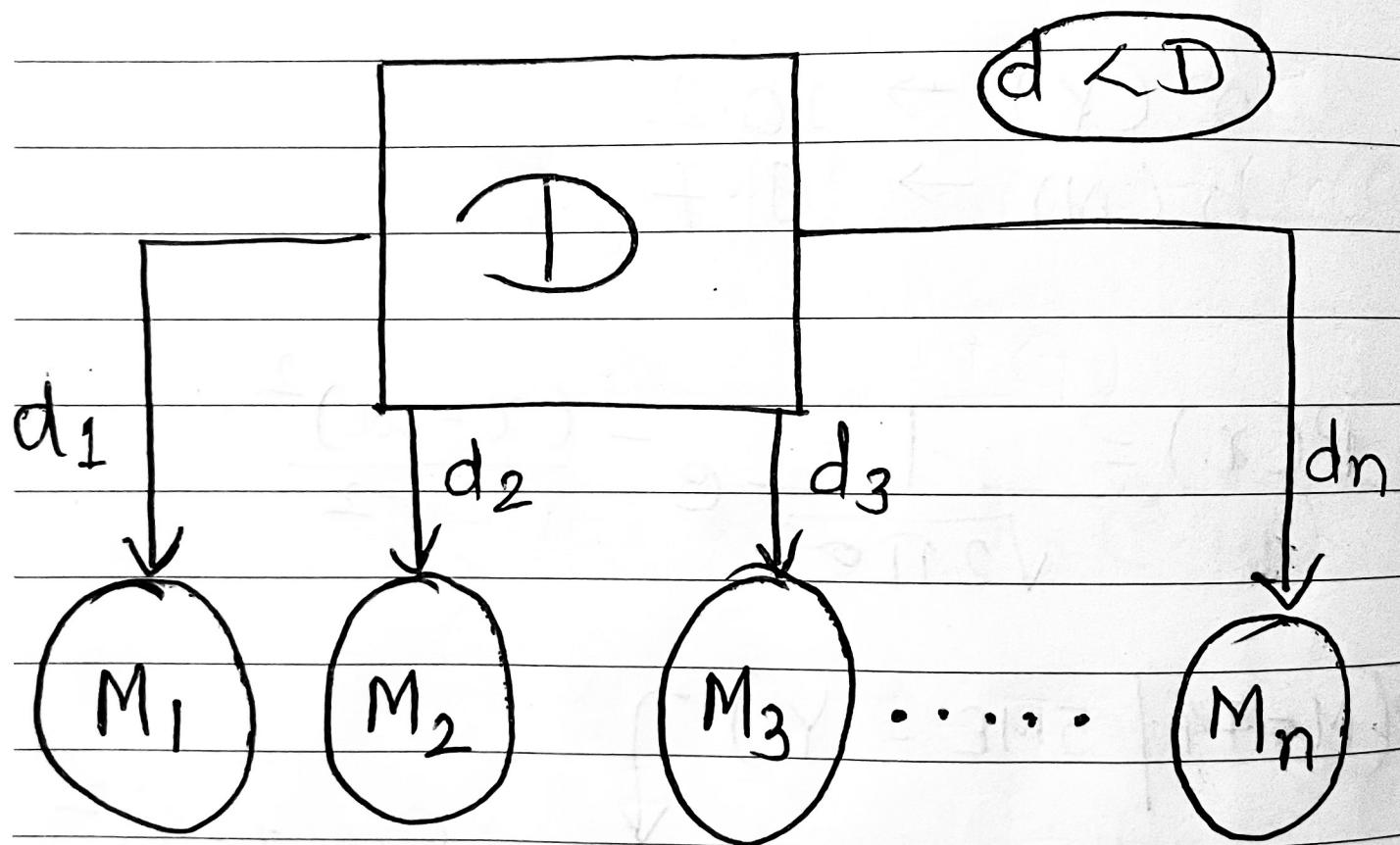


Ensemble Techniques

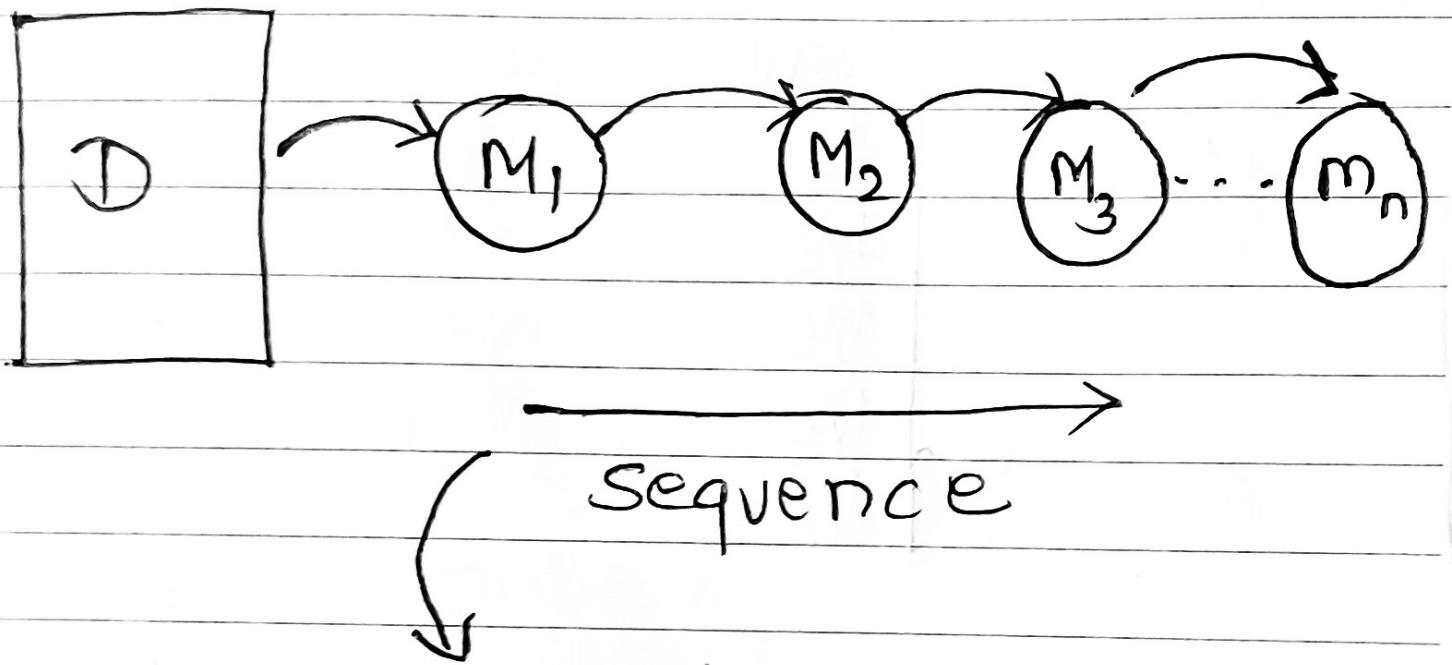
→ Bagging → RF

→ Boosting → AB
→ GB



Classification → Majority
Regression → Average

Boosting



$$\alpha_1 \times M_1 + \alpha_2 \times M_2 + \alpha_3 \times M_3 - \dots + \alpha_n \times M_n$$

$\alpha \rightarrow$ weights / Importance / Influence

① Dataset

"sw"

①	1/5
②	1/5
③	1/5
④	1/5
⑤	1/5

② Classify & get the Best ($m=3$)

→ DT (Lowest IG)

