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Markov Process Investigation

Early Years

The idea of the Markov process was created by a mathematician named Andrey Markov. The Markov process is a probabilistic model that satisfies the Markov property. A process satisfies the Markov property if someone can predict the future of the process solely on the current state, as well as knowing the processes past history. Markov brought new methodology when looking at probability that was far more advanced than doing coin flips. When you look at a situation like a coin flip, each event is independent of one another. Markov looked at chains of linked events where what is going to happen next depends on the current state.

Real Life Application

Markov processes can be seen in many forms in modern day science and everyday life. They are often used to help determine the possibility of someone's child having certain genes based on the genes of the parents. Things like eye color, hair color, and other small characteristics of the body can be predicted based on the heritage of the parents. Markov processes are used everyday when you watch the weather on the news or hear it on the radio. They are what make up the systems that meteorologists use to determine the possible forecast for the week and they are often quite accurate. Markov processes are also what make up everyone's favorite search engines. The creators of search engines often use Markov processes to make a prediction about what results will be relevant based on the key words you are searching. In statistics Markov processes are used to make a representative sample for a large set of possibilities. By taking the results of your statistical study you can draw conclusions about what the probabilities of possible outcomes will be. As shown Markov processes can be seen in many ways in everyday life and allows for accurate predictions to be made.

Potential Application

A potential application of a Markov process is predicting the weather. By looking at the weather from past days you can get an idea of the probability that the weather will be a certain way in the coming days. The data I collected is from my hometown from the past 16 days. Bellow is a sequence of weather conditions from the past days with R representing rain, S representing a sunny day, and G representing snow.

S S R R R S S G G G G R S S G R

State Transition Count Matrix

From\to	R	S	G
R	2	3	0
S	1	3	2
G	2	0	3

State Transition Probability Matrix

From\to	R	S	G
R	.5	.5	0
S	.167	.5	.333

G	.4	0	.6

State Transition Probability Distribution Matrix

From\to	R	S	G
R	.5	1.0	1.0
S	.167	.667	1.0
G	.4	.4	1.0

Process: To simulate a sequence based on the probabilities that I have provided in the tables above is simple. You will need a die to get a random number from 1-6, although you must treat the number as a decimal. Take the last know day's weather condition and look at that row in the STPDM that corresponds to that condition. Than roll your die to get your random number and start going down the row until you find a number greater than the decimal you rolled. Once you have found a number greater record the column that you're in and that number becomes your most recent weather condition. Repeat until you have your desired amount of days predicted.

Results of a sequence: SSRGGGSRRS

References-

- 1. "Markov Chain." *Wikipedia*, Wikimedia Foundation, 18 Feb. 2019, en.wikipedia.org/wiki/Markov_chain.
- 2. Hayes, Brian. "First Links in the Markov Chain." *American Scientist*, 6 Sept. 2018, www.americanscientist.org/article/first-links-in-the-markov-chain.