Artificial Intelligence Laboratory 3: Bayesian Network
DT8042 HT22, Halmstad University

Mohammad Hammoud, {mohham19}@hh.se, {civilingenjör i datateknik}
and Krishnendu Jinesh, {krijin22}@hh.se, {Master Of Information Technology}

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Introduction

The objective of this lab is to learn how to construct Bayesian Network from data, learn how to implement Naïve Bayes algorithm for classification tasks, and how to use Bayesian Network and Naïve Bayes for inference.

> **Q1**: What types of algorithm have you used or implemented in this lab?

In this lab, we developed our knowledge of the Nave Bayes method and Bayesian networks.

Task 1: Bayesian Network

For task 1...

> **Q2**: Learn a Bayesian Network from the given smart grid data. Illustrate the learned network.

A Bayesian network is a directed graph where each node is tagged with quantitative probability data. from the supplied smart grid data in a Bayesian network. Learning networks are Load and duration of the outage Demand factor, overload, and outage duration are all factors to consider. No matter the season

> **Q3**: Compute the following
>
> 1. p(Outage duration=$Otg \leq 1$ | Time = Morning, Demand Factor=Medium)
> 2. p(Demand Factor=High | Overload=Yes, Time=Afternoon)
> 3. p(Number of Customers=Low | Demand Factor=High)

1.p(Outage duration=Otg 1 — Time = Morning, Demand Factor=Medium)=0.482832
2.p(Demand Factor=High — Overload=Yes, Time=Afternoon)=0.374975
3.p(Number of Customers=Low — Demand Factor=High)=0.461176

Task 2: Naïve Bayes

> **Q4**: Compute and fill in the likelihood table (task 2a).

likelihood	Has pet		
Gender	yes	No	P(Gender)
male	2/3	3/5	5/8
Female	1/3	2/5	3/8
P(Has pet)	3/8	5/8	

Table 1: Likelihood table of having pet.

likelihood	Has pet		
Education	Yes	No	P(Education)
University	2/3	2/5	4/8
HighSchool	1/3	3/5	4/8
P(Has pet)	3/8	5/8	

Table 2: Likelihood table of having pet.

Q5: Learn a Bayesian Network from the given smart grid data. Illustrate the learned network.

P(No—Male) : P(Male—No)P(No)/P(Male) = (3/5)(5)/(5/8) =0.6

P(Yes—Female):P(Female—Yes)P(Yes)/P(Female) =(1.3)(3.8)/(3/8) =0.333

P(Yes—University): P(University—Yes)P(Yes)/P(University) =(2/3)(3/8)/(4/8) =0.5

P(No—HighSchool) : P(HighSchool—No)P(NO)/P(HighSchool) =(3/5)(5/8)/4/8 =0.75

Q6: Compute the likelihood of having pets for numerical features (task 2c).

The mean for Yes = 87666.66666666667
The mean for No = 96500.0
The standard deviation for Yes = 11585.43146465518
The standard deviation for No = 10246.950765959598
Normal Distribution for Yes = 3.374346902574001e-05
Normal Distribution for Yes = 3.183753993070195e-05 ...

Q7: Make inference with Naïve Bayes (task 2d).

$$X = (Education = University, Gender = Female, Income = 100000)$$

1.3549583592278048e-06
3.894705495519032e-06

$$X = (Education = HighSchool, Gender = Male, Income = 92000)$$

3.1447115666915206e-06
2.646403045366806e-07

...

Q8 (extra credit): Implement Naïve Bayes (task 2e) classifier and perform classification on the Iris dataset.

Please include the pseudo-code of your implementation in the report.

Conclusion

In this lab, Bayesian networks and the Nave Bayes method are employed. On the basis of this, we create a Bayesian network from the data and carry out classification tasks using the Nave Bayes algorithm.Though we had a previous course that was all about those equations we used here theoretically,this lab allowed us to use our theoretical knowledge in a coding way instead.Using Nave Bayes, we calculate the likelihood table of owning a pet for each category variable, as well as the marginal probability and interference. Additionally, determine the likelihood of owning dogs using the mean, standard deviation, and normal distribution function.