# Data Science & AI

Artificial Intelligence

**Logics**

**Lecture 03**

By- **Sudhanshu Sir**

# Recap of Previous Lecture

Topic

Topic

Topic

Topic

Topic

# Topics to be Covered

**Topic**    Uncertainty in AI
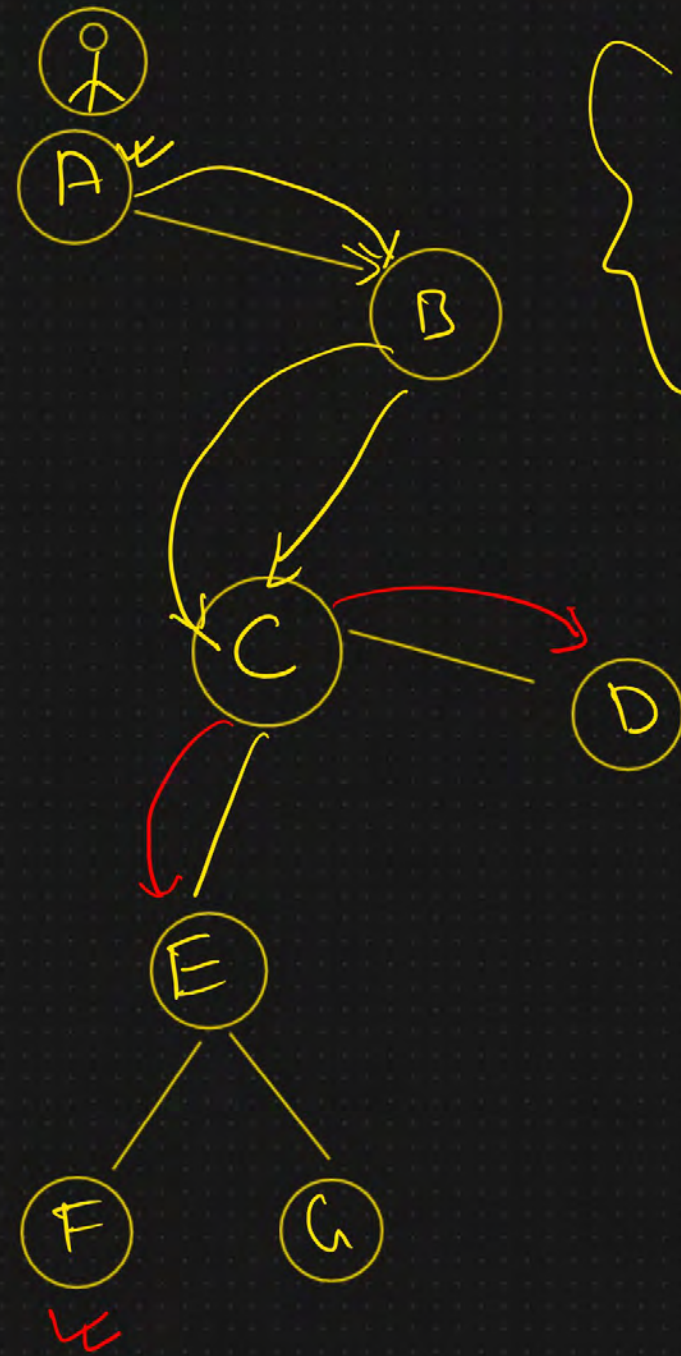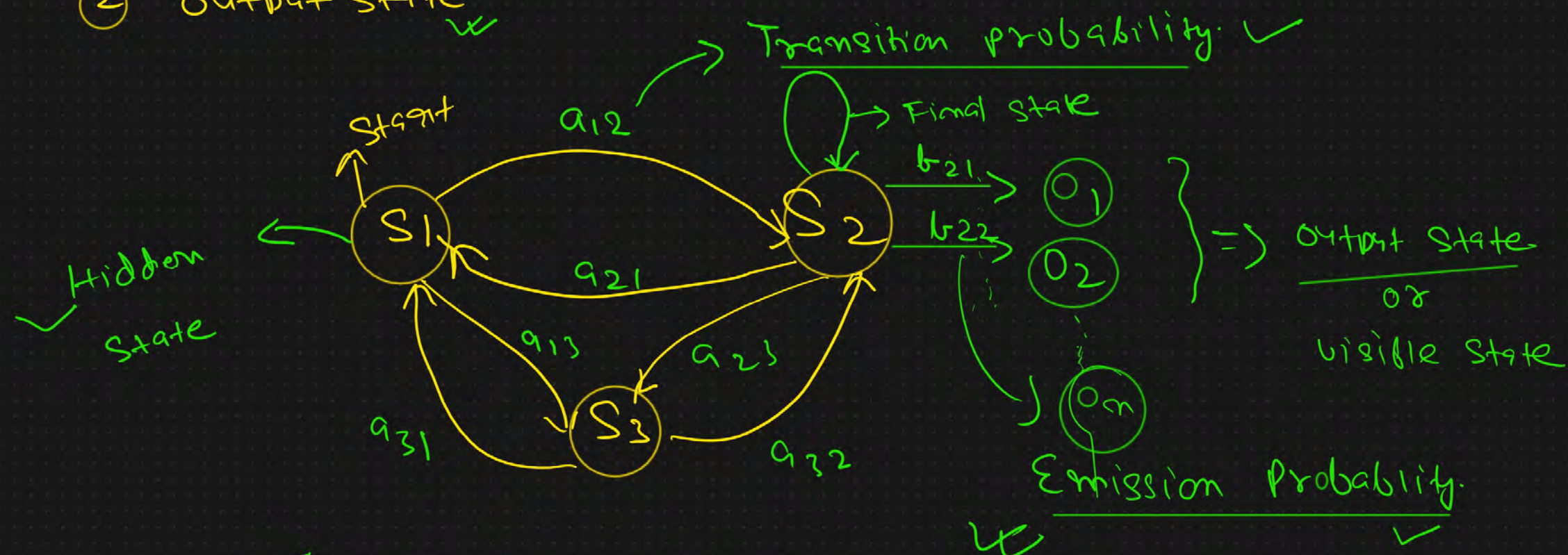
**Topic**

