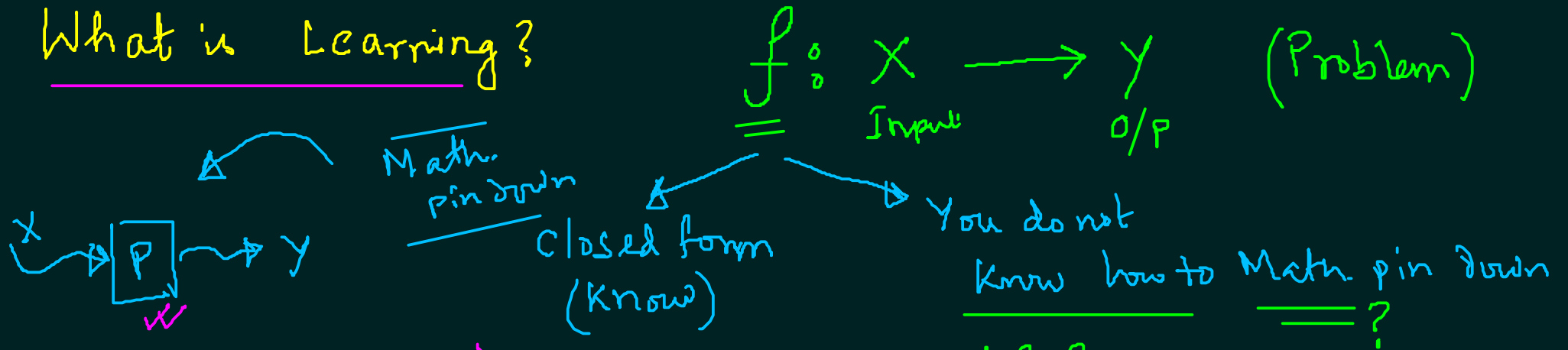
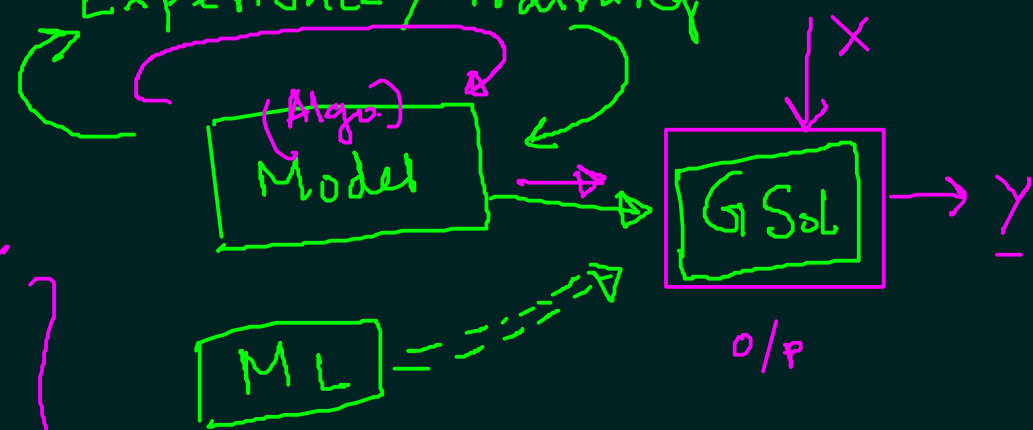


What is Learning?



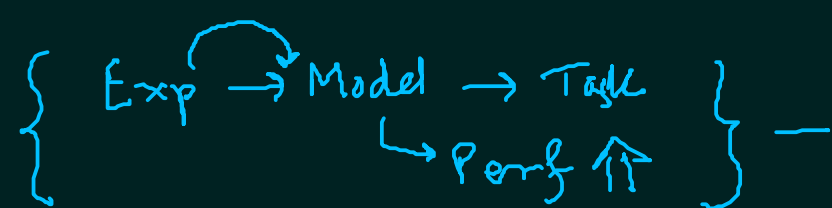
When can we Learn?

- ① When Math. pin down is impossible
- ② Pattern exist
- ③ Data exists for Training



if no pattern ML work?

2 3 11, ...



