Experiment-5

Program to Implement Bayesian Network

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AIM

Write a Program to Implement Bayesian Network

ALGORITHM

A Bayesian network, Bayes network, belief network, decision network, Bayes(ian) model or probabilistic directed acyclic graphical model is a probabilistic graphical model (a type of statistical model) that represents a set of variables and their conditional dependencies via a directed acyclic graph (DAG). Bayesian networks are ideal for taking an event that occurred and predicting the likelihood that any one of several possible known causes was the contributing factor. For example, a Bayesian network could represent the probabilistic relationships between diseases and symptoms. Given symptoms, the network can be used to compute the probabilities of the presence of various diseases.

Graphical Model

Formally, Bayesian networks are directed acyclic graphs (DAGs) whose nodes represent variables in the Bayesian sense: they may be observable quantities, latent variables, unknown parameters or hypotheses. Edges represent conditional dependencies; nodes that are not connected (no path connects one node to another) represent variables that are conditionally independent of each other. Each node is associated with a probability function that takes, as input, a particular set of values for the node's parent variables, and gives (as output) the probability (or probability distribution, if applicable) of the variable represented by the node.

SOURCE CODE

```
import numpy
from pomegranate import *
guest = DiscreteDistribution ({'A': 1./3, 'B': 1./3, 'C': 1./3})
prize = DiscreteDistribution ({'A': 1./3, 'B': 1./3, 'C': 1./3})
monty = ConditionalProbabilityTable (
[['A', 'A', 'A', 0.0],
['A', 'A', 'B', 0.5],
['A', 'A', 'C', 0.5],
['A', 'B', 'A', 0.0],
['A', 'B', 'B', 0.0],
['A', 'B', 'C', 1.0],
['A', 'C', 'A', 0.0],
['A', 'C', 'B', 1.0],
['A', 'C', 'C', 0.0],
['B', 'A', 'A', 0.0],
['B', 'A', 'B', 0.0],
['B', 'A', 'C', 1.0],
['B', 'B', 'A', 0.5],
['B', 'B', 'B', 0.0],
['B', 'B', 'C', 0.5],
['B', 'C', 'A', 1.0],
['B', 'C', 'B', 0.0],
['B', 'C', 'C', 0.0],
['C', 'A', 'A', 0.0],
['C', 'A', 'B', 1.0],
['C', 'A', 'C', 0.0],
['C', 'B', 'A', 1.0],
['C', 'B', 'B', 0.0],
```

```
['C','B','C',0.0],
['C','C','A',0.5],
['C','C','B',0.5],
['C','C','C',0.0]], [guest, prize])
s1 = State(guest, name="guest")
s2 = State(prize, name="prize")
s3 = State(monty, name="monty")
model = BayesianNetwork("Monty Hall Problem")
model.add_states(s1, s2, s3)
model.add_edge(s1, s3)
model.add_edge(s2, s3)
model.bake()
print(model.probability([['A','B','C'],['A','A','C'],['A','C','C']]))
print(model.predict([['A', None, 'C'], ['A','A', None], [None, 'B', 'A']]))
```

OUTPUT

```
[0.11111111  0.05555556  0.        ]
[array(['A', 'B', 'C'], dtype=object), array(['A', 'A', 'C'],
 dtype=object), array(['C', 'B', 'A'], dtype=object)]
```

VIVA QUESTIONS

1. What is bayesian network?

Ans. A Bayesian network is a graphical model that represents a set of variables and their conditional dependencies using a directed acyclic graph (DAG).

2. What does the bayesian network provide?

Ans. It provides a compact and efficient way to represent joint probability distributions and helps in reasoning under uncertainity.

3. What is bayesian network with example?

Ans. A Bayesian network can be used to model the relationship between diseases and symptoms. For example, the probability of having a disease can be inferred based on observed symptoms and other factors.

4. What is bayesian network in machine learning?

Ans. In machine learning, Bayesian networks are used for probabilistic reasoning and decision-making, particularly in classification, clustering and anomaly detection tasks.

5. Where does bayes rule can be used?

Ans. Bayes Rule can be used in a variety of fields such as medical diagnosis, spam filtering, and risk assessment, where prior information is updated with new evidence.

6. How do bayesian networks work?

Ans. Bayesian networks work by representing relationships between variables with nodes and edges, updating beliefs using Bayes Theorem based on new evidence, and calculating the probability of outcomes efficiently.