

Reinforcement Learning:-

- * It will learn depending on changes occurring in Environment.
- * Supervised learning - Human Explicitly Train the machine
- * Unsupervised " - machine itself train

Ex Chessboard

goal - to win the game.

Opponent lose will get win

Right, Left, ...

- * depending on move Opponent will moves in order to Checkmate.

Our main goal is 100% \uparrow in all learning.

Ex Agent

(2 ways - fire & water)

He has to choose one, fire is a wrong choice, water (green sign) is good.

Whenever choosing fire since wrong choice:-

fire - wrong choice (-50 points), Suppose $500 - 50 = 450$.

Water - Correct choice (+50 points)

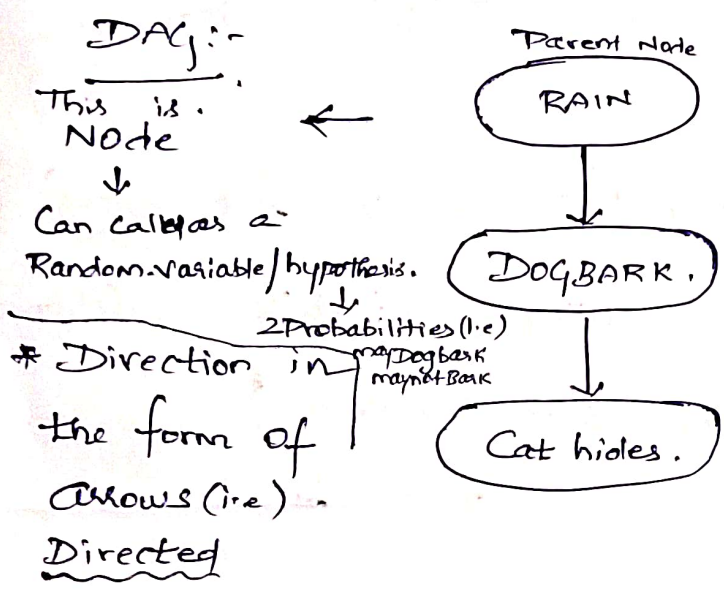
- * Whenever choice is made (wrong / right) feedback is sent to agent.

feedback:- Based on that right choice is taken.

Bayesian Belief Net

- 2. Important Concepts.

- 1) Directed Acyclic Graph (DAG)
- 2) Conditional Probability Table (CPT)



* Whenever RAIN Comes Dog will Bark
DOGBARK / RAIN

* Whenever DOGBARK, Cat will hide.
Cat hide / DOGBARK

* But it is not a condition, if Rain Not Comes also Dog Bark (or) may not Bark, Like wise Cat hides also

- * Acyclic means Not closed
- * Cyclic means

Conditional Probability Table:-

B means Bark, $\sim B$ - negation B means Not Bark.
R " Rain, $\sim R$ " " R " " Rain

Table Consist

	R	$\sim R$
B	9/48	18/48
$\sim B$	3/48	18/48

To calculate Probability defining like this

$$\begin{aligned}
 (B=T \& R=T) &= 9/48 = 0.19 \\
 (B=T \& R=F) &= 18/48 = 0.375 \\
 (B=f \& R=T) &= 3/48 = 0.06 \\
 (B=f \& R=f) &= 18/48 = 0.375
 \end{aligned}$$

How the Conditional Probability Associated

(37)

// * you may get doubt why we doesn't took Cathides,
Because we should have to take from parent node.
Not Child Node. Now parent Node is Rain.

Bayesian Belief Net :-

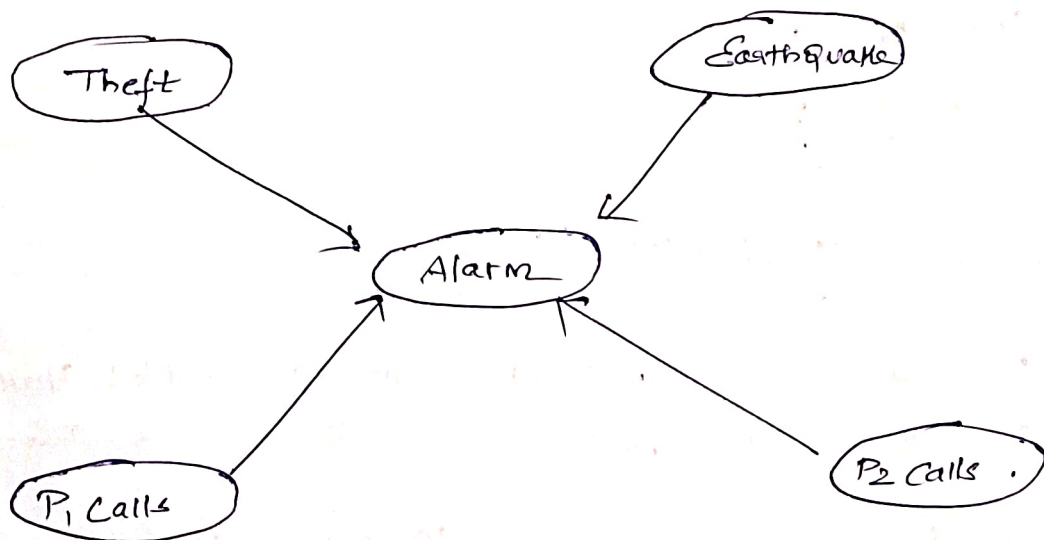
* It is a Probabilistic graphical model (PGM) that represents conditional dependencies between random variables through DAG.

