

School of Engineering and Applied Science (SEAS), Ahmedabad University

Probabilistic Graphical Models (CSE 516)

Project Abstract

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Group Name: r_ads_g4

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Algorithm: Bayesian Network

I. Summary

WeWeather plays an important role in every living species. Weather determines the convenience of doing any work or task. Weather directly affects the social and economic lifestyle of people around it. we are trying to predict tomorrow's rain probability using the bayesian network, which is based on weather forecasting. For that, we are using 10 years of daily Australian weather data. In this paper, we try to make two different networks and gonna compare the accuracy between networks, and try to understand the bayesian network concept from them. Try to conclude How it bayesian network help.

Till this point, we created one small bayesian network and tried to run it. So, here some doubt happened we can solve it now. And also found some information about topic which can help us to understand it better. In next step we want to do different changes in model and try to analyze it for next two week.

II. Abstract

A. Background

In this paper, we are using Bayesian Belief Networks to predict tomorrow's rain. This method takes only data like short-term data such as air temperature, pressure, humidity, and sunlight and long-term factors like season and sunlight to predict the rain.

Bayesian belief network is a probabilistic graphical model that represents conditional dependencies between random variables through a directed acyclic graph. A Bayesian network is an efficient, compact, and intuitive knowledge representation for handling uncertainty. Structure of a graphical model that defines a set of dependence and independence statements over a set of random variables that represent the entire network. The main object of these networks is trying to understand the structure of causality relations.

Mathematical definition of the Belief network

belief network having variable $X = \{X_1, X_2, \dots, X_n\}$ considering directed acyclic graph and probabilities that are calculated by the given formula

$$(X_1, \dots, X_N) = \prod_{i=1}^N P(X_i / \text{Parents}(X_i))$$

Where $\text{Parents}(X_i)$ are the parents of X_i in a network.

From the formula, we are able to calculate the joint distribution, that we need to have conditional probabilities indicated by the network. So Bayesian belief network can be used as a knowledge integration and representation tool for the decision making under uncertainty.

B. Motivation

Many of our social and economic systems depend on weather forecasts, e.g. flood situations, yet making accurate forecasts is still an active area of research. The simplest explanation for weather is that it results from a number of interconnected physical variables, such as wind direction and speed, air pressure, temperature, humidity and long term variables like seasons and distance from ocean. Accurate rainfall prediction is now more difficult than before due to extreme climate variations. Generally, a Machine learning algorithm is used for large weather datasets, but by using a Bayesian Belief network, We can reduce the size of datasets and reduce the complexity of the network. We can also reduce the uncertainty of the result that is generated by the Bayesian belief network, and by this we make inferences in an easy manner. To understand bayesian network and PGM's three part representation, Inference, learning is our main motive.

C. Contribution

Nand And Jay: coding part for hendling data, creating network and finding probabilities.

Vrutik and Manav: finding and reading research paper and information regarding to weather factors and bayesian network.

III. References

<https://towardsdatascience.com/introduction-to-bayesian-belief-networks-c012e3f59f1b>

Dataset: <https://www.kaggle.com/datasets/jsphyg/weather-dataset-rattle-package>

Khabarov, S Shilkina, M Vasiliev, N. (2021). Precipitation forecast based on the Bayesian Network. IOP Conference Series: Earth and Environmental Science. 806. 012016. 10.1088/1755-1315/806/1/012016.

https://en.wikipedia.org/wiki/Climate_of_Australia

A. Nandar, "Bayesian network probability model for weather prediction," 2009 International Conference on the Current Trends in Information Technology (CTIT), 2009, pp. 1-5, doi: 10.1109/CTIT.2009.5423132.