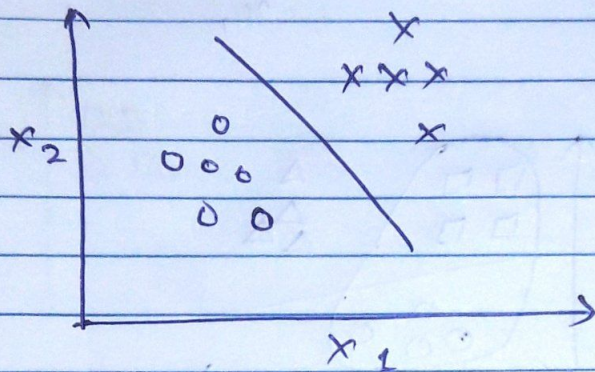
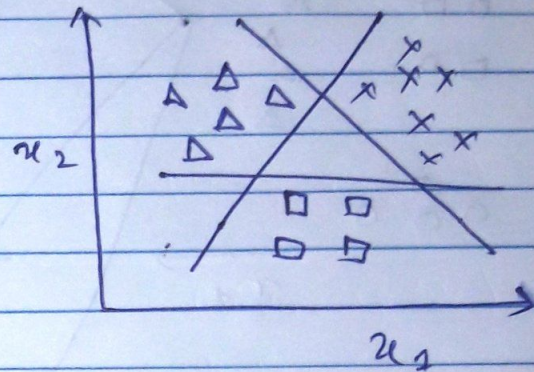


① Multiclass Classification - One Vs Rest and One Vs One:

Binary classification



Multi-class classification



Logistic

$$y \in \{0, 1\}$$

Sum

$$y \in \{-1, 1\}$$

} Binary

Multiclass :

{Dog, Cat, Horse, Human}

$$y \in \{0, 1, 2, 3\} \text{ Multiclass}$$

Two Techniques:

(a) One Vs One

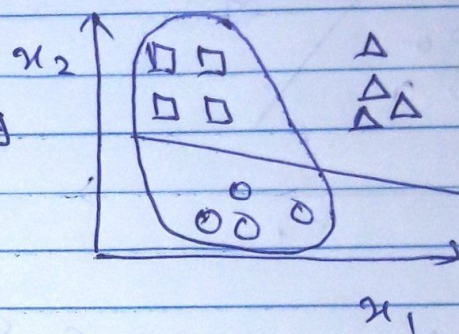
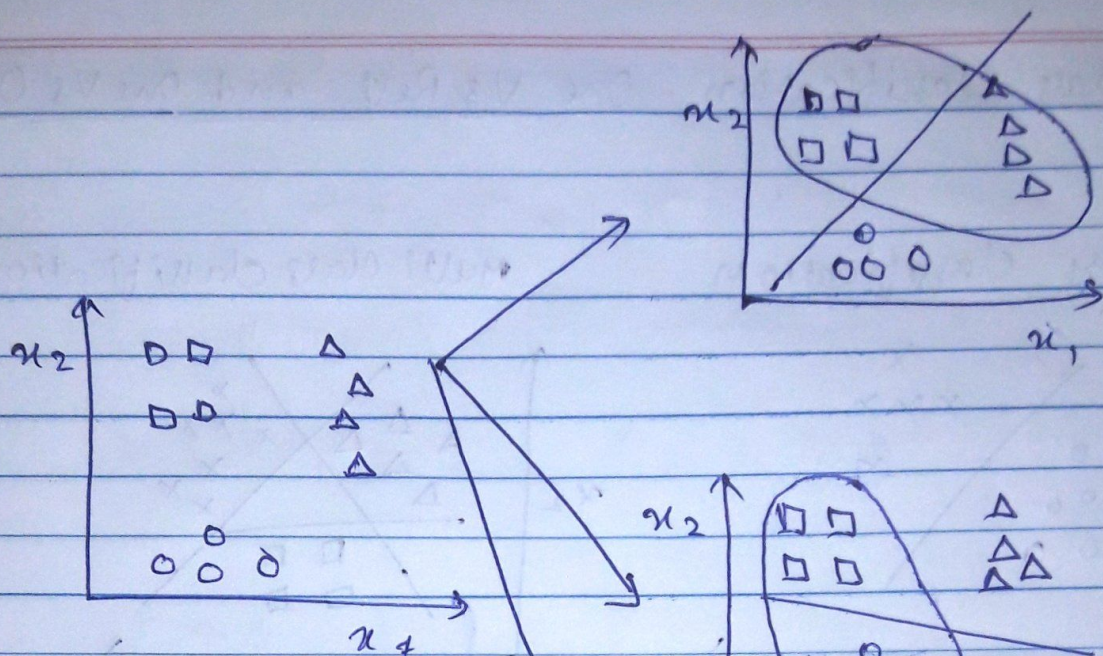
(b) One Vs Rest