(// With the help of DAG. Conditional dependence represented)

* It is also suitable for representing Probabilistic relation between multiple Events. (more than 2 events)

// Here we taken three Events Rain, DB, CH //

Ex.



Concept:- Whenever Theft / Earth Quake - Alarm Should be Ring.

If the People Not in Home it directly notified to his/her Phone either P₁ or P₂.

How the Conditional Probability Associated here.

37

Given Probabilities are,

Theft $\leftarrow P(T=T) = 0.001$

$P(T=F) = 0.999$

Earthquake $\leftarrow P(E=T) = 0.002$

$P(E=F) = 0.998$

Next Set of Probability Given is. Prob of Alarm

Theft (T)	Earthquake (E)	$P(A=T)$	$P(A=F)$
T	T	0.95	0.05
T	F	0.99	0.01
F	T	0.29	0.71
F	F	0.01	0.999

* Parents for Alarm is Theft & Earthquake.

Probability of P_1 Given.

Alarm (A)	$P(P_1=T)$	$P(P_1=F)$
When Ring T	0.90	0.10
Doesn't Ring F	0.05	0.95

Prob of P_2 Given

A	P_2	P_2
T	0.70	0.30
F	0.01	0.99

Given data's.

Question

find the Prob of P_1 is T, P_2 is T, A is T, ~~T~~^{True} is F, and E is F.

$$(i.e) P(P_1, P_2, A, \bar{T}, \bar{E})$$

$$= P(P_1/\underline{A}) P(P_2/\underline{A}) P(A/\bar{T}, \bar{E}) P(\bar{T}) P(\bar{E})$$

Parent node Parent node Parent This is root node No

$$= 0.90 \times 0.70 \times 0.001 \times 0.999 \times 0.998$$

Conditional prob, for T and F

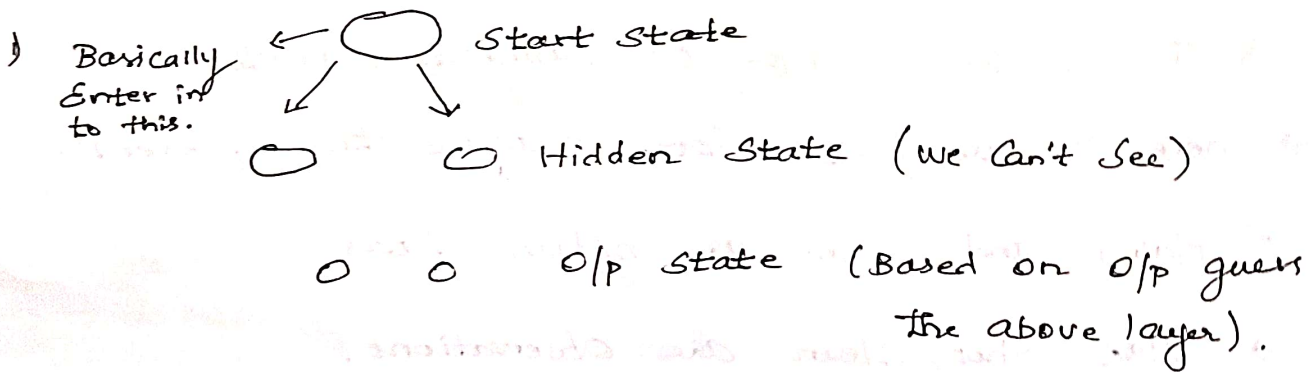
$$= 0.00062 \text{ (less value).}$$

// Low Alarm, So No need to notify P_1 & P_2 more times, due to less value. //

— x — x —

Hidden Markov model:-

- * If informed O/p. Then we can say the order of i/p Travelling.
- * HMM is a Statistical Markov model in which the system being modeled assumed to be a Markov process with unobserved (i.e. hidden states)



- * Hidden Markov model are use to generate other model based on the i/p.

