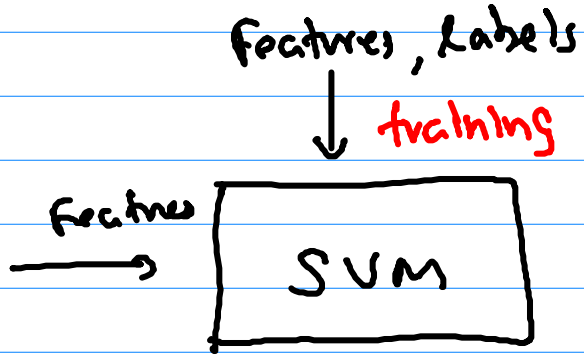


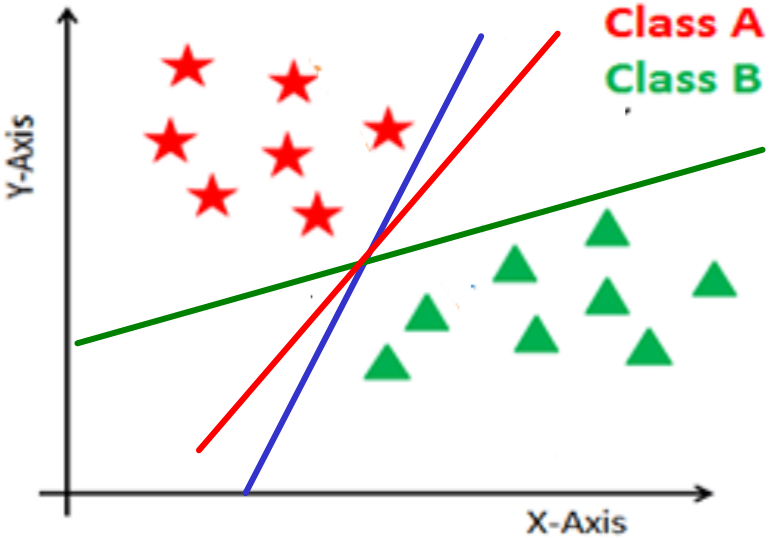
Labels → A, B

Features → X, Y

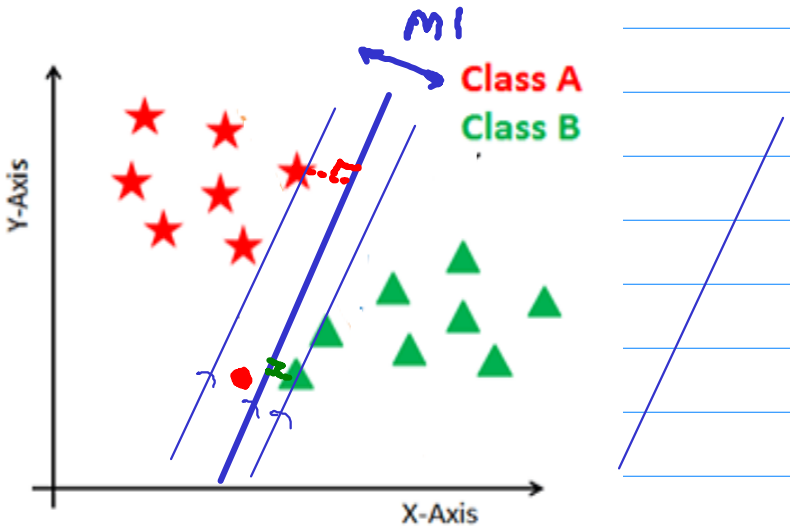




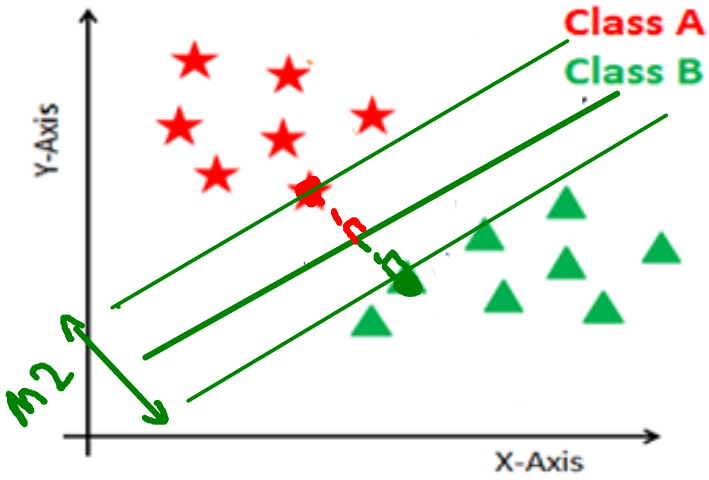
Best hyperplane



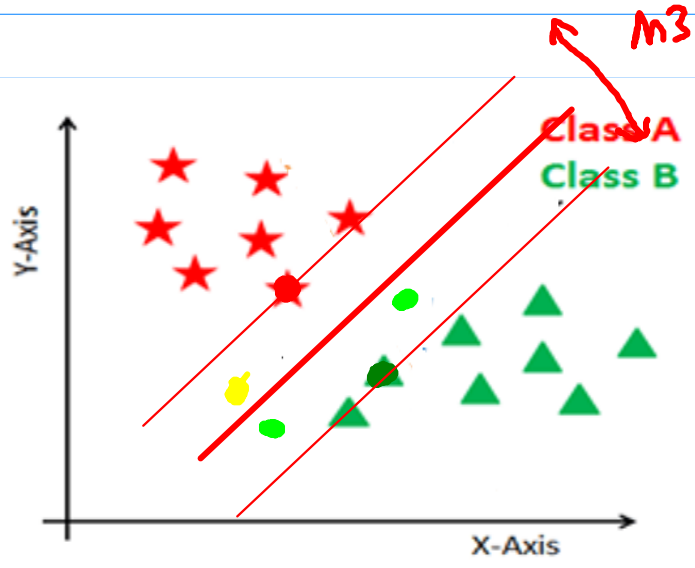
case I



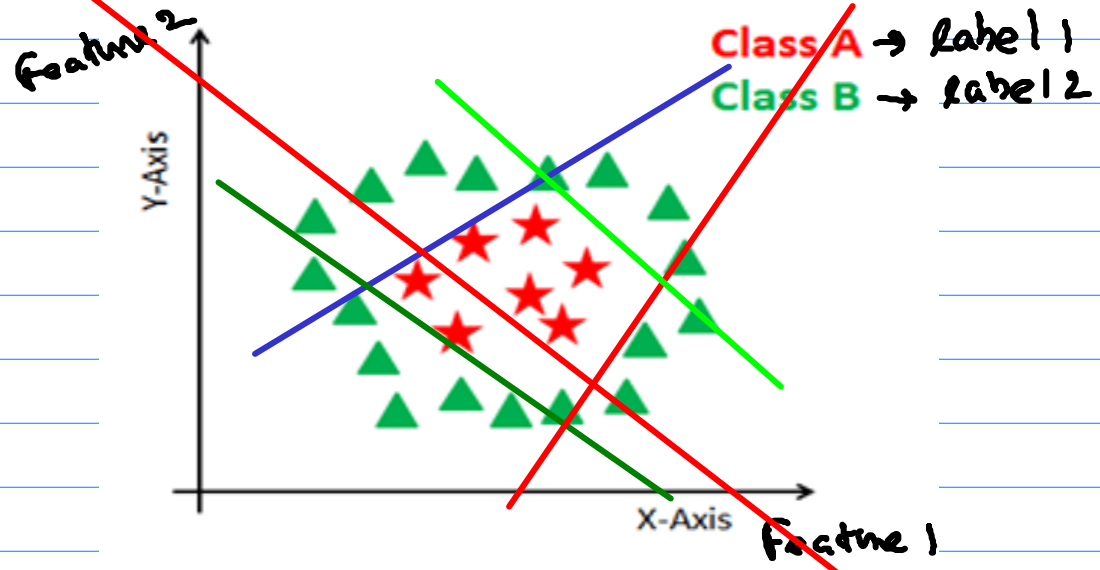
case II



case III



Non Linear Data



Kernels in SVM

