GP Assignment - Simple Markov Process Investigation

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Abstract

This assignment entails a search for knowledge about Markov processes, real world applications of Markov processes, and perspectives on the strengths and weaknesses of Markov models. It then calls for the expression of that knowledge in the form of a short essay.

Establishment of Markov processes

Markov processes was named after Andrei Markov, who had early mathematical contributions to areas of number theory, analysis, infinite series, and so on. But he is best known for his study of the Markov process, which was the study of a class of random processes and is characterized by the Markov property that future behavior of the process is independent of the past behavior, given the present state. Markov founded this new branch of probability theory by applying mathematics to poetry. He spent hours observing patterns of vowels and consonants and summarized his findings of a new technique he developed, the Markov chain.

Real world applications

The Markov process can be seen and used all around us everyday. For example, physics, chemistry, statistics, finance, game theory, and music. In science, you can find the application of the Markov process/chain from identifying genes in DNA, power algorithms for voice recognition and web searches to simulating a collective behavior of systems made up of interacting particles. The markov chain can also be found in statistics where it provides a method of drawing a representative sample from a large set of possibilities. In games such as Snakes and Ladders, the next state of the board depends on your current state and the roll of the dice and has little to nothing to do with the past state is a Markov process compared to a game of blackjack, where the player can gain an advantage by remembering which cards have appeared, is not a Markov process.

Something interesting I found that the PageRank algorithm by Larry Page and Sergey Brin, founders of Google, was based on a Markov chain where the states represented pages of the World Wide Web, and the transitions are links between each page. The goal of this Markov chain was to calculate the probability that a reader could get to a specific webpage by following links at random.

Strengths and weaknesses

Weakness of the markov process, includes not being useful for explaining events, and terrible at modeling a true model of the underlying situation in most cases. For example, it can

model the probability of something happening but not what and why something leads up to that something happening. A strength of this process is that since it is memoryless and that the future is independent of the past, it can be useful to predict things with little information even though it might not be the best prediction. The prediction and probability of a future event happening only depends on the current position or state and has little to nothing to do with the past. All in all the primary advantages of Markov analysis is that it's simplicity and is useful for financial speculators however it is not useful in explaining events and why something happens.

References

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