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Fuzzy logic based loan evaluation system

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Abstract

Retail loans play a key role in the banking of many countries. At the same time loans to individuals are regarded as more risky than business loans. For these reasons, the efficiency of retail credit granting is important for the welfare of both households and of banking system.

In this paper a fuzzy logic model for retail loan evaluation is proposed. The fuzzy model consists of five input variables such as "income", "credit history", "employment", "character", and "collateral condition" and single output variable which indicates credit standing. Whether applicant's credit standing shall be regarded as "low", "medium" or "high" depends on the degree of membership for the linguistic terms of fuzzy output.

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Keywords: Credit, loan evaluation, income level, fuzzification, inference system, aggregation, defuzzification;

1. Introduction

Banks play an important role in the economy since they support local communities with an adequate supply of credit to fund consumption and investment spending by individuals, businesses and government agencies. Bank loans satisfy the strong need of many individuals and businesses for immediate funds to cover expected future cash needs and to meet emergencies. For many individuals, taking out a loan may be the only way to afford a house, car, or other welfare. For many companies, bank lending supports the growth of new businesses and jobs and promotes economic vitality.

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Before approving or denying a particular retail loan, the credit division of a bank is evaluating the loan application. Loan evaluation is a field, in which different techniques to support automatic decisions have been utilized so far. Among most common models used is credit scoring models based on statistical methods such as discriminate analysis and logistic regression[1,2]. In these models, decision making is based on statistical analysis of large numbers of historical data over many years of providing credit and decision variables are expressed in crisp values. However, because of incompleteness, imprecision and uncertainty of information such approaches cannot model the way human experts make their decisions about the creditworthiness of the applicant. These models make unrealistic statistical assumptions and have complete lack of communication with the decision makers. For example, the applicant's income level can be measured quantitatively but the other aspects such as applicant's character or saleability of collateral are usually valuated according to loan officers' professional knowledge, experience and subjective judgments because it is often difficult to obtain exact economic assessment data. Linguistic values such as "very high", "adequate" and so on are usually used to express their estimations.

The topic of theory and application of application of fuzzy logic[3] in marketing research is one of the topics increasing precision and reliability of portfolio analysis, customer segmentation, performance measurement, managerial decisions etc. and still being studied. In the books[4,,5,6] were considered applications of fuzzy logic in business, finace and menegement.

Rommelfanger[7] investigated Fuzzy logic-based processing of expert rules used for checking the credibility of small business firms.

In[8] was developed a fuzzy system for credit analysis in a German credit insurance system.

Decision making on credit-worthiness, using a fuzzy connectionist model was examined in[9].

The aim of this paper is to develop a decision-making model for retail loans based on fuzzy logic concept that allows to handle uncertainty and imprecision of input data using human subjective judgment by linguistic terms.

2. Input information

Retail loan evaluation usually involves a detailed study of the following information about the applicant:

1. *Income level*. Loan officers want to be sure the borrower will have acceptable cash flow (usually net salary) to repay the loan.
2. *Credit History*. The loan decision can be negatively impacted if there is history of late loan repayments or bankruptcy gathered from credit bureau.
3. *Character*. Loan officers shall be certain about applicant's purpose of the loan and moral responsibility to repay a loan fully and on time.
4. *Employment.* Most lenders are not likely to grant a sizeable loan to someone who has held his or her present job for only a few months.
5. *Collateral.* Loan officers would like to be sure about the sale ability of collateralized asset.

3. Fuzzy logic based credit evaluation system

The fuzzy logic computation consists of three steps: fuzzification of inputs, fuzzy inference associated with the rule base and defuzzification.

Fig.1 shows the steps of fuzzy logic computation.

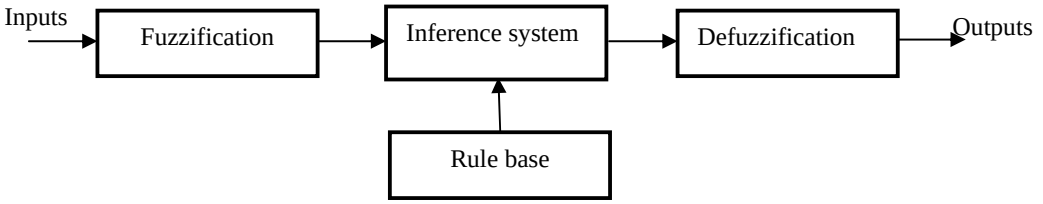

Fig 1. Steps of fuzzy logic computation