**Topic**

**Topic**

**Topic**

# Hidden markov model

$\{$ A, B, C, D, E, E, G, E, F $\}$

A, B, C, E, F

① Hidden State ✓

② Output State ✓

Transition probability ✓

Start

$a_{12}$

→ Final state

$b_{21}$

S1

$a_{21}$

S2

$b_{22}$

$O_1$

$O_2$

⟹ Output State
———————
or
Visible State

Hidden
State ✓

$a_{13}$

$a_{23}$

$O_n$

$a_{31}$

S3

$a_{32}$

Emission Probability ✓

$\sum a_{ij} = 1$

$\sum b_{ij} = 1$

$P(A|B)$

Hidden State
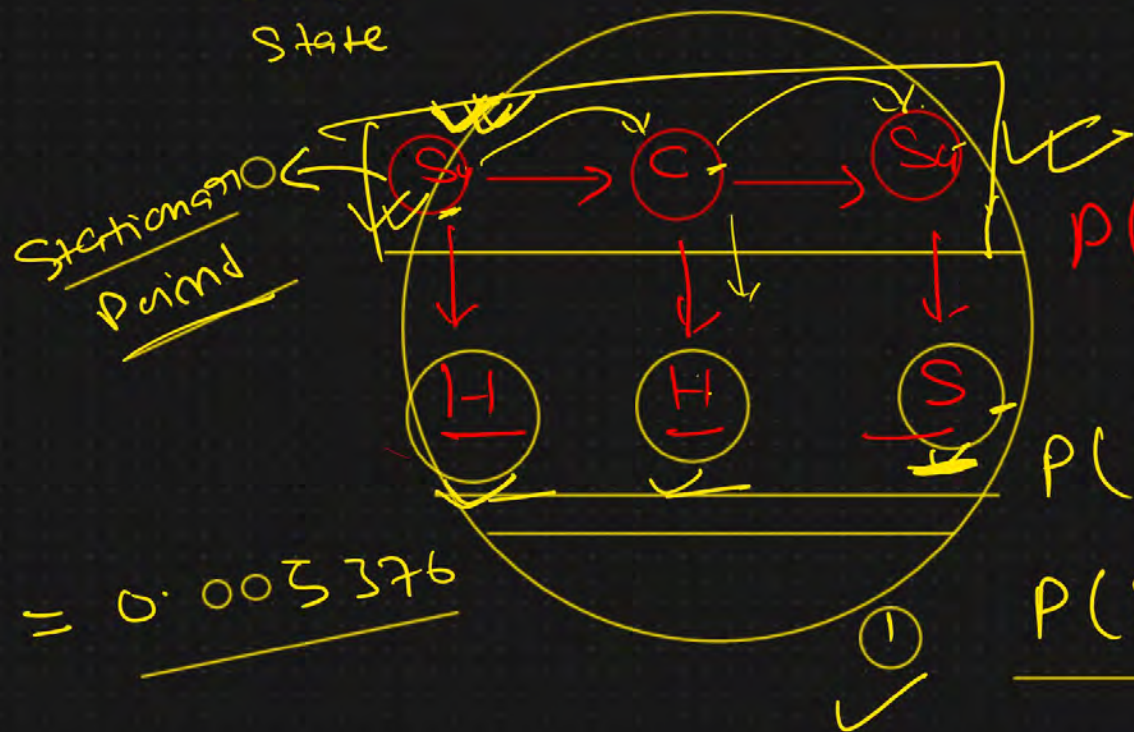
Output State

Stationary Point

R    C    S
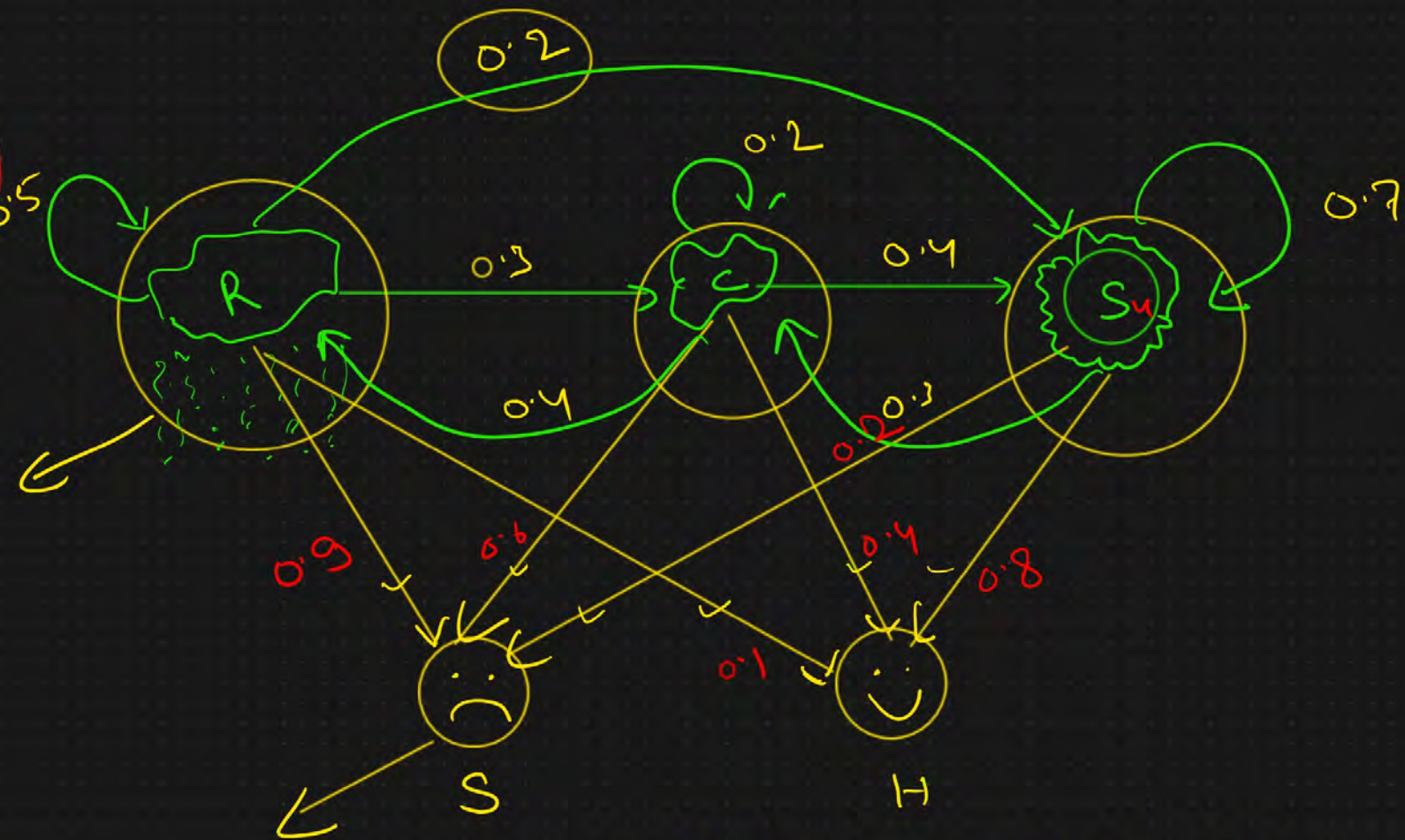
$$TP = \begin{matrix} & R & C & S \\ R & 0.5 & 0.3 & 0.2 \\ C & 0.4 & 0.2 & 0.4 \\ S & 0 & 0.3 & 0.7 \end{matrix}$$

$$EP = \begin{matrix} & S & H \\ R & 0.9 & 0.1 \\ C & 0.6 & 0.4 \\ S & 0.2 & 0.8 \end{matrix}$$

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)}$$

