CHAPTER I

INTRODUCTION

1.1   Background

Nowadays, applications that utilize artificial intelligence are experiencing increased demand, such as the Recommendation System. The Recommendation System is part of artificial intelligence that can predict an item's user preferences. The purpose of the Recommendation System is to connect customers with the items to buy, so that it expects that the sales of each product will increase or save costs [1]. Not only that, however the Recommendation System is also the basis for users in conducting searches such as movies, songs, restaurants, and other products [2]. Items recommended to users are usually placing on the frequently purchased items page, but not all products placed have the same preferences as each user. Therefore, there needs to be a page containing items that correspond to the user's personalization [1]. It is applied to the Netflix movie provider's service site. In an academic publication written by Gomez-Uribe with Netflix's Chief Product Officer, Netflix seeks to grow its business on a considerable scale to become a market leader in the movie provider market; with a recommendation system, Netflix can save more than $1 billion per year [3]. According to the readwrite.com website, in 2011, e-commerce company eBay acquired star-up Hunch for $80 million. It is because the items sold move quite quickly, hence eBay acquires Hunch in order to personalize recommendations from its users. Some of the recommendation technologies hunch uses are predictive merchandising, interpreting unstructured data, and creating merchant insights [11].

A 2017 survey accenture.com of 8,000 customers from North America (Canada, The United States) and Europe (France, Germany, Italy, Spain, Sweden, The United Kingdom) with gender distribution was 51.69% male and 48.31% female, revealing that 91% of consumers tended to shop with relevant recommendation items [12]. According to McKinsey and Company, in 2012, North America's retail patterns look different than they did ten years ago in 1990. Consumers make purchases have changed drastically; they tend to open smartphones to compare prices, view product reviews, and know the recommendations given. Here is a comparison of retail revenue in 1990 and 2021, shown in Figure 1.1.
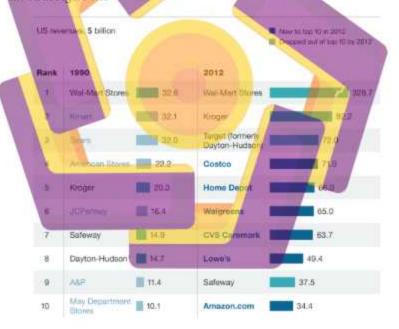

Rank	1990		2012	
				New to top 10 in 2012
				Dropped out of top 10 by 2012
1	Wal-Mart Stores	32.6	Wal-Mart Stores	328.7
2	Kmart	32.1	Kroger	92.2
3	Sears	32.0	Target (formerly Dayton-Hudson)	72.0
4	American Stores	22.2	Costco	71.0
5	Kroger	20.3	Home Depot	66.0
6	JCPenney	16.4	Walgreens	65.0
7	Safeway	14.9	CVS Caremark	63.7
8	Dayton-Hudson	14.7	Lowe's	49.4
9	A&P	11.4	Safeway	37.5
10	May Department Stores	10.1	Amazon.com	34.4

Figure 1. 1 Comparison of retail revenue in 1990 and 2021 (Stores; US Securities and Exchange Commission fillings; McKinsey analysis)

It could see from the comparison above amazon e-commerce is entered into the list of the top ten retail that has the highest revenue, and Amazon is the new retail in the picture above. Meanwhile, that sense states that 35% of Amazon's revenue comes from Items found by customers through recommendations [13].

There are two popular methods used to build recommendation systems, collaborative filtering, and content-based [1]. Collaborative Filtering is the best method and is often uses in recommendation systems [4]. This approach requires similarity measurement techniques such as Pearson Correlation Coefficient (PCC), Cosine Similarity, Jaccard Coefficient to search for the same user or item from the list of active users [5]. However, there are some flaws in Collaborative Filtering, i.e. Cold Start. Sparsity, and lack of appropriate recommendations [6]. Researchers have conducted experiments to address the problem and improve the Recommendation System's quality, one of which is research conducted by Guibing Guo using TrustSVD techniques to reduce the deterioration in the quality of recommendation systems caused by sparsity and cold start [7]. Liu Xiaojun then demonstrated that clustering techniques could be uses to improve the quality of the Recommendation System. However, this technique failed to gain higher accuracy because clustering tended to give equal weight to all items when forming user clusters [8].

