06.30.2024 JOURNAL OF

Systematic and Modern Science Research (JSMSR) Vol. 4 No.9

AN ENHANCED RURAL COMMUNITY LOAN ELIGIBILITY MATCHMAKING MODEL USING A HYBRIDIZED RECOMMENDER SYSTEM

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ABSTRACT

The involvement of modern technology is necessary for lenders to find a borrower with whom they can build confidence and reliable relationships leading to a good financial community development system in Nigeria. Grameen model is used as a standard to offer unsecured small loans to the poor in Africa and beyond but the model has some limitation like control of groupings by individual is centered on human behaviour factor, Punishment meant for others are suffered by different people. Hence to solve these problems stated we develop a an enhanced rural community loan eligibility matchmaking model using a hybridized recommender system. In this project, we developed a Lenders-to-Borrowers Recommender system using a hybridized algorithm of Content-based filtering and Success Credibility Score model to ensure credible recommendations of Borrowers to Lenders. Object-Oriented Analysis and Design Methodology was used in the analysis and was implemented with PHP programming language with the Apache web server to manage the

Introduction

Lending to the poor or lower income group raises many debates among practitioners and academicians[1]. Microfinance is defined as the provision of financial services to low-income clients, including consumers and the self- employed, who traditionally lack access to banking and related services[2]. Microfinance is a place for the poor and near poor clients to get access to a high quality financial service, which include not just credit but also savings, insurance and fund transfer. According to [3], microfinance is a provision of a broad range of financial services such as savings, credit, insurance and payment services to the poor or low-income group who are excluded from the normal banking sectors. The abundance of available information indicates

E-ISSN 3027-2939 P-ISSN 3026-8397

Database developed using MySql. Our hybridized system was able to produce accurate and credible recommendations of Eligible Borrower and the result shows that Lenders can effectively be guided on the choice of borrowers for loans.

Keywords: Matchmaking, Collaborative Filtering (CF), Content-Based Model, Loan Recommendation, Loan Eligibility.

The extreme need to overcome irrelevant information [4]. The recommender system is the building block of data filtering [5]. The aim of building a recommender system is to provide maximum information required for personalized learning and interests depending on the interactive patterns of the clients [6, 7,8]. The world has a long way to go before achieving full financial inclusion. Today, microfinance is a mainstay development strategy for extreme poverty alleviation and is supported by many as a way of achieving the United Nations Millennium Development Goals and developing countries must allocate all the necessary resources to the microfinance industry. People leaving in the rural areas are still having difficulty in accessing small loans from the federal government as a result of poor repayment plans or schedule. This research work has taken the village / community as the beginning and the ending of the world in terms of settlements. Individuals are brought up in the villages/ communities and developments leads individuals to cities/ urban areas and also government (local, state and federal) supposed to play part in exposing individuals and their life to betterment. Therefore this research work is an opening key believed to develop financing mechanism with a capability of arranging records of monetary contributions of the meetings / cooperatives and keeping the flows of account of individuals in and out of the recommended Local Government Area micro-finance banks and to keep exposure of the interested individual traders / village entrepreneur through an intelligent setup.

RELATED WORK

A. Borrower-Lender Relationship Agreement

The borrower-lender relationship agreement is a keypoint of financial institution. Each time a borrower borrows money from the lender, they engage in a relationship agreement that directly determines their quality of services.

B. Recommender Systems

A recommender system is a program that sees what a user is doing and tries to recommend courses of action it thinks would be beneficial to the user. A recommender system is a class of information filtering system that seeks to predict the fidelity or preference that a user has for an item or entity. It has been widely used to recommend books, videos, or news articles on the Internet[9].

Collaborative Filtering (CF), which explores the interaction between borrowers and lenders, and Content-Based (CB), which explores similarities between entities for which a user expressed a preference in the past [10]. More specifically, CF models analyze the relationships between users and interdependencies among items to identify preference similarity across individuals.

Content-Based Model

Content-based filtering makes recommendations by finding regularities, in the textual content information of users and items, such as user profiles and product descriptions [11]. CF is based on the assumption that if users X and Y rate n items similarly or have similar behaviors, they will rate or act on other items similarly [12]. CF only utilizes the user-item rating matrix to make predictions and recommendation.