$$P(Y = H, H, S \mid X = S_4, C, S_4) =$$

$$P(H|S) = \frac{P(S|H) \cdot P(H)}{}$$

$$P(S_4|H) = \frac{P(H|S_4) \cdot P(S_4)}{0.8} \cdot \frac{0.7}{} = 0.56$$

$$P(C|S_4) \cdot P(H|S)$$

$$= 0.003376$$

$\pi$   P1 P2 P3

$$\text{⑤} = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix}$$

$$0.3 \cdot 0.4 = 0.12 \qquad\qquad = 0.005376$$

$$\text{③} \quad P(S|C) \cdot P(S|S_4)$$
$$0.4 \qquad\qquad .2 \qquad = 0.08$$

$$\begin{array}{c}
\phantom{TP} \quad R \quad\; C \quad\; \square \\
TP = \begin{matrix} R \\ C \\ S \end{matrix} \begin{bmatrix} 0.5 & 0.3 & 0.2 \\ 0.4 & 0.2 & 0.4 \\ 0 & 0.3 & 0.7 \end{bmatrix}
\end{array}
= \begin{bmatrix} 0 \times 0.5 + 0 \times 0.4 + 1 \times 0, & 0 \times 0.3 + 0.02 + 1 \times 0.3, & 0 \times 0.2 + 0 \times 0.4 + 1 \times 0.7) \end{bmatrix}$$