x_1, x_2, x_3 → Features

* Linear

(i) Polynomial $z = a_1 x_1^{n1} + a_2 x_2^{n2} + a_3 x_3^{n3} + \ldots$

(ii) RBF (Radial Bias Function) → $e^{-(x^2+y^2)}$

(iii) Sigmoid

(iv) Hyperbolic Tangent (tanh)

} Discussed under Neural Networks

```
from sklearn.datasets.samples_generator import make_circles

data,target=make_circles(100)
```

data → (points)

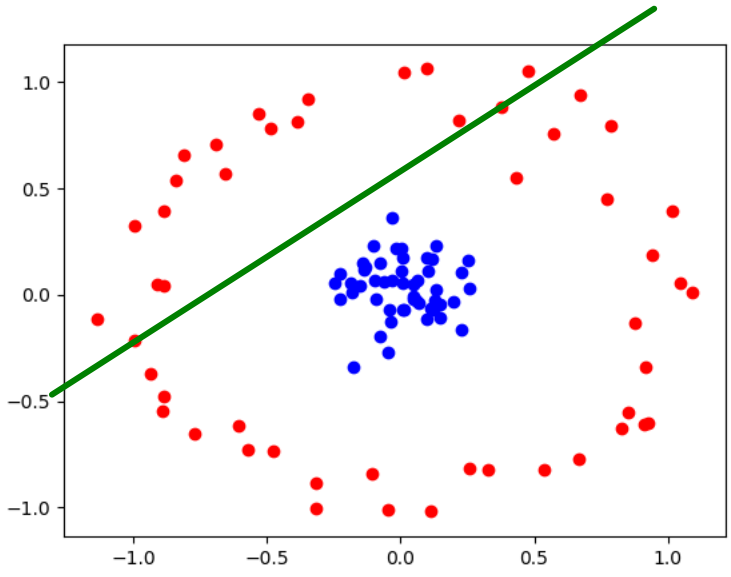
0	1
x	y
x_1	y_1
x_2	y_2
⋮	
x_{100}	y_{100}

target

0
0
⋮
0

target → 0 inner circle
1 outer circle

Linear Kernel



```
clsfr=SVC(kernel='poly',degree=2)
```

$x, y \leftarrow$ Features

General Form

Higher Dimension (z) $= a_1x + a_2y + a_3x^2 + a_4y^2 + c$

ex → $2x^2 + 3y^2$ ($a_1, a_2 = 0, a_3 = 2, a_4 = 3$)

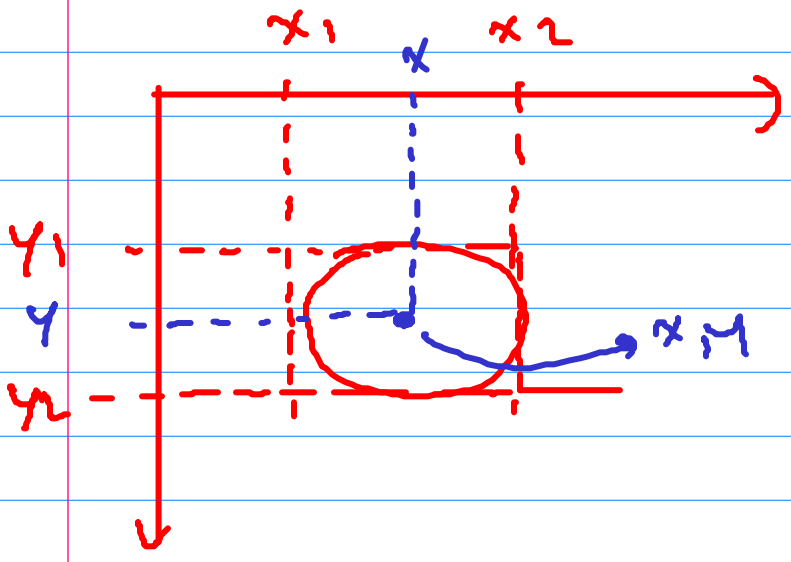
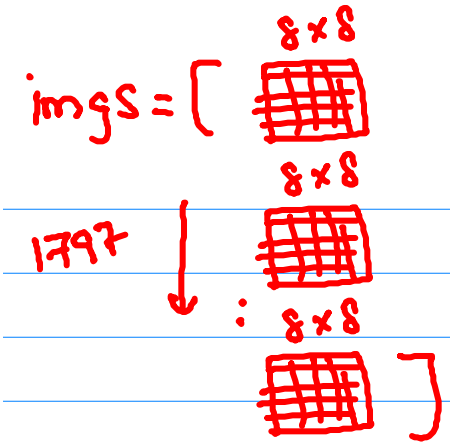
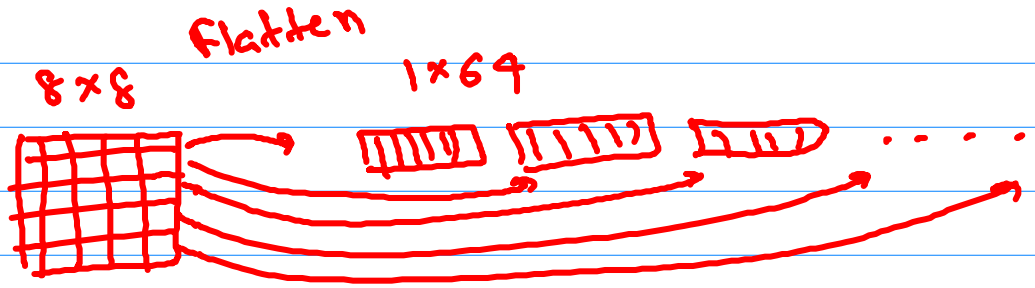
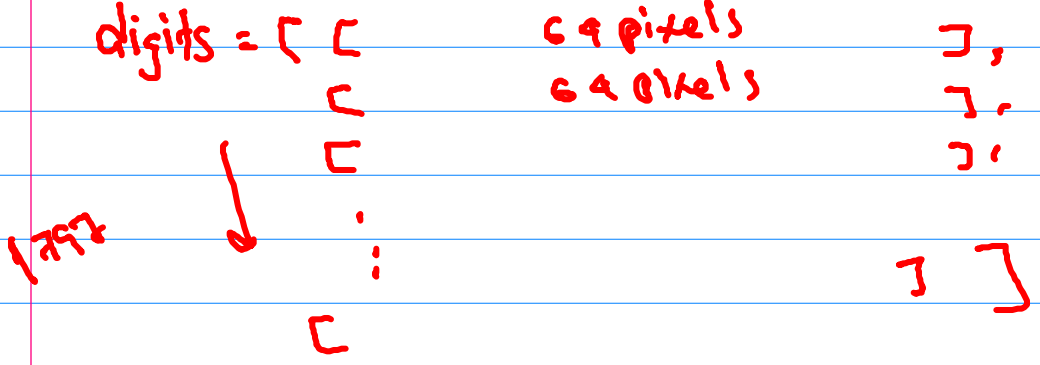
```
clsfr=SVC(kernel='rbf')
```

$z = e^{-(x^2+y^2)}$

Tkinter widgets

1. Button — OK
2. Scale
3. Label — Hello world
4. Spinner 2
5. Radio Buttons — maths, Bio, com, Art
6. Selection

Tkinter create oval



```
digits=load_digits()

data=digits.data
target=digits.target

imgs=digits.images
```