Examples:

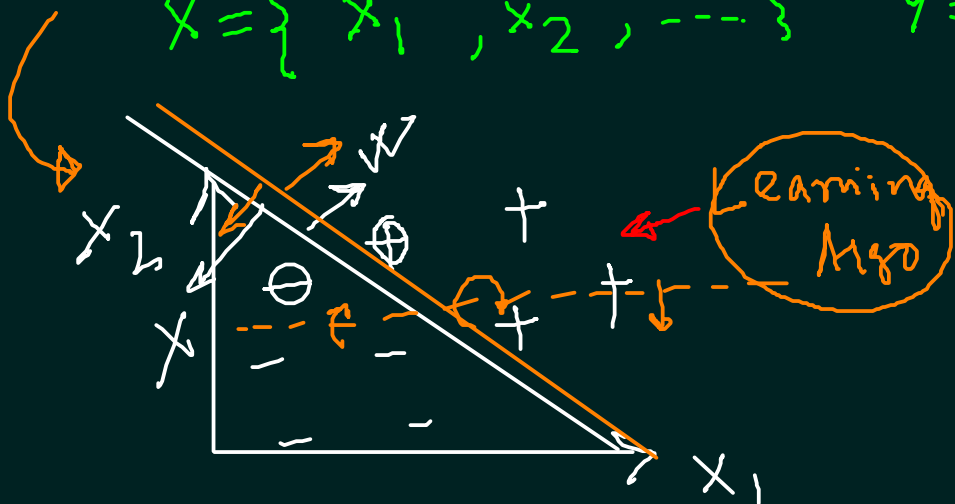
① Credit Approval

Age	23 yr
Job	1 yr
Sal	10 Lakh/An.
Debt	1 Lakh
Years of Resi.	2

Classification ✓

Approve +1
 Decline -1

$$X = \{x_1, x_2, \dots\} \quad Y = \{+1, -1\}$$

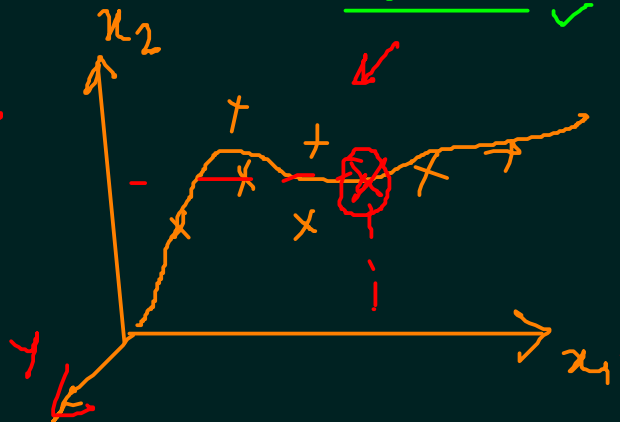


② Netflix Rating

10% improvement \approx 1M\$ rating



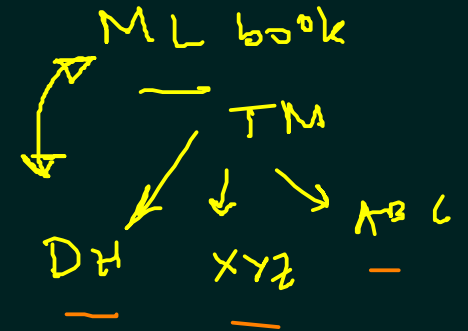
Regression ✓



Rating? \rightarrow 8.5/10

$$f: X \rightarrow Y^{TM}$$

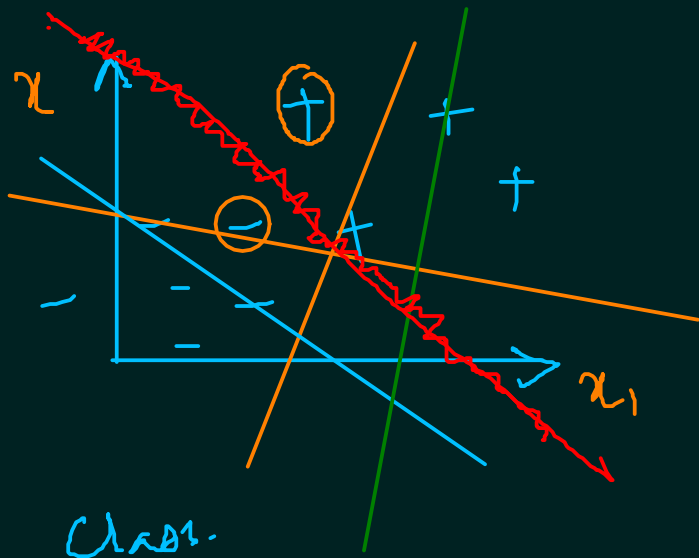
Recommendation



$$\text{Prob}(Y = DH \mid X) \leftarrow \text{Associations}$$

3) Spam filtering \rightarrow you win \$1000000 ?
 $P(S=1 \mid x_1, x_2, \dots) \geq 0.8$
 $S=0$ how are you - let us talk?