$$= \begin{bmatrix} 0, & 0.3, & 0.7 \end{bmatrix}$$
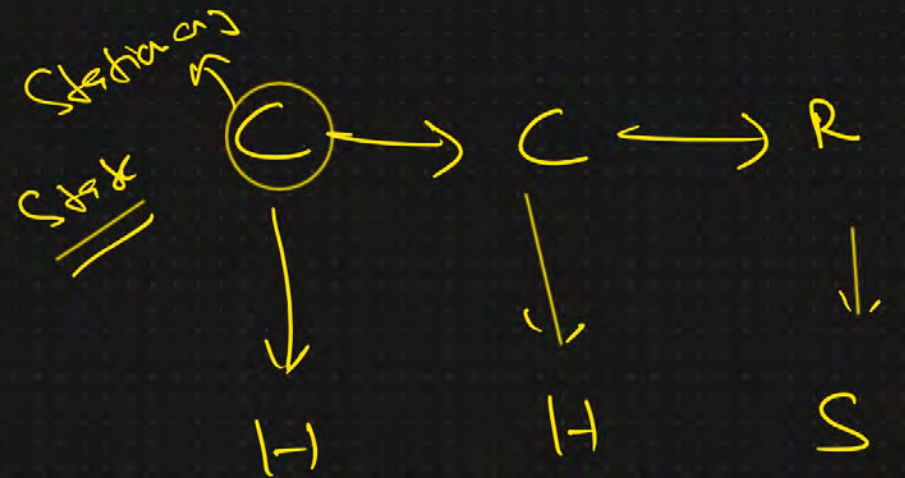
Stationary

Start

$$\bigcirc{C} \rightarrow \quad C \longleftrightarrow R \qquad P(C) \cdot P(H|C) \qquad\qquad P(R|C) \cdot P(S|R)$$

$$\downarrow \qquad\qquad \downarrow \qquad\qquad \downarrow \qquad = 0.2 \times 0.4 = 0.08 \qquad\qquad = 0.4 \times 0.9$$

$$H \qquad\qquad H \quad\; S \qquad P(C|C) \cdot P(H|C) \qquad\qquad = 0.36$$

$$\qquad\qquad\qquad\qquad .2 \quad \cdot \;.4 \quad = 0.08 \qquad\qquad T1 \quad P1, P2 \, \square$$

$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad = 0.08 \times 0.08 \times .36$$
$$\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad = 6.002304$$

$$\begin{array}{c}
R \quad\; C \quad\; S \\
\begin{bmatrix} 0 & 1 & 0 \end{bmatrix} \times \begin{bmatrix} .5 & .3 & .2 \\ .4 & .2 & .4 \\ 0 & .3 & .7 \end{bmatrix}
\end{array}
= \begin{bmatrix} 0 \times .5 + 1 \times .4 + 0 \times 0, & 0 \times .3 + 1 \times .2 + 0 \times .3, & 0 \times .2 + 1 \times .4 + 0 \times .7) \end{bmatrix}$$

$$= \begin{bmatrix} .4, & 0.2, & .4 \end{bmatrix}$$

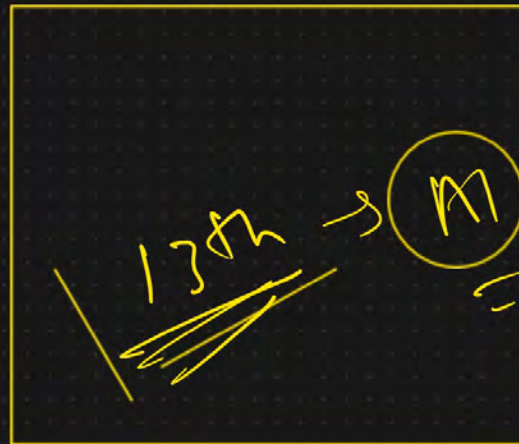$M1 = 0.005376$  $\arg\max ( m_1, m_2, )$

$M2 = 0.002304$

$\max ( m_1 , m_2 )$

① S S S

④ ② S C S

③ C C R

④ R R C

13th → Ⓜ

⑫

# 2 mins Summary

Topic

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Topic

Topic

# THANK - YOU