Metaheuristic Swarm Intelligence (SI) techniques include Cuckoo Search, Artificial Bee Colony (ABC) [7], Particle Swarm Optimization, Firefly Algorithm (FA), and Bat Algorithm (BA). It is often done by researchers to find optimal solutions. SI techniques produce optimal solutions by repeatedly improving previous solutions. The use of SI techniques to find each feature's optimal weight can form the same and a better group of users. Bat Algorithm (BA) is one of the rarely researched metaheuristic methods for calculating feature weights [9]. In this study, the authors submitted research to build a recommendation system using BA with data used is open dataset from MovieLens. To test the BA algorithm, the author used the FA method on swarm intelligence.

1.2 Problems

The design of recommendation systems with traditional methods has affected results. Traditional methods cannot produce optimal solutions that lead to a decrease in the Recommendation System's quality. Therefore, Swarm Intelligence techniques are expecting to improve the quality of the Recommendation System.

1.3 Problems Limitation

The authors created problem limitations to prevent the widespread scope of problems in this study, the problem limitations of this study are as follows:

1. This research emphasizes more on method testing.

2. The similarity method used is Pearson Correlation Coefficient (PCC).

3. The metaheuristic Swarm Intelligence method, to find the optimal weight in the user is the Bat Algorithm (BA)

4. To conduct testing against BA the author also uses another swarm intelligence method Firefly Algorithm (FA) to then be compared.

5. The problem examined is the quality of the Recommendation System by comparing BA and FA.

6. The dataset used is Open Dataset MovieLens 100K.

1.4   Research Purpose

This study aims to test the quality of recommendation systems using Swarm Intelligence techniques to find optimal weight in users.

1.5   Research Benefits

The benefit gained in this study for researchers is, to gain new knowledge about improving the quality of recommendation systems taking into account optimal weight using the Bat Algorithm (BA) and Firefly (FA). While for others, this research is expected to increase the contribution to science.

1.6   Research Methodology

These are the stages performed in this study

1.6.1   Literature Review

To collect various references to the Recommendation System, PCC, BA, and FA method. From several journals, proceedings, books, articles, and several other references.

1.6.2   Problems Analysis

The analysis of the problems is based on the information obtained at the previous stage in order to obtain the right method to solve the problem in this study.

1.6.3   System Design

At this stage, the system is designed using pipelines to solve the problems contained in the analysis stage.

1.6.4 Implementation

At this stage, implementation is carried out based on the analysis that has been done in the form of programs (notebooks) in accordance with the design.

1.6.5 Testing

The next stage of testing the system has been made to test the quality of the Recommendation System using BA and FA methods. The techniques used to perform the test are Mean Absolute Error (MSE) and Root Mean Squared Error (RMSE).

1.6.6 Report Formulation

At the last stage, the writing the entire research report that has been done.

1.7 Systematics Writing

Overall this thesis report consists of five (5) chapters in accordance with the thesis report guidelines applicable at Universitas AMIKOM Yogyakarta, the systematics of writing this report are as follows:

CHAPTER I INTRODUCTION

Contains the background, problem formulation, problem boundaries, research aims and objectives, research benefits, research methods, and writing systematics.

CHAPTER II RELATED WORKS

This chapter contains a description of the theories used and related to this research.

CHAPTER III RESEARCH METHODOLOGY

This chapter contains the analysis of the methods used, to improve the quality of the Recommendation System

CHAPTER IV IMPLEMENTATION AND DISCUSSION

This chapter contains a discussion of the implementation of the methods used as well as the analysis and design that has been done previously and testing the results obtained.

CHAPTER V CONCLUSION

This closing chapter contains the conclusions obtained by the author through the previous chapters and also answers the problem formulations in chapter 1, as well as suggestions for further research.

REFERENCES

This section contains a list of references that have been used in writing.