How to learn?



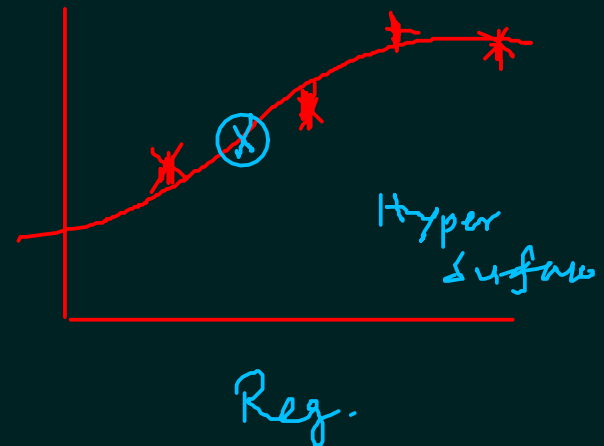
x_1
 x_2

LA Hyperplane

$$w_1 x_1 + w_2 x_2 = C$$

\downarrow weights \downarrow w_0
 \downarrow

$$w_i \leftarrow w_{i-1} + \Delta$$



$f: X \rightarrow Y$
Unknown Target

Credit approval

Learning Diagram

Training Data
 $\{ \langle x_1, y_1 \rangle, \langle x_2, y_2 \rangle, \dots \}$

past customer record

Learning Algo.

