Review and Rating basedMultilayer Perceptron Neural Network Product Recommender System

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ABSTRACT

In the modern world, the demandbetter and effective products are increasing exponentially. With the surge in usage of internet and the related access has made people to get the knowledge on the products. Many e-commerce and suppliers utilize the internet as the platform to reach out the people with the recommendations based on their need. The issue with this type of recommender system is that either they are rating based or review based and the accuracy of the recommendation should be in higher order. In the present paper, Review and Rating based product recommender system is proposed to recommend the best product for people. The customer reviews of amazon product dataset is employed to train the Multi-layer-Preceptor Neural network (MPNN) to generate the appropriate recommendation. The future scope is to extend the work on multi-product or product accessories recommendation. The test data is used to assess the proposed MPNN-RS performance. From the analysis, it is validated that the proposed system is very effective with higher accuracy than the decision tree method. The future scope is to extend the work on multi-product or product accessories recommendation.

Introduction

Nowadays, increase in E-commerce that has animportantgrowth in user reviews. Users have altered their mode of shopping and consistent with internet-based electronic commerce is emergingquicklyby the proliferation of commercial Web sites and enhancingthe acceptance of on-line transactions by users (Hong, 2004).The novel advertising channelvaries from traditional retail formats in numerous ways. The purchase decisions should be based on product data presented on Web site. On-line sellers seek to overcome this limitthrough giving users the opportunity to share product evaluations on-line (Park, 2007).

Recommender systems (RSs)aid customers through providing useful data and products recommendationsbased on their own interest. RS node provides recommendations to its neighbors in probabilistic wayfor examples like Epinions, IMDb, and Amazon where there are collections of products that have been rated by other users. Some systems like Netflix

provide recommendations based on users' taste and preferences. Users may read reviews about various products which helps their purchasing decision (Davoudi, 2015).

The researchers are remunerating more attention to review rating predictions (RRP).The RRP consider as more difficult to improve the performance of RRP through extracting dissimilar features, like words, lexical patterns, syntactic structures, and semantic topics [Wang, 2018].In this paper, a novel multilayer perceptron neural network (MPNN) method for review rating prediction by taking product information into account. ANN structures to examine the performance of MPNN-RS architectures to solve the gradient problem. Apply artificial neural network (ANN) method to make comparisons of different Product by similarity, which will help RS to give ranking score solely based on combination factors of product.

The objective of the proposed system can be summarized as follows:

1. To improve the recommendation performance by considering both review and rating of the customers using MPNN.
2. Based on MPNN, experimental results show the effectiveness of using review as well as rating of the customers.

The performed work is systematized in the subsequent manner: Section 2 contains the discussion of works done by the researchers earlier; Section 3 clarifies the methodology proposed; Section 4 discusses all the obtained results; and final section provides a conclusion.

Related works

Ewees, et al., 2020 presented the meta-heuristic methodbased on grasshopper optimization algorithm (GOA) are termed as chaotic grasshopper optimization algorithm (CGOA) was utilized as trainer to a neural network (NN) for predicting the monthly instable price iron ore. The experimental outcomes provide the better accuracy value and lesser mean square error.

Koren, 2009 presented the matrix factorization technique based on collaborative filtering (CF) RSs. Netflix prize information has shown the accuracy through classical adjacentneighbour methods to offer the memory efficient model. Aciar, 2007 presented the text mining methodsare used to extract beneficialdata from review comments for RS to suggest the difficult of using customer opinion about products. The experimental results provide the better recall and precision rate.

Dadouchi, 2018 presented the real stock levels in RS process to shift demand toward particular products for a particularconsumer. It is divided into two stages; they are consumers and item scores categorization. The main concentration is to aidcorporations shape demand by an execution process through acting upon short-term demands to recover from excess and short inventory positions and limit the consequences of mismanagement of stocks.

Castillo, et al., 2018 presented the ExUP technique for inferring consumer preferences and creatingRS without relying on obtainability or text quality reviews. Only the consumer'shistories of ratings are used to generate product recommendation.The experimental results offer better score prediction rate, recall, and f-measure.

Cao, 2007 presented the fuzzy-based optimal electronics retrieval scheme for customer.The personalized RS must be built up consistent with the special features of somekind of product, and forming professional RS for dissimilar products. The experimental outcomes of fuzzy logical algorithm are used to attainthe product knowledge from experts.

Choi et al., 2012 presented the RS utilizing CFmethods for userswithsequential pattern analysis (SPA) resulting through temporal purchase patterns.CF may be practical to online transaction informationwhile no explicit rating data is available.The experimental result of SPA provides improvedin recommendation quality, better prediction and recall.