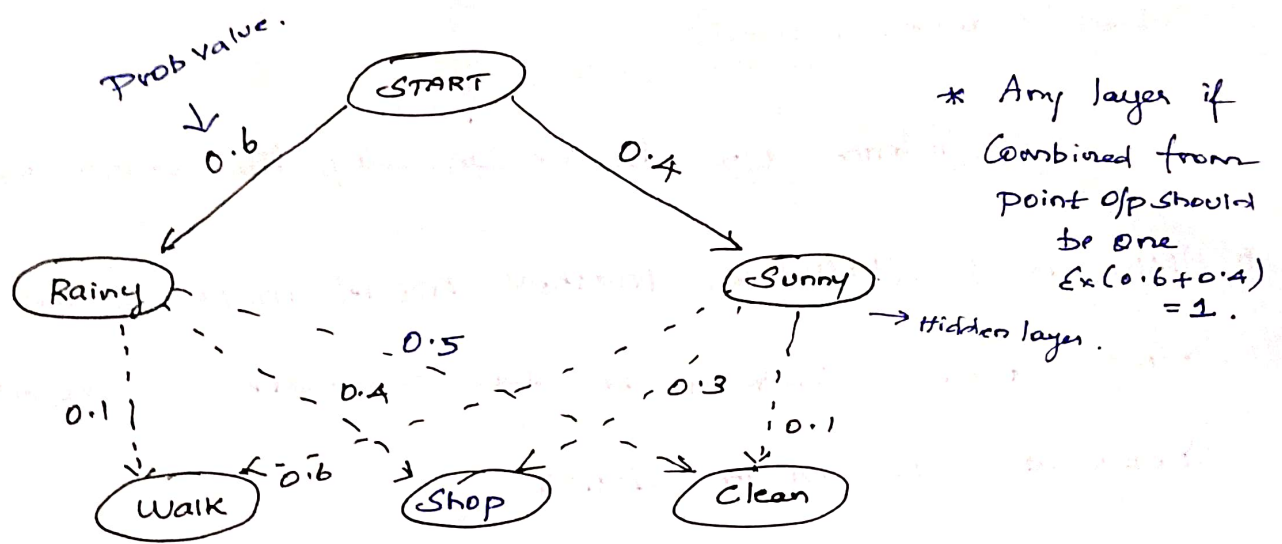
→ Based on i/p generate O/p.

(Based on this concept we can generate model.)

Terminology in HMM:-

- * The term hidden refer to the first order Markov process behind the observation.
- * Observation refer to the data

Ex Assume:-



* This is also a type of Classification method.

→ here we use finite state machine to represent.

→ Rainy and Sunny are hidden states

→ Walk, Shop, Clean are observations.

→ here whatever we add things/values always get Prob 1 (outgoing sum).

Application of HMM:-

→ Online Handwriting Recognition

→ Speech Recognition

→ Gesture Recognition

→ Language modeling

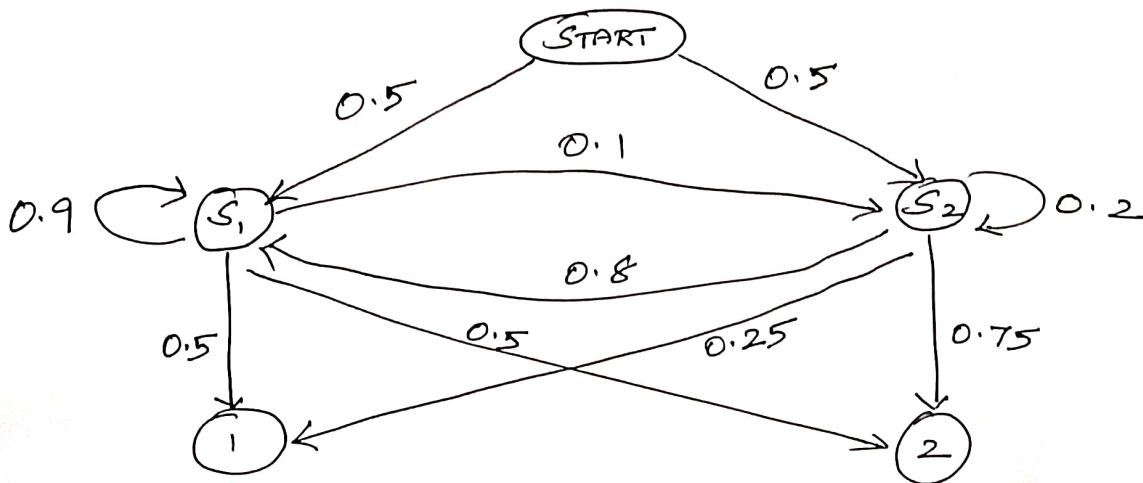
→ motion video Analysis & tracking

→ Stock Price Prediction.