weight w_{ij}

hypothesis

$g \approx f$

$g = h_i \cdot x$

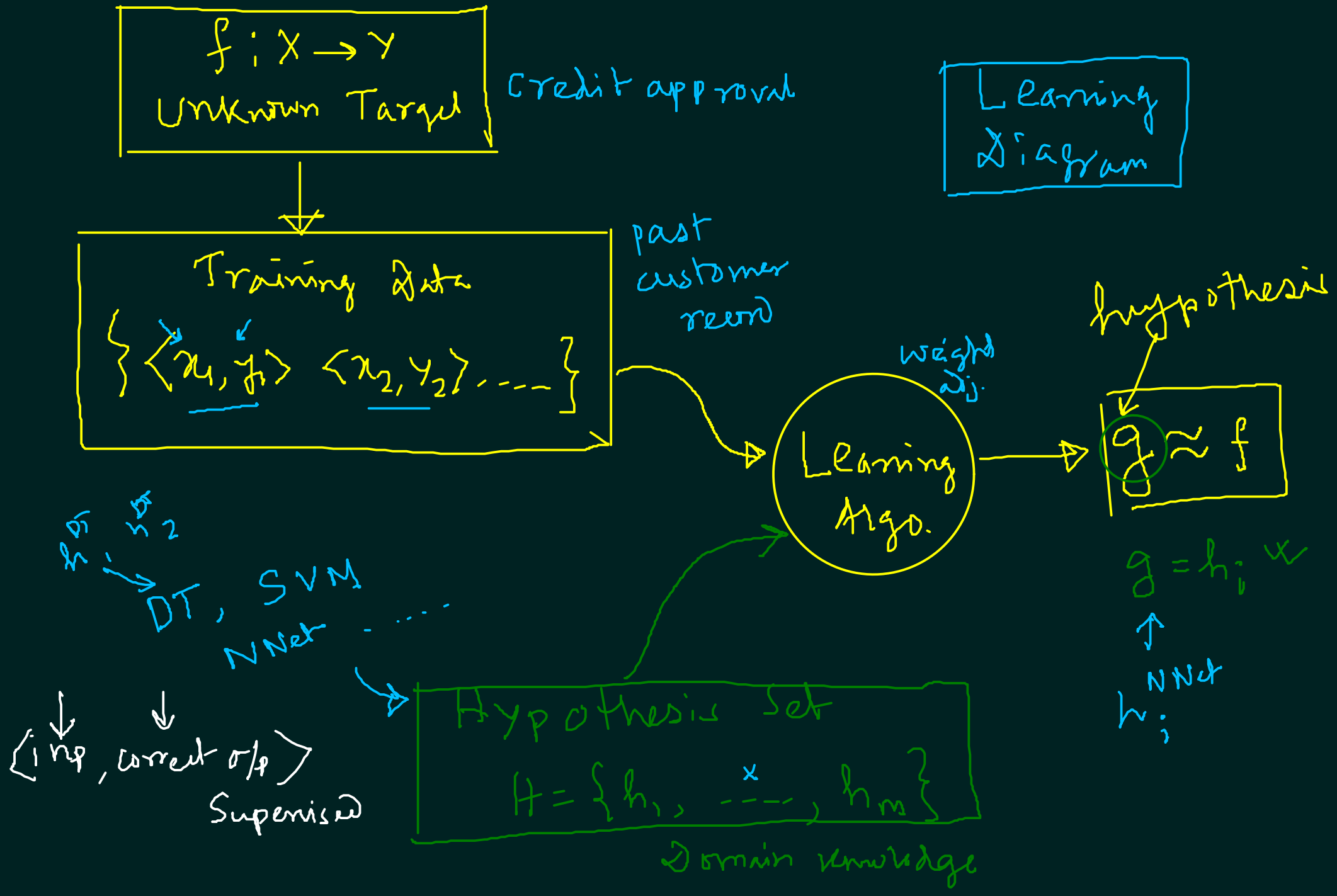
h_i
NNet

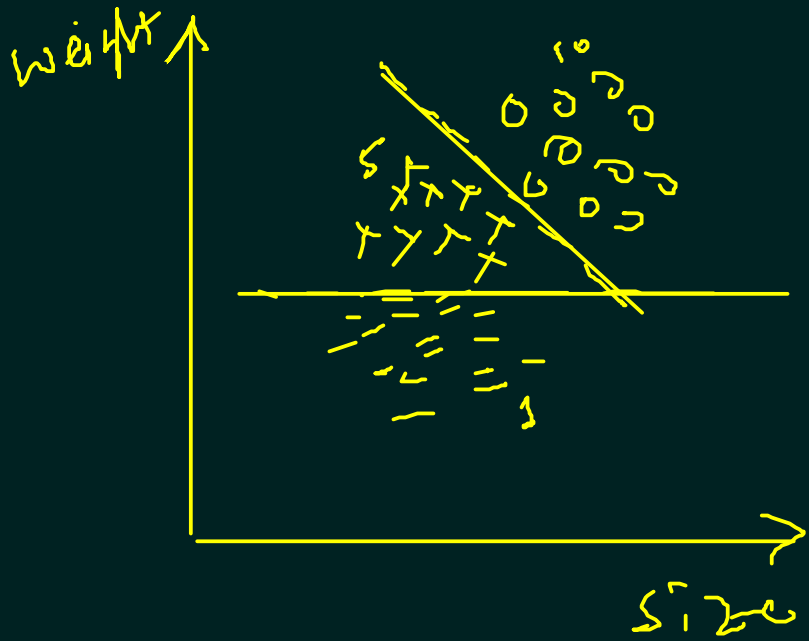
x_1, x_2
DT, SVM
NNet

$\langle \text{inp}, \text{correct o/p} \rangle$
Supervised

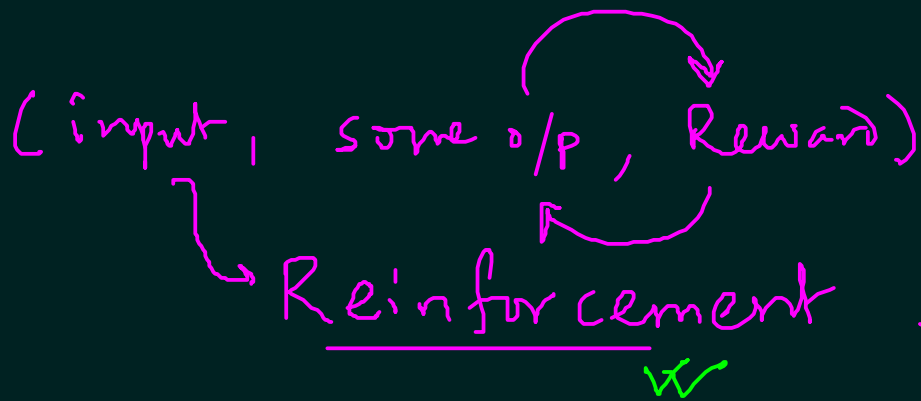
Hypothesis Set
 $H = \{ h_1, \dots, h_m \}$

Domain knowledge





(Clustering) Unsupervised



(input, ?)

— AlphaGo

Backgammon — NNet ✓

Train

✓

✓

✓

$$f = +1$$

$$f = -1$$

Test

$$f = +1$$

$$f = ?$$

$$f = -1$$

[Can
We
Really
Learn??]