(a) One Vs One :

N classes

$\Rightarrow N C_2$ classifiers
(every pair of data)

$${}^N C_2 = \frac{N \cdot (N-1)}{2} = 10 \text{ classifiers}$$

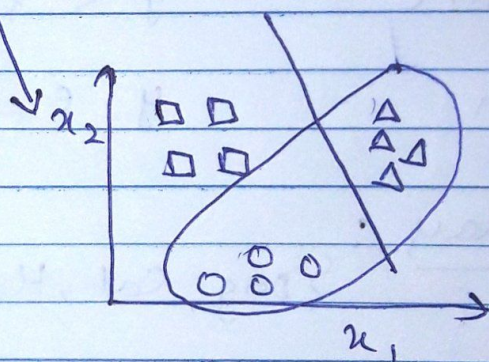


$3 C_2$ classifiers
 $= 3$

Yellow - Blue

Yellow - Green

Blue - Green



Yellow $\Rightarrow \square$

Blue $\Rightarrow \triangle$

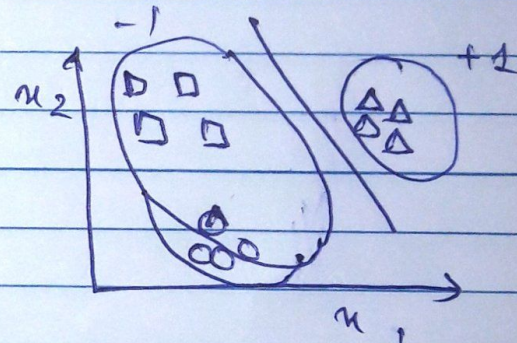
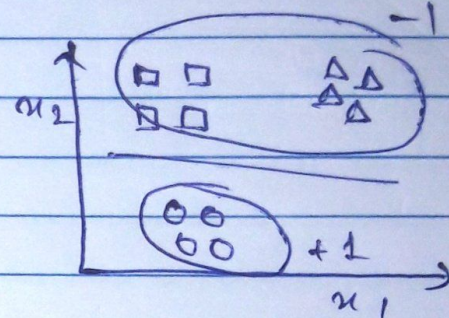
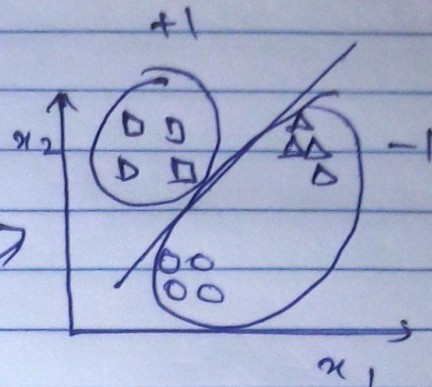
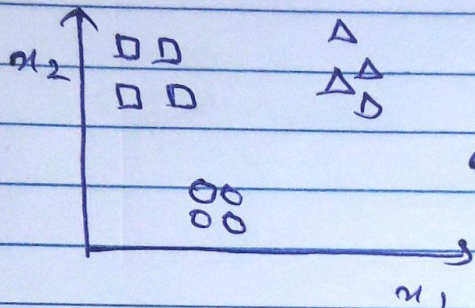
Green $\Rightarrow \circ$

Majority vote from $N C_2$ classifiers

Time complexity $= O(n^2)$

Useful : Large dataset can fit in one
when scheme

② One vs Rest:



→ Require more memory

→ N - Classifiers

↳ yes/No $x^i \in c^j$

→ Parallel

→ less Time $O(N)$

→ Common \Rightarrow SciKit Learn (library)

→ 'OVR' parameter in SciKit Learn
(one vs rest)

'OVO' \leftarrow by default
(one vs one)