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Lab 4

1 Objective

To classify instances from a dataset into different classes using a Bayesian Network model. The dataset includes a target variable (class) and several features.

2 Dataset

- **Format**: CSV file (train.csv)
- **Columns**:
  - `class` (Target Variable)
  - `feature1`, `feature2`, `feature3`, `feature4`, `feature5` (Independent Variables)

3 Approach

3.1 Data Preparation

- **Loading the Data**:
  - The dataset is read using `pandas`, with columns explicitly named for clarity.
- **Separating Features and Target**:
  - Independent variables (`feature1` to `feature5`) are separated from the target variable (`class`).

3.2 Bayesian Network Model

- **Model Definition**:
  - A Bayesian Network structure is defined where each feature influences the `class`. This structure assumes that each feature directly affects the `class` variable.
- **Training**:

  - The model is trained using `MaximumLikelihoodEstimator` to estimate the conditional probabilities from the data.

- **Inference**:
  - `Variable Elimination` is used for querying the network. Predictions are made based on the observed feature values.

3.3 Predictions and Evaluation

- **Query Example**:
  - For given feature values $[107, 10.1, 2.2, 0.9, 2.7]$, the network predicts the probability distribution over possible classes.