Understand the jargon without the confusion

What is Hidden Markov Model in Machine Learning?

Sanjay N Kumar

Data scientist | AI ML Engineer | Statistician | Analytics Consultant

What is a Hidden Markov Model (HMM)?

🧠 A Hidden Markov Model is a way to **predict hidden things** by looking at what we **can see**.

🔍 It helps in finding patterns when we can't see everything directly.

👉 Think of it like guessing the **weather** (☀️🌧️) by just looking at what people are wearing (🧥👕).

Real-Life Example –

Weather & Clothes

👗 Imagine you're in a room with no windows. You want to know if it's rainy or sunny outside. But... you can only see what people wear!

- If people wear coats & carry umbrellas → it’s probably rainy ☔
- If people wear T-shirts → it's probably sunny ☀️

🧩 You don’t **see the weather**, but you **guess it** based on what people wear.

🟰 This is like a **Hidden Markov Model**!

What Does "Hidden" Mean?

🤐 **"Hidden"** = we can’t see it directly

🔎 **Example:** You can’t see a person’s **mood** (happy or sad), but you can see:

- If they’re smiling 😊
- Or crying 😢

You guess the mood based on what they do.

That’s **HMM logic**!

Markov – What's That?

⏩ Markov means: **What happens next only depends on what's happening now.**

🎲 **Example:**

If it's raining today, the chance of it raining tomorrow depends only on today – not last week!

🧮 **It's like:**

P(Tomorrow's Weather | Today's Weather)

📌 Not based on the full history – just the current state.

HMM – In Math (Very Simple!)

Let’s say:

- **States** (hidden): Sunny ☀️, Rainy ☔
- **Observations** (visible): Dry ground 🟫, Wet ground 💧

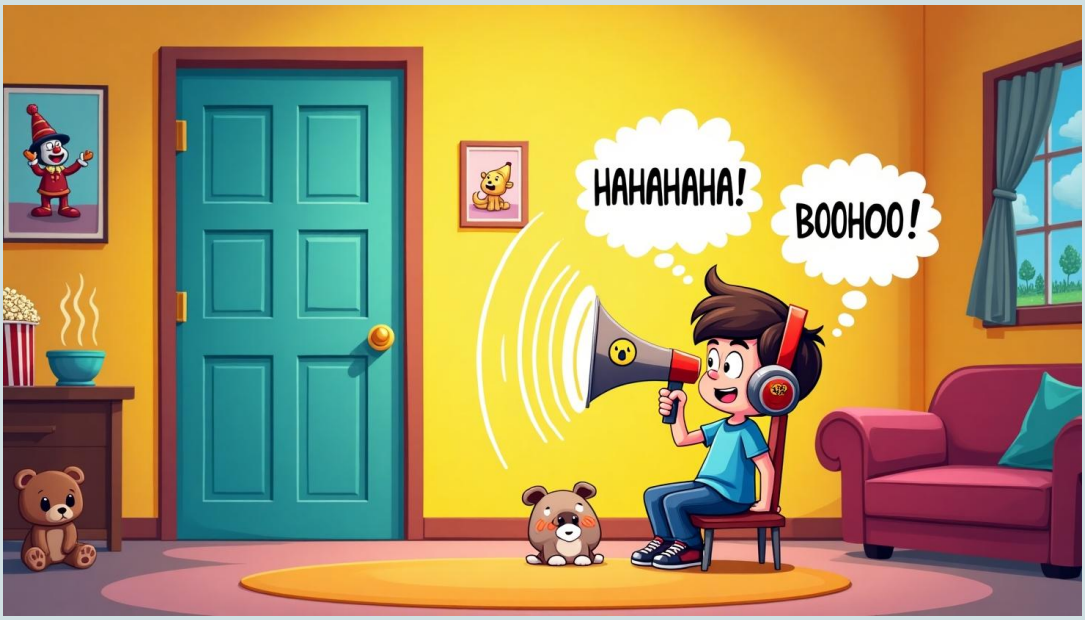
We define:

- Transition probability: chance of going from Sunny to Rainy
- Emission probability: chance of seeing wet ground if it's Rainy

We use these to **guess the hidden states** (weather) from what we observe (ground condition).

Real-Life Example –

Watching a Cartoon



You hear a cartoon 🎞️ in another room, but can’t see the screen.

🎧 **Based on the sounds:**

- **If you hear laughing** 😂 → the scene might be funny
- **If you hear crying** 😭 → the scene might be sad

You **predict the scene** using sound — like how HMM predicts the hidden state.

Example – HMM in Phone Typing

📱 When you type on your phone, it **guesses your next word**.

It doesn't know what you'll say for sure, but it looks at your previous word.

👀 If you type "Good", it may suggest:

- "morning"
- "luck"

"job"

It uses **patterns** – like an HMM!

Example – Student Behavior

🎓 A teacher wants to know if a student understands math.

They can’t see inside the student’s brain 🧠, but they observe:

- If they answer questions correctly ✅
- Or stay silent or wrong ❌

📌 The teacher uses that to guess if the student **knows** the topic. That’s HMM in action!

Building Blocks of HMM

There are 3 parts in HMM:

1. **States** (hidden): like weather, mood, knowledge
2. **Observations**: what we see or hear
3. **Probabilities**: rules that tell how things move or happen

🔢 It’s like a **puzzle** we solve with math!

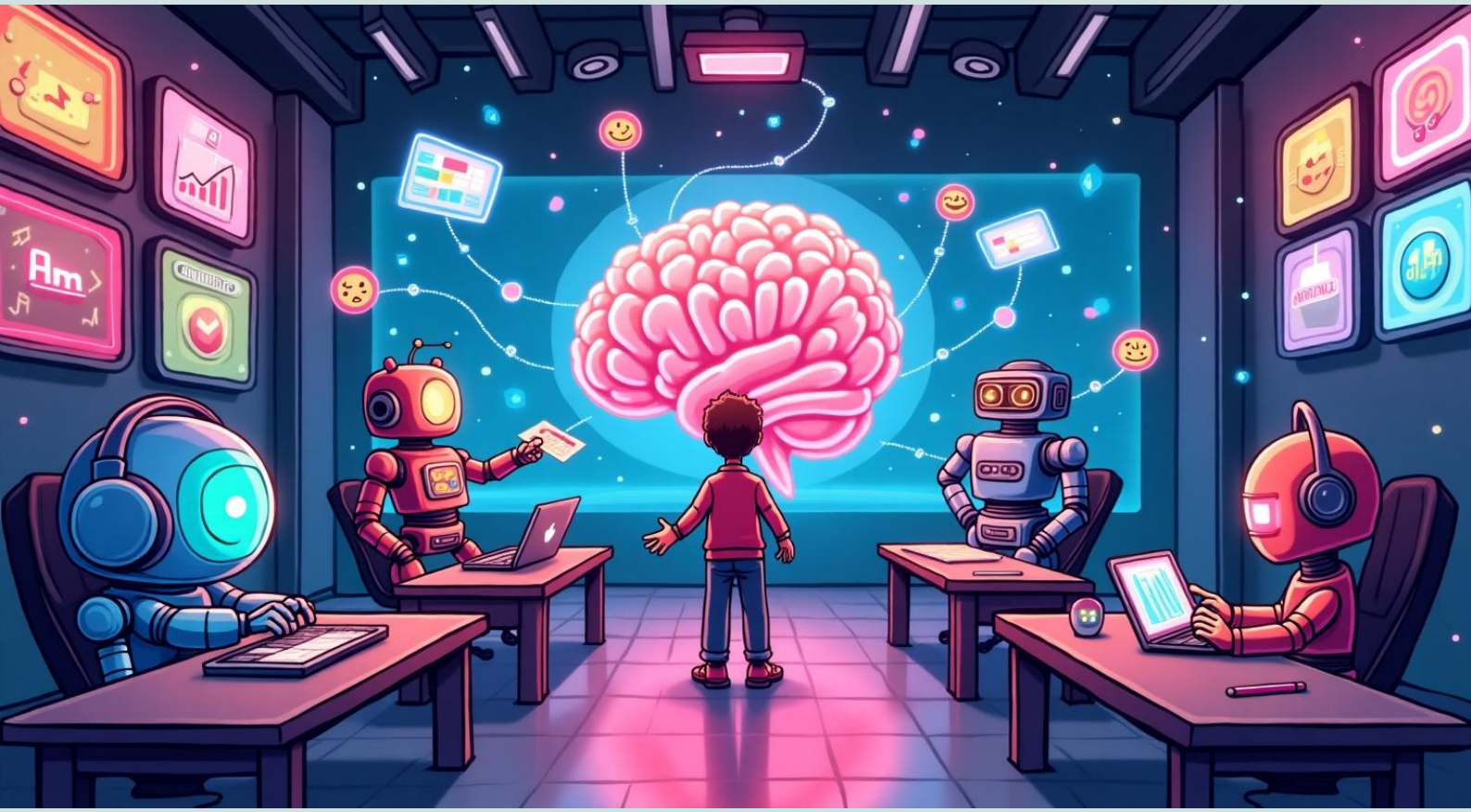
HMM in Games

🎮 In some games, the computer guesses where the player is hiding even without seeing them.

👣 It looks at footprints, doors opened, etc.

🧠 The game **learns and predicts** – just like HMM does!

Where Is HMM Used in AI/ML?



🗣️ Speech recognition (Siri, Alexa)

🎵 Music genre detection

📈 Stock market predictions

✍️ Handwriting recognition

🤖 Robots understanding human actions

👉 HMM helps machines **guess hidden things** by learning from what they can see.

Summary

✅ Hidden = We don’t see it

✅ Markov = Current only depends on now

✅ HMM = Guess hidden things using what we observe and some probabilities

🔄 Used in AI & ML to **make smart guesses**!

🎯 Decode the Unseen with Hidden Markov Models

Turn observations into insights.

Let HMMs unveil the invisible, guide predictions, and power smarter AI decisions!

📩 Ready to explore the hidden patterns? Let’s connect and unlock intelligence together! 💡

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https://www.linkedin.com/in/sanjaytheanalyst360/

sanjaytheanalyst360@gmail.com