③ Calculate the ' α '

$$\alpha = \frac{1}{2} \log \frac{1 - TE}{TE}$$

TE → Miss-classified

$$\text{Performance} = \frac{1}{2} \log \frac{1 - TE}{TE}$$

$$\alpha = \frac{1}{2} \log \frac{1 - 1/5}{1/5}$$

$$\boxed{\alpha = 0.69}$$

④ New SW

	SW	NSW	NNSW
①	1/5	0.10	0.126
②	1/5	0.10	0.126
③ w	1/5	0.39	0.493
④	1/5	0.10	0.126
⑤	1/5	<u>0.10</u> 0.79	<u>0.126</u> 0.997

$$NSW = OW * e^{\pm \alpha}$$

→ Correct
 + → Wrong

$$\begin{aligned} NSW &= \frac{1}{5} * e^{-0.69} \\ \underline{\text{(Correct)}} &= 0.1004 \checkmark \end{aligned}$$

$$\begin{aligned} NSW &= \frac{1}{5} * e^{+0.69} \\ \underline{\text{(Wrong)}} &= 0.3988 \end{aligned}$$

⑤ Bins/ Bucket

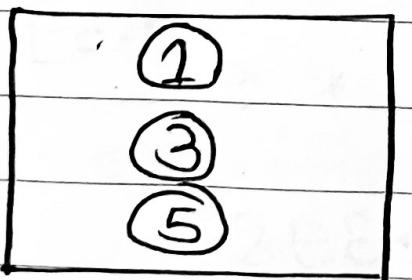
	NNSW	Bins
①	0.126	0 - 0.126
②	0.126	0.126 - 0.252
③	0.493	0.252 - 0.745
④	0.126	0.745 - 0.871
⑤	0.126	0.871 - 0.997

⑥ Random Selection (0-1)