Vector space model. The vector space model [13] is a standard algebraic model commonly used in information retrieval (IR). It treats a textual document as a bag of words, disregarding grammar and even word order.

Cosine similarity is a standard measure estimating pairwise document similarity in the vector space model. It corresponds to the cosine of the angle between two vectors, and it has the effect of normalizing the length of documents. Let $q = (wq,1, wq,2, \ldots, wq,N)$ and $\overline{d = (wd,1, wd,2, \ldots, wd,N)}$ be two N-dimensional vectors corresponding a query and a document, their cosine similarity $sq,d = \frac{q \cdot d}{||q|| \times ||d||}$

Chung-Wei Yeh presents a customized academic e-advising services by using rule-based technology to provide each individual learner for recommending courses for college students in Taiwan. he proposed an application system, called CRIS (course recommendation intelligent system)[15].

Emile R Chimusa et al. proposed a formalized matchmaking system, which is aimed at reversing the trend, by introducing the knowledge transfer programme (KTP). Instead of individual researchers travelling to other labs to learn, researchers with desirable skills are invited to join African research groups for six weeks to six months[16].

Kang et al. proposed a new reciproal model to improve user recommendations in social networks. In the reciprocity only model's binary contact matrix, users' dating activities are also represented in an N x M contact matrix C. The model proposed a way to make recommendations to others so that the user is interested in and attractive to those other users which have been recommended[17].

METHODOLOGY

Matchmaking systems should meet the users need by creating optimal matches. We are concerned with Lender-to-Borrowers matching to enhance a reliable loan eligibility in rural community in Nigeria. In our proposed system given the need to perform the

matchmaking, it would be uncircumcisized to design separate recommendation algorithms for each of them. Rather, we adopt a unified approach proposed in, to perform hybrid matrix factorization (MF) and recommend each borrower according to the level of weekly contribution information available about them.

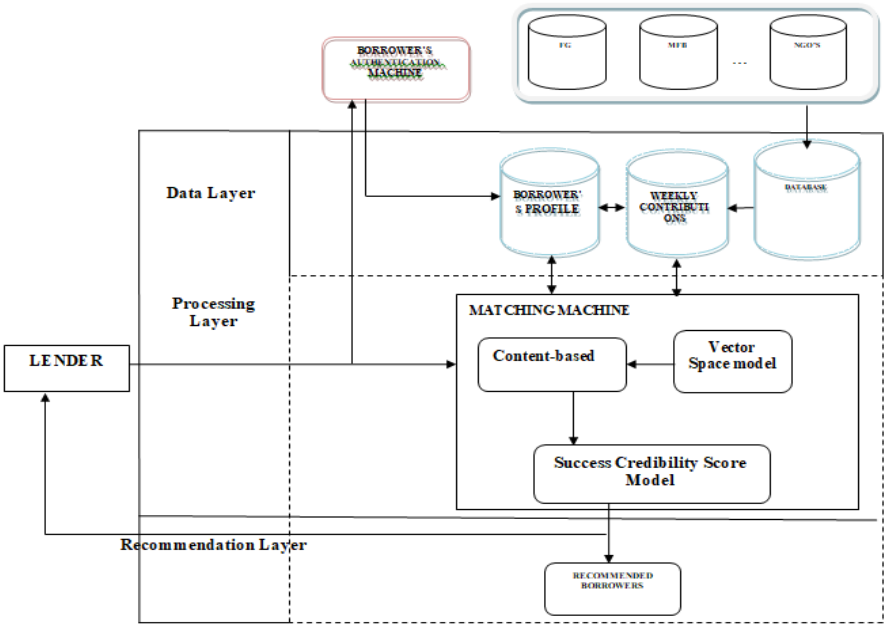

Figure 1 Architecture of the proposed system

Algorithm for Credit Scoring (Eligibility)

1) If Total Contribution is LOW AND loan amount Requested is HIGH THEN Account Status is NOT ELIGIBLE
2) If Weekly Monetary Contribution is REGULAR AND loan amount requested is HIGH THEN account status is ELIGIBLE
3) If Weekly Monetary Contribution is NOT REGULAR AND loan amount requested is HIGH THEN account status is NOT ELIGIBLE.

