CS 514: Applied Artificial Intelligence

Project 4

Application Name: Loan Approval and Interest Rate Estimation System

Pseudo Name: MegaMind

i. Abstract

The Loan Approval and Interest Rate Estimation System is an application developed in Netica using a combination of Bayesian networks and influence diagram technology. The system is designed to help its users determine if their current financial background, credit score and residential status are strong enough to help them get their loan request approved. The system performs a brief analysis of the current situation of the user by allowing the users to update the root nodes (nodes without parents) of the Bayesian network, recalculates the probabilities of all nodes from the root to the leaf in order to determine whether he/she is a good candidate for a loan application. In addition, it uses the decision net to estimate if the interest rate applied on his/her loan should be low or high. Such an application is not only beneficial for a bank in determining whether or not to approve a loan request, but also a handy application for the person seeking loan.

ii. Features

1. The Bayesian network designed for the loan approval and interest rate estimation system consists of 26 nodes.
2. The root nodes (nodes that do not have any parent nodes) are known as the evidence variables and they do not have any dependencies on other nodes of the Bayesian network.
3. There are 18 such evidence variables in the Bayesian network of the designed loan approval system.
4. These nodes also act as the input nodes and have prior probabilities associated with them.
5. The inner nodes serve two purpose, grouping the data and decreasing the size of the Conditional Probability Tables (CPTs).
6. The prior probabilities of the evidence (independent) variables are used by inner nodes to calculate their own CPTs.
7. There are 6 such inner nodes of which one is the final node that predicts the outcome i.e. the loan approval/rejection decision probability.
8. Additionally, there are two more nodes in the network viz. a utility node and a decision node to estimate whether the interest rate would be high or low.

iii.   Nodes and Descriptions

Input nodes/Independent variables-

1. Age
    a.   Below 18
    b.   Above 18
2. Job_Type
    a.   Unemployed
    b.   Part-time
    c.   Full-time
    d.   Personal Business
3. Years_Employed
    a.   Less than 4 years
    b.   More than 4 years
4. Stock_Investments
    a.   Low
    b.   High
5. Property_Investments
    a.   Low
    b.   High
6. Bank_Balance
    a.   Low
    b.   High
7. Housing_Loan
    a.   Yes
    b.   No
8. Personal_Loan
    a.   Yes
    b.   No
9. Student_Loan
    a.   Yes
    b.   No
10. Business_Loan
    a.   Yes
    b.   No
11. No_of_Credit_Cards
    a.   Less than 6
    b.   More than 6
12. Account_Diversity
    a.   Low
    b.   High
13. Payment_History
    a.   Poor
    b.   Good
14. Time_in_file
    a.   Less than 5 years
    b.   Greater than 5 years

15. Revolving_Debt
    a. Yes
    b. No
16. Installment_Debt
    a. Yes
    b. No
17. Open_Debt
    a. Yes
    b. No
18. Residential_Status
    a. Own House
    b. On Rent
    c. Homeless

Dependent non-output nodes-
1. Employment_Score – Depends on the Years_Employed and Job_Type nodes.
    a. Bad
    b. Good
2. Financial_Background – Depends on the Stock_Investments, Bank_Balance, Property_Investments, Employment_Score and Loan_Owe_Score nodes.
    a. Poor
    b. Good
3. Loan_Owe_Score – Depends on Housing_Loan, Personal_Loan, Student_Loan and Business_Loan nodes.
    a. Low
    b. High
4. Credit_Score – Depends on Account_Diversity, No_of_Credit_Cards, Debt, Payment_History and Time_in_file nodes.
    a. Low
    b. Moderate
    c. High
5. Debt – Depends on Revolving_Debt, Installment_Debt and Open_Debt nodes.
    a. Low
    b. High

Utility node-
1. Repayment_Strength – Depends on the Financial_Background, Loan_Owe_Score and Payment_History to determine the decision of the Interest_Rate_Estimator node.

Decision node-

1. Interest_Rate_Estimator – Estimates whether the interest rate would be high or low by utilizing the utility node.

Output node-

1. Loan_Decision – Depends on the dependent non-output nodes viz. Residential_Status, Financial_Background, Age and Credit_Score. Possible values are – Approved or Rejected

iv.   Usage Manual

Steps to execute the .neta file:

1. Download the 'LoanApprovalSystem.neta' file and open it in Netica.
2. Click 'Compile Net' in the menu bar.
3. Click on any input nodes to toggle between its values.
4. This would update the probabilities at all the dependent nodes and hence the final output node would also be updated.
5. The probability of the output node indicates the chances of each possible outcome.
6. Depending on all these probability values, the utility node which itself depends on other nodes guides the decision of the decision node.

v. Output Sample

Years_Employed
Less than 4	15.0
Above 4	85.0

Job_Type
Unemployed	5.00
Part time	15.0
Full time	40.0
Personal business	40.0

Age
Below 18	2.00
Above 18	98.0

No_of_Credit_Cards
Less than 6	65.0
More than 6	35.0

Time_in_file
Less than 5 years	30.0
Greater than 5 years	70.0

Employment_Score
Bad	33.7
Good	66.3

Account_Diversity
Low	50.0
High	50.0

Revolving_Debt
Yes	10.0
No	90.0

Financial_Background
Poor	33.9
Good	66.1

Installment_Debt
Yes	10.0
No	90.0

Stock_Investments
Low	30.0
High	70.0

Debt
Low	83.7
High	16.3

Credit_Score
Low	25.5
Moderate	53.7
High	20.8

Open_Debt
Yes	10.0
No	90.0

Property_investments
Low	30.0
High	70.0

Bank_Balance
Low	10.0
High	90.0

Housing_Loan
Yes	5.00
No	95.0

Loan_Decision
Approved	60.3
Rejected	39.7

Residential_Status
Own House	80.0
On Rent	19.0
Homeless	1.0

Payment_History
Poor	20.0
Good	80.0

Personal_Loan
Yes	5.00
No	95.0

Loan_Owe_Score
Low	72.0
High	28.0

Student_Loan
Yes	5.00
No	95.0

Business_Loan
Yes	15.0
No	85.0

Repayment_Strength

Interest_Rate_Estimator
High	31.1937
Low	67.0118