Bayesian_Networks_p7

November 2, 2025

Read a dataset and indicate the likelihood of an event occurring using Bayesian Networks.

[2]:
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!pip install pgmpy
```

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Collecting pgmpy
  Downloading pgmpy-1.0.0-py3-none-any.whl.metadata (9.4 kB)
Requirement already satisfied: networkx in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (3.1)
Requirement already satisfied: numpy in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (1.26.4)
Requirement already satisfied: scipy in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (1.10.1)
Requirement already satisfied: scikit-learn in
c:\users\harsh\anaconda3\lib\site-packages (from pgmpy) (1.7.2)
Requirement already satisfied: pandas in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (1.5.3)
Requirement already satisfied: torch in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (2.7.1)
Requirement already satisfied: statsmodels in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (0.14.0)
Requirement already satisfied: tqdm in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (4.65.0)
Requirement already satisfied: joblib in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (1.2.0)
Requirement already satisfied: opt-einsum in c:\users\harsh\anaconda3\lib\site-
packages (from pgmpy) (3.4.0)
Collecting pyro-ppl (from pgmpy)
  Downloading pyro_ppl-1.9.1-py3-none-any.whl.metadata (7.8 kB)
Requirement already satisfied: python-dateutil>=2.8.1 in
c:\users\harsh\anaconda3\lib\site-packages (from pandas->pgmpy) (2.8.2)
Requirement already satisfied: pytz>=2020.1 in
c:\users\harsh\anaconda3\lib\site-packages (from pandas->pgmpy) (2023.3.post1)
Requirement already satisfied: six>=1.5 in c:\users\harsh\anaconda3\lib\site-
packages (from python-dateutil>=2.8.1->pandas->pgmpy) (1.16.0)
Collecting pyro-api>=0.1.1 (from pyro-ppl->pgmpy)
  Downloading pyro_api-0.1.2-py3-none-any.whl.metadata (2.5 kB)
Requirement already satisfied: filelock in c:\users\harsh\anaconda3\lib\site-
packages (from torch->pgmpy) (3.13.1)
Requirement already satisfied: typing-extensions>=4.10.0 in
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c:\users\harsh\anaconda3\lib\site-packages (from torch->pgmpy) (4.15.0)
Requirement already satisfied: sympy>=1.13.3 in
c:\users\harsh\anaconda3\lib\site-packages (from torch->pgmpy) (1.14.0)
Requirement already satisfied: jinja2 in c:\users\harsh\anaconda3\lib\site-
packages (from torch->pgmpy) (3.1.3)
Requirement already satisfied: fsspec in c:\users\harsh\anaconda3\lib\site-
packages (from torch->pgmpy) (2023.10.0)
Requirement already satisfied: mpmath<1.4,>=1.1.0 in
c:\users\harsh\anaconda3\lib\site-packages (from sympy>=1.13.3->torch->pgmpy)
(1.3.0)
Requirement already satisfied: colorama in c:\users\harsh\anaconda3\lib\site-
packages (from tqdm->pgmpy) (0.4.6)
Requirement already satisfied: MarkupSafe>=2.0 in
c:\users\harsh\anaconda3\lib\site-packages (from jinja2->torch->pgmpy) (2.1.3)
Requirement already satisfied: threadpoolctl>=3.1.0 in
c:\users\harsh\anaconda3\lib\site-packages (from scikit-learn->pgmpy) (3.6.0)
Requirement already satisfied: patsy>=0.5.2 in
c:\users\harsh\anaconda3\lib\site-packages (from statsmodels->pgmpy) (0.5.3)
Requirement already satisfied: packaging>=21.3 in
c:\users\harsh\anaconda3\lib\site-packages (from statsmodels->pgmpy) (24.2)
Downloading pgmpy-1.0.0-py3-none-any.whl (2.0 MB)
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Downloading pyro_ppl-1.9.1-py3-none-any.whl (755 kB)
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   ---------------------------------------- 756.0/756.0 kB 1.4 MB/s eta 0:00:00
Downloading pyro_api-0.1.2-py3-none-any.whl (11 kB)
Installing collected packages: pyro-api, pyro-ppl, pgmpy

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Successfully installed pgmpy-1.0.0 pyro-api-0.1.2 pyro-ppl-1.9.1


[notice] A new release of pip is available: 25.1.1 -> 25.3
[notice] To update, run: python.exe -m pip install --upgrade pip
```

[16]:
```python
import pandas as pd
from pgmpy.models import DiscreteBayesianNetwork
from pgmpy.estimators import MaximumLikelihoodEstimator
from pgmpy.inference import VariableElimination

# Step 1: Create a more realistic dataset
data = pd.DataFrame({
    'Rain':    ['Yes', 'Yes', 'No', 'No', 'Yes', 'No', 'Yes', 'No', 'No',␣
 ↪'Yes'],
    'Traffic':  ['High', 'High', 'Low', 'Low', 'Low', 'Low', 'High', 'Low',␣
 ↪'High', 'High'],
    'Late':    ['Yes', 'No', 'No', 'No', 'Yes', 'No', 'Yes', 'No', 'No', 'Yes']
})

# Step 2: Define Bayesian Network structure
model = DiscreteBayesianNetwork([('Rain', 'Traffic'), ('Traffic', 'Late')])

# Step 3: Train the model
model.fit(data, estimator=MaximumLikelihoodEstimator)
```

```python
# Step 4: Inference
inference = VariableElimination(model)

# Step 5: Query probability P(Late | Rain = Yes)
prob = inference.query(variables=['Late'], evidence={'Rain': 'Yes'})
print(prob)
```

```
INFO:pgmpy: Datatype (N=numerical, C=Categorical Unordered, O=Categorical
Ordered) inferred from data:
 {'Rain': 'C', 'Traffic': 'C', 'Late': 'C'}
```

```
+-----------+-------------+
| Late      |   phi(Late) |
+===========+=============+
| Late(No)  |      0.4800 |
+-----------+-------------+
| Late(Yes) |      0.5200 |
+-----------+-------------+
```

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