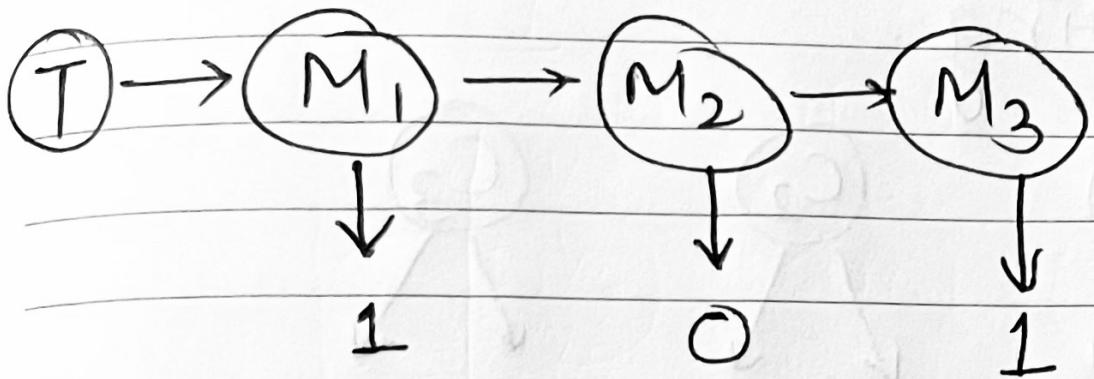
5

- 0.011 → ① ✓
- 0.33 → ③ ✓
- 0.45 → ③ ✓
- 0.60 → ③ ✓
- 0.90 → ⑤

3 Times



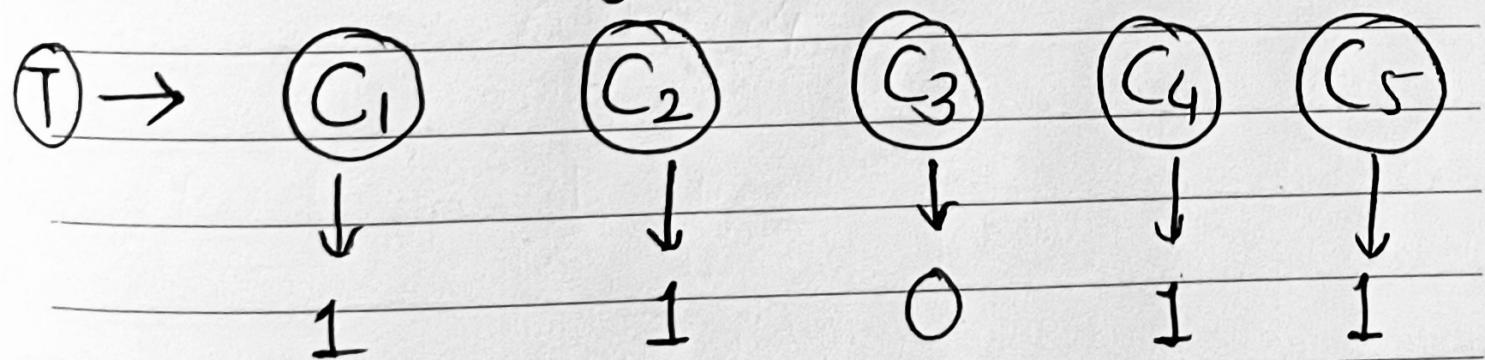
New dataset



$$\begin{aligned}
 & \rightarrow 0.69(1) + 0.51(0) + 0.30(1) \\
 & \rightarrow 0.99(1) + 0.51(0)
 \end{aligned}$$

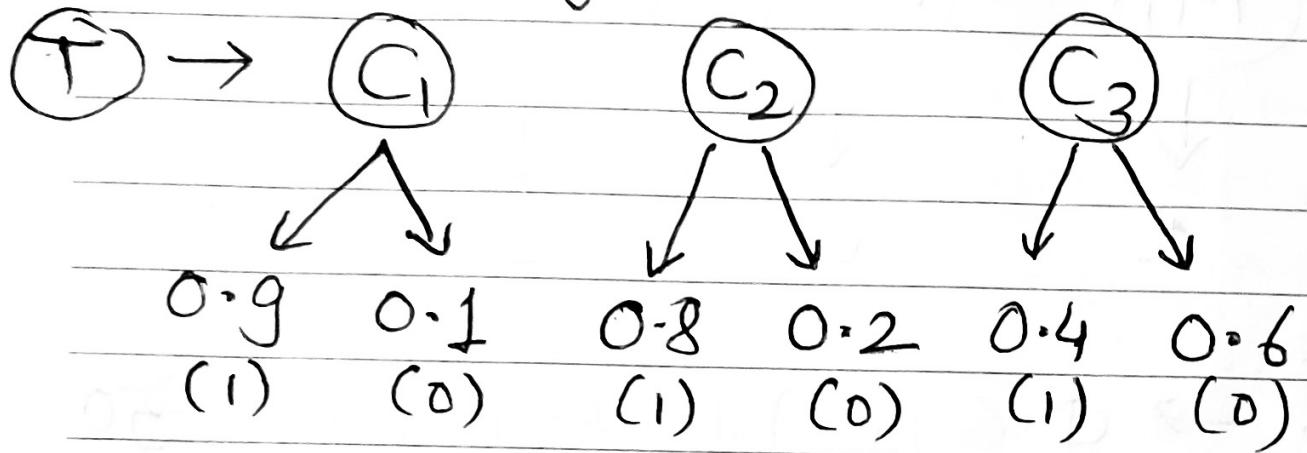
$$\begin{aligned}
 \text{POS}(1) &\rightarrow 0.99 \quad \checkmark \\
 \text{POS}(0) &\rightarrow 0.51
 \end{aligned}$$

Hard voting



Prediction $\rightarrow '1'$ (Majority)

Soft Voting.



$$(1) \rightarrow \frac{0.9 + 0.8 + 0.4}{3} = 0.7 \checkmark$$

$$(0) \rightarrow \frac{0.1 + 0.2 + 0.6}{3} = 0.3$$

Prediction $\rightarrow 1$