RESULTS AND DISCUSSION

Modeling Success Credibility Score

In this model, the formula to calculate the credibility score is;

$$SCS = \left(\frac{NSWC}{TNC} * \frac{100}{1}\right) * \left(\frac{1}{DUR}\right) \quad \ldots\ldots\ldots \text{Eqn(1)}$$

Where;
SCS = Success Credibility Score
NSWC = Number of Successful Weekly Contributions
TNC = Total Number of Contributions
DUR = Duration for the contribution

For **Borrower B1** with N1000 Weekly Contribution, the credibility score is calculated as;

$$SCS = \left(\frac{2}{12000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.2$$

$$SCS = \left(\frac{4}{12000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.4$$

$$SCS = \left(\frac{8}{12000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.8$$

$$SCS = \left(\frac{12}{12000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 1.2$$

$$SCS = \left(\frac{10}{12000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 1.0$$

$$SCS = \left(\frac{6}{12000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.6$$

Table 1: Success Credibility Score Model for 1000 Weekly Contribution

Table1 below shows the borrowers, number of success weekly contribution (NSWC), total number of contribution (TNC), Duration in weeks, credibility score. Borrower B1 pays N1000 on a weekly basis in 12 weeks will amount to N12000. To calculate the credibility score of B1 in 2,4,6,8,10,12 weeks which is shown in Table 1 below 0.2 value is seen as LOW contribution and 1.2value is seen as HIGH or REGULAR weekly contribution.

Borrowers	Number of Success Weekly Contribution(NSWC)	Total Number of Contribution(TNC)	Duration(in Weeks)	Credibility Score
B1	2	12000	12	0.2
B1	4	12000	12	0.4
B1	6	12000	12	0.6
B1	8	12000	12	0.8
B1	10	12000	12	1.0
B1	12	12000	12	1.2

If B1 request for a loan of N12000 with a 0.2 value of Success Credibilty Score (SCS), the system will recommend "NOT ELIGIBLE" because 0.2 value is seen as LOW weekly

contribution for N1000 category. But if B1 request for a loan of N12000 with a 1.2 value of Success Credibilty Score(SCS), the system will recommend "ELIGIBLE" because 1.2 value is seen as HIGH weekly contribution for N1000 category.

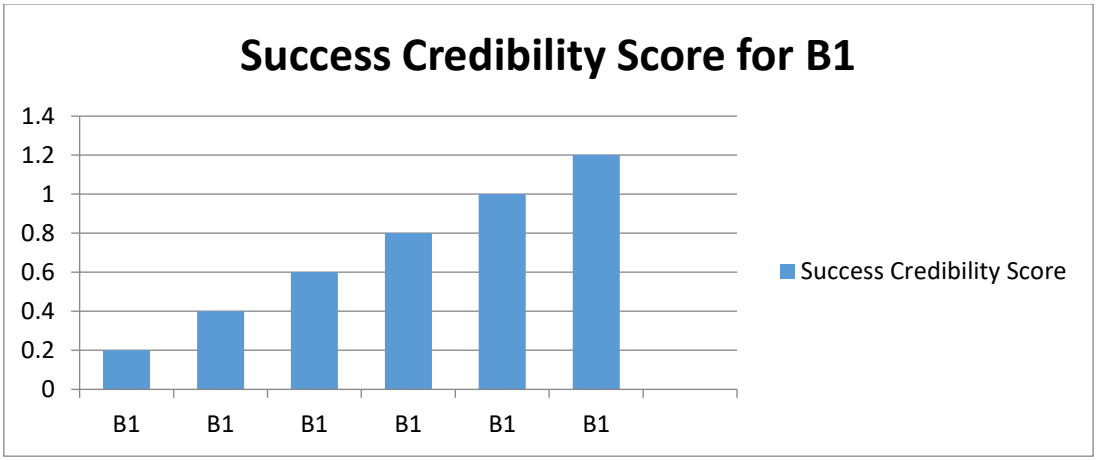

Figure 2 Success Credibility Score for N1000 weekly monetory contribution

For **Borrower B2** with N2000 Weekly Contribution, the credibility score is calculated as;

$$SCS = \left(\frac{2}{24000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.1$$

$$SCS = \left(\frac{4}{24000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.2$$

$$SCS = \left(\frac{8}{24000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.4$$

$$SCS = \left(\frac{12}{24000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.6$$

$$SCS = \left(\frac{10}{24000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.5$$

$$SCS = \left(\frac{6}{24000} * \frac{100}{1}\right) * \left(\frac{1}{12}\right) = 0.3$$

