Date 05/01/2021

Expt. No. 9

Page No. 22

9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using Standard Heart disease data set. You can use Java/Python ML library classes/API.

```
import numpy as np
import pandas as pd
import csv
from pgmpy.estimators import MaximumLikelihoodEstimator
from pgmpy.models import BayesianModel
from pgmpy.inference import VariableElimination

heartDisease = pd.read_csv('Lab7_heart.csv')
heartDisease = heartDisease.replace('?', np.nan)

print('Sample instances from the dataset are given below')
print(heartDisease.head())

print('\n Attributes and datatypes')
print(heartDisease.dtypes)

model = BayesianModel([('age', 'heartdisease'), ('sex', 'heartdisease'),
        ('exang', 'heartdisease'), ('cp', 'heartdisease'), ('heartdisease',
          'restecg'), ('heartdisease', 'chol')])

print('\n Learning CPD using maximum likelihood estimators')
model.fit(heartDisease, estimator=MaximumLikelihoodEstimator)
```

```
print('In Inferencing with Bayesian Network.')
HeartDiseasetest_infer = VariableElimination(model)

print('In 1. Probability of HeartDisease given evidence=restecg:1')
q1 = HeartDiseasetest_infer.query( variables = ['heartdisease'],
        evidence = {'restecg':1})
print(q1)

print('In 2. Probability of HeartDisease given evidence = cp:2')
q2 = HeartDiseasetest_infer.query( variables=['heartdisease'],
        evidence = {'cp':2})
print(q2)
```

Teacher's Signature : _____

Dataset:

age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	hD
63	1	1	145	233	1	2	150	0	0
67	1	4	160	286	0	2	108	1	2
67	1	4	120	229	0	2	129	1	1
37	1	3	130	250	0	0	187	0	0
41	0	2	130	204	0	2	172	0	0
56	1	2	120	236	0	0	178	0	0
62	0	4	140	268	0	2	160	0	3
57	0	4	120	354	0	0	163	1	0
63	1	4	130	254	0	2	147	0	2

Output:

Sample instances from the dataset are given below

age	sex	cp	trestbps	chol	fbs	restecg	thalach	exang	hD
63	1	1	145	233	1	2	150	0	0
67	1	4	160	286	0	2	108	1	2
67	1	4	120	229	0	2	129	1	1
37	1	3	130	250	0	0	187	0	0
41	0	2	130	204	0	2	172	0	0

Attributes and datatypes

age	int64
sex	int64
cp	int64
trestbps	int64
chol	int64
fbs	int64

restecg	int64
thalach	int64
exang	int64
hD	Object/int64
dtype :	object

Learning CPD using maximum likelihood estimators.

Inferencing with Bayesian network:

1. Probability of HeartDisease given evidence = restecg: 1

heartdisease	phi(heartdisease)
heartdisease(0)	0.1012
heartdisease(1)	0.0000
heartdisease(2)	0.2392
heartdisease(3)	0.2015
heartdisease(4)	0.4581

2. Probability of heartDisease given evidence cp: 2

heartdisease	phi(heartdisease)
heartdisease(0)	0.3610
heartdisease(1)	0.2159
heartdisease(2)	0.1373
heartdisease(3)	0.1537
heartdisease(4)	0.1321