**MARKOV CHAINS**

A Markov Chain is a mathematical model that describes a sequence of events where the probability of a future event of a given system depends only on the state of the system in a current event.

Markov Property- The future state depends only on the present state not past states.

Applications

They can be used in computer science for generating random text, image processing and natural language processing.

Markov chains can also be used in recommendation systems, language models and reinforcement learning.

Importance

Markov Chains are a great tool for analyzing and predicting the behavior of complex systems with uncertainty allowing for understanding long term events and calculating probabilities of future events.

Example

Using a Weather model

Using state of weather at a time, t;

Let; P(t=R)=Probability of rain at time t.

P(t=S)=Probability of sun at time t.

Include a transition matrix T which represents the probabilities of transitioning from one state to another;

**T=((0.7,0.3),(0.4,0.6))**

To find the probability distribution of the weather for a future time we multiply the current probability distribution P(t) by the transition matrix T. Like so;

**P(t+1)=P(t)\*T**

Let’s say we have a 50-50 chance of rain or sun on day on day 1:

**P(1)=(0.5,0.5)**

We can find the probability distribution for the second day:

**P(2) = P(1)\*T=(0.5,0.5)\*((0.7,0.3),(0.4,0.6))**

**=(0.55,0.45)**

Therefore; There’s a 55% chance of rain and a 45% chance of sun.