E-ISSN 3027-2939 P-ISSN 3026-8397

Table 2: Success Credibility Score Model for 2000 Weekly Contribution

Table2 below shows the borrowers, number of success weekly contribution (NSWC), total number of contribution (TNC), Duration in weeks, credibility score. Borrower B2 pays N2000 on a weekly basis in 12 weeks will amount to N12000. To calculate the credibility score of B2 in 2,4,6,8,10,12 weeks which is shown in Table 2 below 0.1 percentage value is seen as LOW contribution and 0.6 percentage value is seen as HIGH or REGULAR weekly contribution.

Borrowers	Number of Success Weekly Contribution(NSWC)	Total Number of Contribution(TNC)	Duration(in Weeks)	Credibility Score
B2	2	12000	12	0.1
B2	4	12000	12	0.2
B2	6	12000	12	0.3
B2	8	12000	12	0.4
B2	10	12000	12	0.5
B2	12	12000	12	0.6

If B2 request for a loan of N12000 with a 0.1 percentage value of Success Credibilty Score (SCS), the system will recommend "NOT ELIGIBLE" because 0.1 value is seen as LOW weekly contribution for N2000 category. But if B1 request for a loan of N12000 with a 0.6 value of Success Credibilty Score(SCS), the system will recommend "ELIGIBLE" because 0.6 percentage value is seen as HIGH weekly contribution for N2000 category.

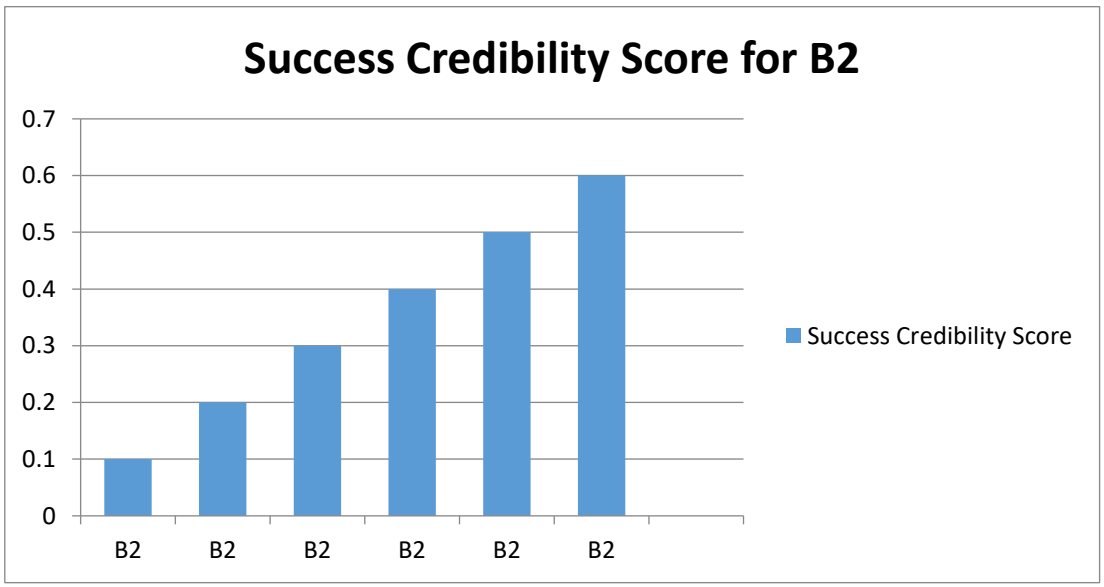

Figure 3 Success Credibility Score for N2000 weekly monetory contribution

CONCLUSION

This system gives users (Lender) a more flexible way to get to view the borrowers weekly contributions without vigorous process of going through the cooperative group. We see that the higher the credibility score of a Borrower, the higher the recommendation. Derivation of a success credibility model that brought about the credibility in lender-borrower recommendations in the rural community development in Nigeria. The result shows that, the model can meet borrower's needs better and help borrower getting loan more efficiently. Furthermore, it contributes to finance industry by accelerating the funds flow and does favor to economic recovery.

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