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Product Recommender System E-Commerce Application Using Genetic Algorithm

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Abstract. With a large amount of products available to purchase in an e-commerce website, these website owners will face a challenge where customers might have a difficulty on choosing the right products for them and these website owners also need to promote their products to the right audience. Therefore, a recommender system will be developed to help the website owners giving a product recommendation for their customers based on the category of the products as an approach using Genetics Algorithm and Fuzzy Sets. In this study, the fuzzy set algorithm is used to determine the suitability of product rankings between the ranking of the categories to be recommended and then these results can be continued using genetic algorithms to find a set of products that have the appropriate suitability values for use as the final output which is the actual set of products that will be recommended to the customers.

1. Introduction

Rapid technological developments make every company must adapt and evaluate an activity in the administration and operational activities of the company. The growth of technology that occurs from year to year is increasing specifically in computer technology. Computers are assets for companies because they can help in all fields of work such as medicine, military, communication, government, and others. With computers all the information that is needed by the company can be found easily, quickly and accurately. The information obtained is a very important resource. The need for increasingly complex computer and internet technology now makes every company use technology as well as possible so that companies can have an advantage in data processing. Competition that occurs in the business world requires information that is always up-to-date. For this reason, a good data processing system is needed in order to produce information that is useful and in accordance with needs. In an e-commerce application, of course there are many products that can be seen by buyers, this can make buyers hesitated when they want to buy products. According [1] e-commerce based websites there are supporting features that aim to increase sales, such as top products and product recommendation. Therefore, the authors are interested in evaluating the Genetic Algorithm method to create a product recommendation system and design a system related to e-commerce. The application to be designed is a web-based e-commerce application that can later be configured. This configuration refers to the types of products sold that can later sell products other than games. This application can later recommend various types of products, in this thesis the author chooses digital video games as an example of products to be sold and recommended to buyers. Video game is a game application that can be enjoyed by humans. Video games aim to entertain and can be enjoyed by children and adults. The recommendation system that will be built is a product recommendation system. The product to be recommended to the customer uses product data that is



available on the e-commerce website. The recommendation system that will be built will use the Genetic Algorithm to process product data so that it can be information in the form of product recommendations that can be given to website visitors. Genetic Algorithms are algorithms that utilize the natural selection process known as the evolution process. In the process of evolution, individuals continually undergo changes in genes to adapt to their environment.

2. Method and Materials

The system designed is a web-based e-commerce application. this application will provides a recommender system feature that will recommend products to website visitors. The recommender system designed will use the Genetic Algorithm to get product recommendations based on the products available on the website. Making recommendations in this application uses the Fuzzy Sets method to select product titles and Genetic Algorithms to determine the best results to recommend to customers. Genetic Algorithms are algorithms that utilize the natural selection process known as the evolution process. In the process of evolution, individuals continually undergo changes in genes to adjust to their environment. This natural selection process involves changes in genes that occur in individuals through the process of propagation. In this Genetic Algorithm, this breeding process becomes the basic process of primary concern. This Genetic Algorithm was invented by John Holland and developed by his student David Goldberg. Characteristics of problems that require Genetic Algorithms are problems that have the possibility of an infinite number of solutions, require real-time solutions in the sense that solutions can be obtained quickly, and have multi-objective and multi-criteria so that solutions that are wisely accepted by the need to be accepted by the all parties. In using the Genetic Algorithm there are stages to get optimal new individuals. The stages of this algorithm run as follows:

- a. Defining individuals, where individuals state one possible solution (solution) of the problem raised
- b. Define the value of fitness which is a good measure of whether or not an individual or whether or not the solution obtained
- c. Determine the initial population generation process. This is usually done by random generation such as a random walk.
- d. Determine the selection process to be used.
- e. Determine the crossover process to be used[2],[3],[4].

In this e-commerce application, fuzzy sets are used in the process of selecting product titles. Before choosing a product title, the admin will first input the desired rating value as a recommendation base. Fuzzy sets will be used to find the match value between the desired rating value and the rating value contained in the product title in the database table based on allowable deviation tolerances. What is meant by deviation tolerance is the difference between the desired rating value and the chosen rating value [5],[6],[7]. To initialize the steps of the recommender system are as follows :

Step 1 : Initiate population by drawing 7 sets of population from the database which consist 10 products titles in each set.

Step 2 :

- a. Determine the fuzzy sets value for each product titles in each sets using the formula below:

$$Diff(\delta(x), y) = \text{Max}[0, (1 - \alpha|\delta(x) - y|)] \quad (1)$$

Description:

$\delta(x)$: Product rating value

y : Desired category rating value

α : Deviation Tolerance

- b. Eliminate product titles in each sets with the lowest fuzzy sets value.

Step 3: Determine the fitness value for each sets in the population using the formula below:

$$F(Chromosome) = C - \sum_{i=1}^n (\alpha_i |\delta_i - y_i|) \quad (2)$$

Description:

$$C = Constant \sum_{i=1}^n (y_i)$$

$\delta(x)$: Product rating value

y : Desired category rating value

α : Deviation Tolerance

Step 4: Determine 2 sets with highest fitness value to be selected in the selection process of genetic algorithm

Step 5: Determine the crossover method that will be used, in this is case the single-point crossover method will be used. Crossover is done by exchanging parts of genes between two sets whose positions are chosen at random and in result will produce 2 new sets. Not all individuals will experience a crossover process. Individuals who can experience the crossover process are two sets who have the highest fitness value.

Step 6: After going through the process fuzzy sets and crossovers, a selection process will be conducted where the sets with the highest fitness will be the end results which the sets are the products titles that will be shown to the website visitors.

3. Results and Discussion

Based on steps listed above, the final output of Genetic Algorithm and Fuzzy Sets based on the formula previously described and obtained as follows:

Table 1. Final Population

Sets	Abbreviated Product Titles							Fitness
1	RCTW	WC3	JWE	CS	LP	CV	WOLC	3.924
2	WC3	CNC	TF2	RC	AT	RUNE	GF	3.824
3	CNC	LBW	CIV	GRID	MTAP	TW3	MHW	3.748
4	CIV	RCTW	JWE	SG	F1	CV	GF	3.844
5	CIV	CNC	RCTW	MTAP	AT	MHW	WAR	3.812
6	CORR	JWE	WC3	RC	LP	RUNE	UA	3.794
7	JWE	AE2	LBW	VS	GRID	MHW	ME2	3.808
8	CIV	RCTW	JWE	CS	LP	CV	WOLC	3.854
9	RCTW	WC3	JWE	SG	F1	CV	GF	3.914

With set 1 having the highest fitness values among all sets, set 1 can be further selected as the final output product titles set that will be shown to the website visitors.

4. Conclusion

The conclusions achieved by reviewing this calculation are as follows:

E-commerce web application with recommender system using genetic algorithm provides a combination of product titles based on a predetermine quantity of product titles which is stored in the database of the application itself. The final results of genetic algorithm can be further improved by having a larger quantity of product titles available in the database and can be improved even further more by accepting more product titles in each sets before initializing the population.

5. References

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