Team ML_ShibaInu

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Homework 6: Bayesian Belief Network

Question 6.6: Naive Bayes for PlayTennis Problem

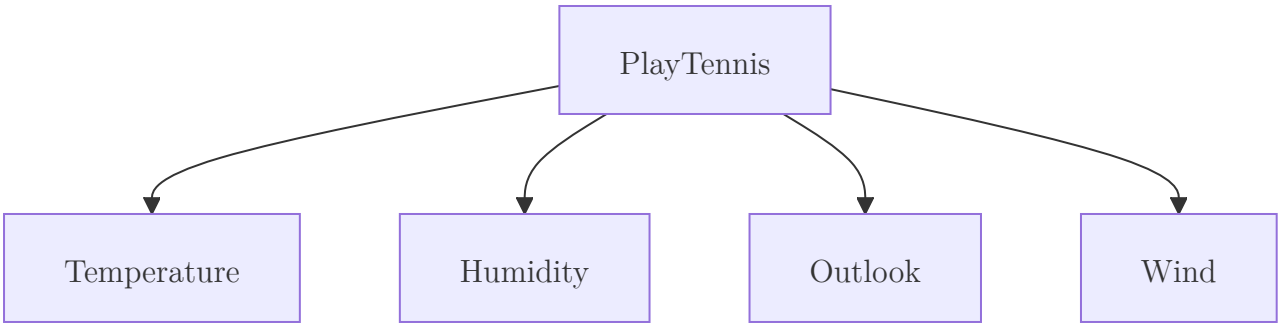
Draw the Bayesian belief network that represents the conditional independence assumptions of the naive Bayes classifier for the PlayTennis problem. Give the conditional probability table associated with the node "Wind."

ANSWER:

1. Bayesian Network Representation for Naive Bayes

In a Naive Bayes classifier, the assumption is that all features (in this case, `Outlook`, `Temperature`, `Humidity`, and `Wind`) are conditionally independent given the target variable `PlayTennis`.

Thus, the network looks like:



2. Conditional Probability Table for "Wind"

To calculate the conditional probability table for the node `Wind`, we need to look at the data in the `PlayTennis` dataset and count how the values of `Wind` are distributed for each class label `PlayTennis`.

Data Breakdown:

- **PlayTennis = Yes:**
  - Days: D3, D4, D5, D7, D9, D10, D11, D12, D13
  - Wind = Weak: 6 instances
  - Wind = Strong: 3 instances
- **PlayTennis = No:**
  - Days: D1, D2, D6, D8, D14
  - Wind = Weak: 2 instances
  - Wind = Strong: 3 instances

Conditional Probability Table for "Wind"

The conditional probability table (CPT) for `Wind` given `PlayTennis` can now be calculated as follows:

- $P(\text{Wind} = \text{Weak} | \text{PlayTennis} = \text{Yes}) = \frac{6}{9} = 0.67$
- $P(\text{Wind} = \text{Strong} | \text{PlayTennis} = \text{Yes}) = \frac{3}{9} = 0.33$
- $P(\text{Wind} = \text{Weak} | \text{PlayTennis} = \text{No}) = \frac{2}{5} = 0.40$
- $P(\text{Wind} = \text{Strong} | \text{PlayTennis} = \text{No}) = \frac{3}{5} = 0.60$

Thus, the conditional probability table is as follows:

P(Wind|PlayTennis)	**Wind = Weak**	**Wind = Strong**
PlayTennis = Yes	0.67	0.33
PlayTennis = No	0.40	0.60

This table reflects the likelihood of different wind conditions given whether or not tennis is played.