Zhang, 2020 presented the hybrid probabilistic matrix factorization method to predict consumer’s rating scores through capturing consumer’s preferences extracted from auxiliary data.Based on convolutional neural network it attempts to predictthe textual attractiveness of different user’s item’s with improved recommendation quality.

3. Proposed methodology

The offered n MPNN-RS recommendation system is shown in the figure 1. The product review dataset that contains the discrete responses on different products fromAmazon dataset with the features shown in table 1 for recommendation. The features in the recommender system are product ID and its review along with the review recommend and rating. A total of 50 samples are considered for the proposed MPNN system.

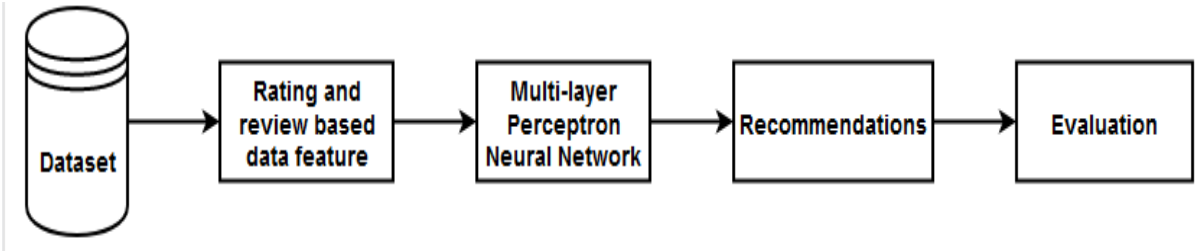

Figure 1: MPNN-RS

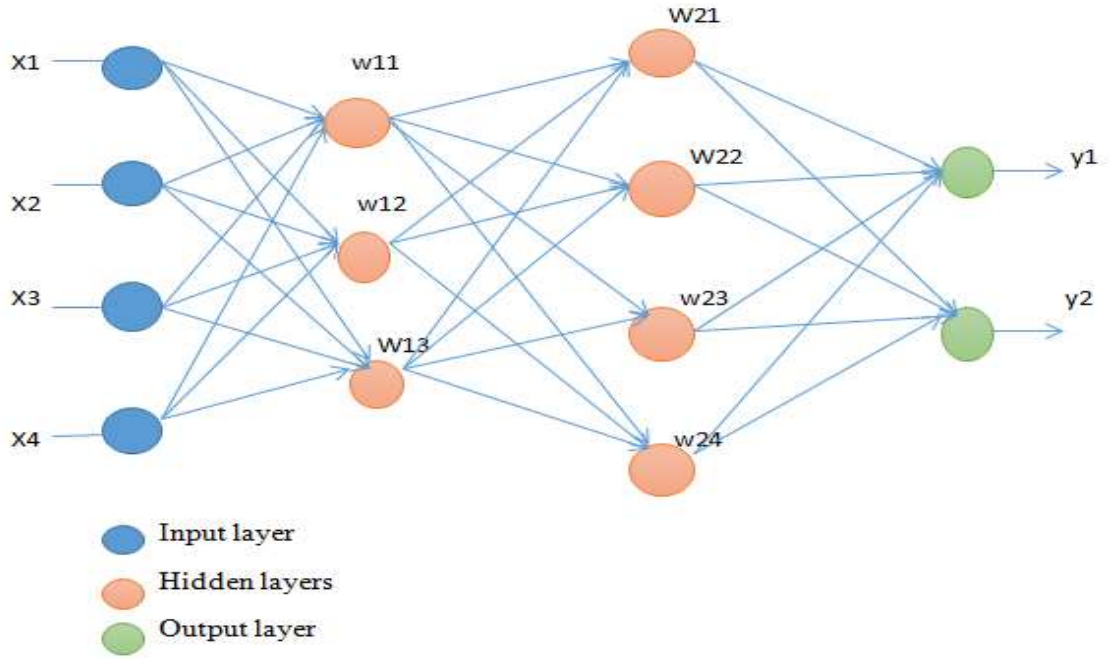

Figure 2 General structure of multilayer perceptron neural networks

These networks are basically a combination of neurons, biases allocated to neurons, interconnections among them and weights allocated to these interconnections. Learning process is executed consistent with input data and target information sets with training algorithms. The amazon product review dataset is segmented in the ratio of 70% and 30%. The 70% of data is fed into the MPNN for training the recommendation of products. The MPNN structure is given in figure 2.In the proposed model MPNN has input layer (I_l) with five nodes and double hidden layer (H_{al}, H_{bl}) and two recommending nodes at output layer (O_l). The weight and bias of the layers are given by W_l and B_l. The activation function F is defined for the hidden layers. The mathematical representation for each layers are given as,

Hidden layer 1: $H_{1j} = F\left(\sum_{i=1}^{n} W_{1j}\, x_i(t)\right) \ldots\ldots\ldots (1)$

Hidden layer 2:$H_{2k} = F\left(\sum_{i=1}^{m} W_{1jk}\, x_{jk}(t)\right) \ldots\ldots\ldots (2)$

Output layer: O= $F\left(\sum_{i=1}^{o} W_{1jko}\, x_{jko}(t)\right)$ ... ... (3)

Back propagation algorithm is used to train the MP-NNs network with error-correction rule based on learning process. The error rate can be computed by relating with the actual target values and network output value. Subsequently, biases and weights are adjusted to reduce the error rate; the training procedure will continue until the network reaches the predefined slightest allowable error. The error function that is utilized for this purpose is generally denoted as mean square error (MSE).At the termination of training process, the MPNN-RSis constructed. The test data is provided to the generated model to evaluate the performance of the recommendation of product.

4. Result and discussion

Weka tool is exploited for the development and experimentation of the proposed recommender system. The proposed MPNN-RS is evaluated on the performance metrics like accuracy, RMSE. The performance of the proposed MPNN-RS is given in table 1 and its corresponding confusion matrix is given in table 2.

Table 1: Performance of MPNN recommender system

Parameters	Results
Corrected classified instances	47
Incorrect classified instances	3
Kappa statistics	0.88
Mean absolute error	0.119
Root mean square error	0.2664
Relative absolute error	23.74%
Root-relative square error	53.09%
total number of instances	50

Table 2: Confusion matrix

Recommendation	True positive	True negative
Not recommended	23	2
Recommended	1	24

Based on the confusion matrix the different performance metrics like accuracy, sensitivity, specificity and F measures for the proposed MPNN-RS are obtained as in figure 3. The performance of the proposed MPNN-RS is better than the decision tree on sensitivity, f measure and accuracy. However the specificity ids lower for MPNNRS than decision tree.

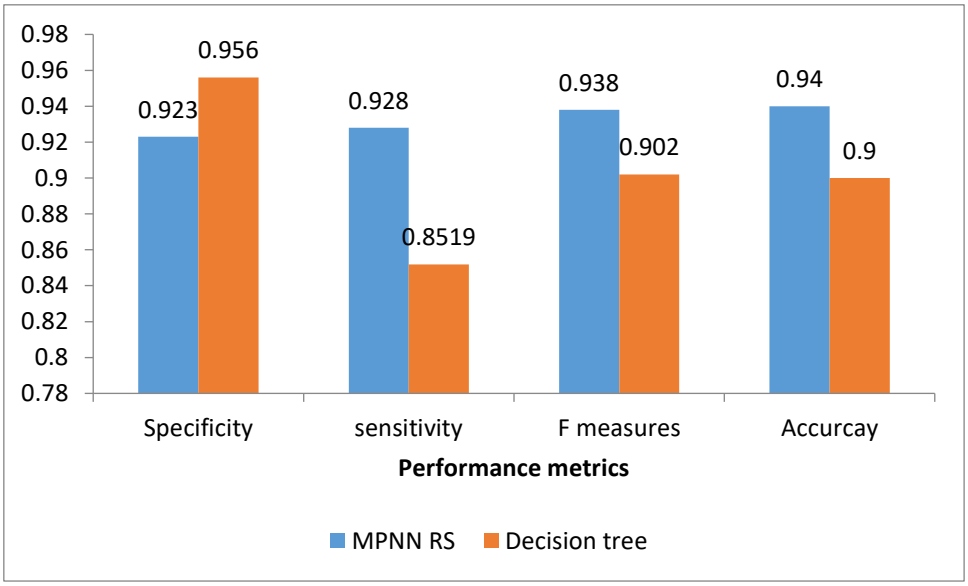

Figure 3: Performance of MPNN recommender system

5. Conclusion

The novel MPNN-RS is proposed to recommend the product to the user. The Amazon product review dataset are split into training and testing data. After the training, the MPNN-RS is tested for its performance. The performance analysis showed that the proposed MPNN has higher accuracy (94%) and sensitivity is (0.928) value. The proposed MPNN-RS is better than Decision tree. The future scope of the proposed system is to extend the work on multi-product or product accessories recommendation.

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