hl6dciyza

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```python
[ ]: # !pip install pgmpy
```

```python
[1]: import numpy as np
     import pandas as pd
     from pgmpy.models import BayesianModel
     from pgmpy.estimators import MaximumLikelihoodEstimator
     from pgmpy.inference import VariableElimination
```

```python
[2]: # Read Cleveland Heart Disease data
     heartDisease = pd.read_csv('heart.csv')
     heartDisease = heartDisease.replace('?',np.nan)

     # Display the data
     print(f"Few examples from the dataset are given below : \n\n{heartDisease.
      ↪head()}")

     # Model Bayesian Network
     model =␣
      ↪BayesianModel([('age','trestbps'),('age','fbs'),('sex','trestbps'),('exang','trestbps'),('t
                      ('fbs','heartdisease'),('heartdisease','restecg'),␣
      ↪('heartdisease','thalach'),('heartdisease','chol')])

     # Learning CPDs using Maximum Likelihood Estimators
     print('\nLearning CPD using Maximum likelihood estimators')
     model.fit(heartDisease, estimator=MaximumLikelihoodEstimator)

     # Inferencing with Bayesian Network
     print('Inferencing with Bayesian Network:')
     HeartDisease_infer = VariableElimination(model)

     # Computing the Probability of HeartDisease given Age
     print('1. Probability of HeartDisease given Age=38')
     q = HeartDisease_infer.query(variables=['heartdisease'], evidence={'age':38})
     print(q)

     # Computing the Probability of HeartDisease given cholesterol
     print('\n 2. Probability of HeartDisease given cholesterol=230')
```

```
q=HeartDisease_infer.query(variables=['heartdisease'], evidence ={'chol':230})
print(q)
```

WARNING:pgmpy:BayesianModel has been renamed to BayesianNetwork. Please use
BayesianNetwork class, BayesianModel will be removed in future.

Few examples from the dataset are given below :

```
   age  sex  cp  trestbps  chol  fbs  restecg  thalach  exang  oldpeak  slope  \
0   63    1   1       145   233    1        2      150      0      2.3      3
1   67    1   4       160   286    0        2      108      1      1.5      2
2   67    1   4       120   229    0        2      129      1      2.6      2
3   37    1   3       130   250    0        0      187      0      3.5      3
4   41    0   2       130   204    0        2      172      0      1.4      1

   ca thal  heartdisease
0   0    6             0
1   3    3             2
2   2    7             1
3   0    3             0
4   0    3             0
```

Learning CPD using Maximum likelihood estimators
Inferencing with Bayesian Network:
1. Probability of HeartDisease given Age=38

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```
+-----------------+---------------------+
| heartdisease    |   phi(heartdisease) |
+=================+=====================+
| heartdisease(0) |              0.7026 |
+-----------------+---------------------+
| heartdisease(1) |              0.1024 |
+-----------------+---------------------+
| heartdisease(2) |              0.0577 |
+-----------------+---------------------+
| heartdisease(3) |              0.0631 |
+-----------------+---------------------+
| heartdisease(4) |              0.0741 |
+-----------------+---------------------+
```

2. Probability of HeartDisease given cholesterol=230

heartdisease	phi(heartdisease)
heartdisease(0)	0.0000
heartdisease(1)	0.3270
heartdisease(2)	0.3059
heartdisease(3)	0.0000
heartdisease(4)	0.3671

[ ]: