

Bayesian Network Project Guidelines

Objective

Develop a Bayesian network model using Netica for an application of your choice. This project demonstrates your understanding of Bayesian networks, from structure design to probabilistic inference.

Submission Requirements

Groups must submit:

- **Video Presentation** (max 6 minutes):
 - Explain the network's construction (variables, states, edges, probabilities).
 - Demonstrate at least two probabilistic inference scenarios.
 - The video must not be AI-generated, and at least one group member must provide a human narration.
- **Netica File:** Submit the constructed Bayesian network file.

Note: On Blackboard, you will find a folder with academic articles showcasing Bayesian networks in various scenarios to inspire your project.

Tasks

1. Identify an Application of Interest

Choose a domain where Bayesian networks are applicable, such as:

- **Healthcare:** Diagnosing diseases.
- **Environmental Science:** Predicting weather conditions.
- **Sports Analytics:** Predicting match outcomes.
- **Business Decision-Making:** Customer behavior analysis.

2. Design the Bayesian Network

- a. **Identify relevant variables and their states.**
 - Example: For diagnosing diseases, variables might include symptoms (e.g., fever, cough) and diseases (e.g., flu, cold).
- b. **Define the relationships (edges) between variables.**
 - Example: *Fever* might influence the likelihood of *Flu*.
- c. **Specify conditional probability tables (CPTs).**
 - Base probabilities on logical assumptions or existing literature.

3. Demonstrate the Network

- Use Netica to:
 - Define nodes, states, and probabilities.
 - Establish directed edges to represent relationships.
- Show how the network performs probabilistic inference:
 - Example: Input evidence (e.g., *Cough* = *Yes*) and explain updated probabilities for outcomes.

Example Scenario: Healthcare Diagnosis

Application Description

Develop a Bayesian network to assist in diagnosing diseases based on symptoms and test results.

Steps to Create the Network

a. **Identify Variables:**

- *Disease Status* (Yes/No)
- *Symptoms* (e.g., Fever, Cough)
- *Test Results* (Positive/Negative)
- *Risk Factors* (e.g., Age, Smoking)

b. **Define Relationships:**

- *Risk Factors* influence *Disease Status*.
- *Disease Status* influences *Symptoms* and *Test Results*.

c. **Assign Probabilities:**

- Example: Probability of *Positive Test Result* given *Disease Status* = *Yes*.

Inference Demonstration

- **Scenario 1:** Given a *Positive Test Result* and *Fever*, determine the probability of *Disease Status* = *Yes*.
- **Scenario 2:** Analyze how changing *Risk Factors* affects the probability of *Disease Status*.