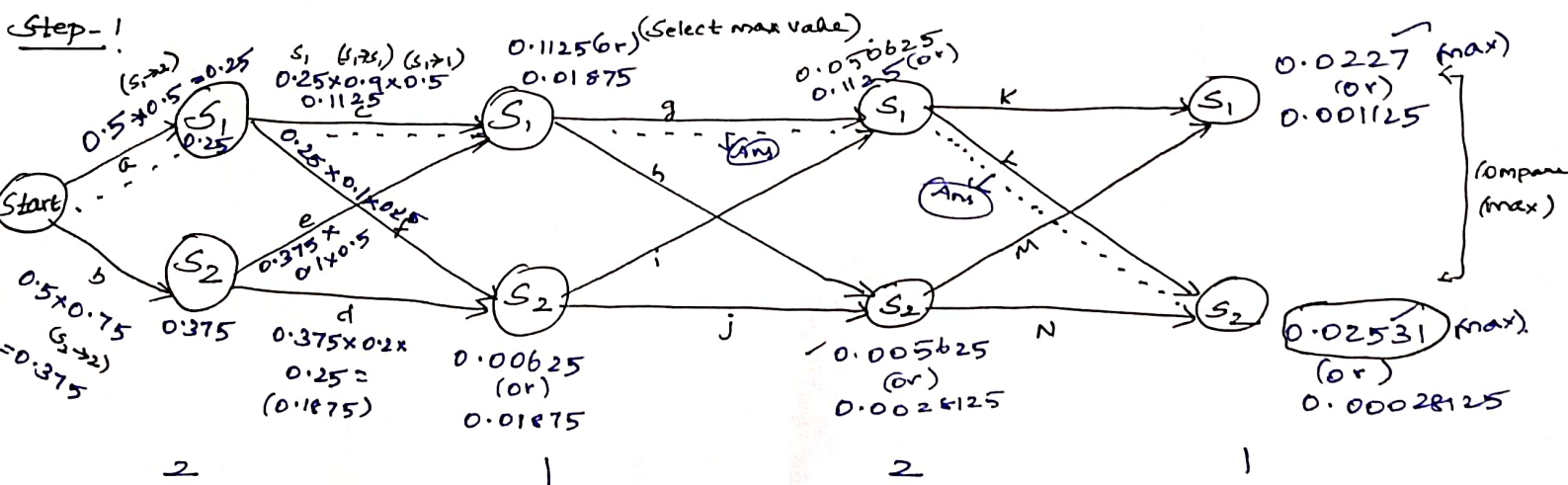
Viterbi & forward Alg for HMM!

* What problem to solve?

Basically in ML one of the most popular things are Pattern Recognition. (NLP). voice, face Recognition]. Based on Pattern to identify what are the ip's. This concept is called HMM.



Pattern given = 1 2 1 & 1 2 2 1 2 2



@ 2.

$$g = 0.1125 \times 0.9 \times 0.5 = 0.050625$$

$$j = 0.1875 \times 0.2 \times 0.75 = 0.0028125$$

$$i = 0.1875 \times 0.8 \times 0.5 = 0.0075$$

$$h = 0.1125 \times 0.1 \times 0.75 = 0.005625$$

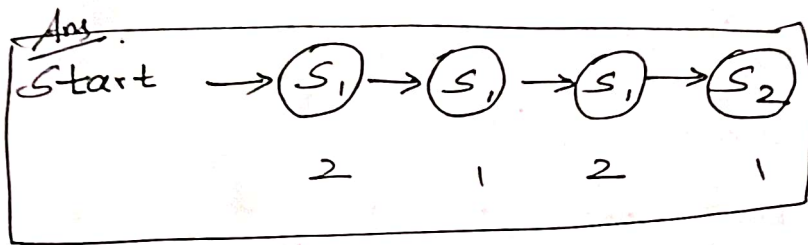
$$K = 0.50625 \times 0.9 \times 0.5 = 0.0227$$

$$L = 0.50625 \times 0.1 \times 0.5 = 0.02531$$

$$M = 0.005625 \times 0.8 \times 0.25 = 0.001125$$

$$N = 0.005625 \times 0.2 \times 0.25 = 0.00028125$$

Back track NOW
With max Value.



11/18 for 1 2 2 1 2 2 will perform

—X—