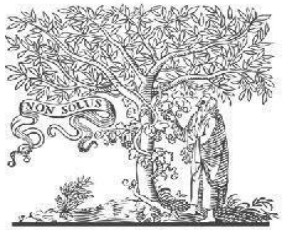
International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

COPY RIGHT



ELSEVIER SSRN

2024 IJIEMR. Personal use of this material is permitted. Permission from IJIEMR must be obtained for all other uses, in any current or future media, including reprinting/republishing this material for advertising or promotional purposes, creating newcollective works, for resale or redistribution to servers or lists, or reuse of any copyrighted component of this work in other works. No Reprint should be done to this paper; all copy right is authenticated to Paper Authors

IJIEMR Transactions, online available on 7th Sep 2024. Link

https://ijiemr.org/downloads.php?vol=Volume-13& issue=issue09

DOI: 10.48047/IJIEMR/V13/ISSUE 09/39

Title Experimental Study and Analysis of Neural Network and SVM Classification Models for Social Networking Advertisements

Volume 13, ISSUE 09, Pages: 431 – 436

Paper Authors
Dr. P.G.V. Suresh Kumar , Dr. G. Ravi Kumar, Dr. Getachew Mamo Wegari, Amanuel Assefa Workineh

USE THIS BARCODE TO ACCESS YOUR ONLINE PAPER

To Secure Your Paper as Per UGC Guidelines We Are Providing A ElectronicBar code

International Journal for Innovative Engineering and Management Research
PEER REVIEWED OPEN ACCESS INTERNATIONAL JOURNAL
www.ijiemr.org

Experimental Study and Analysis of Neural Network and SVM Classification Models for Social Networking Advertisements

Dr. P.G.V. Suresh Kumar [1], Dr. G. Ravi Kumar[2], Dr. Getachew Mamo Wegari[3], Amanuel Assefa Workineh[4]

[1]Professor, Department of Computer Science
Jimma Institute of Technology , Jimma University, Ethiopia
pendemsuresh@gmail.com

[2]Assistant Professor, Department of Computer Science,
Rayalaseema University , Andhra Pradesh, India
grkondaravi@gmail.com

[3]Assistant Professor of Information Technology
Jimma Institute of Technology, Jimma University, Ethiopia
getachew.mamo@yahoo.com

4Lecturer, Department of Information Technology
Jimma Institute of Technology , Jimma University, Ethiopia
amanuel.workineh@ju.edu.et

Abstract

Social networking platforms have become a vital medium for advertisement campaigns due to their extensive user base and engagement potential. Social media platforms such as Facebook, Twitter, and WhatsApp have gained immense popularity in recent years as a means of marketing communication. These platforms, commonly known as social networking sites, have become a prominent part of the online world. Facebook, in particular, positions itself as an ideal marketing tool, offering an advertising system that enables businesses to access and target the information of every Facebook user. However, despite the widespread use of Facebook for advertising, this study reveals that users' purchasing decisions are not influenced by ads, and they do not actively rely on Facebook as a source of information. Nevertheless, Facebook provides an excellent platform for facilitating communication between organizations and users. This research paper presents an experimental study that investigates the effectiveness of utilizing neural networks and Support Vector Machine (SVM) classification techniques for social networking advertisement. The study aims to compare the results obtained from these two approaches and analyze their performance in terms of accuracy, precision, and recall.

Keywords — SVM, Neural Network, ML, Social Network and Model Selection

Introduction

The popularity of Facebook has grown significantly since its inception in 2004, becoming the most prominent social networking platform today. Initially limited to students, Facebook opened up to the public around 2006, allowing people to connect with their friends. With over 500 million active users, Facebook has become an essential platform for communication and social interaction [1].

Recognizing the potential of social networking sites, businesses and advertisers have turned to these platforms as an ideal marketing tool to propel their organizations forward. Online platforms offer unique advantages for marketers, allowing them to be in the same space as their customers, engage with them, and gain insights into their attitudes, interests, preferences, needs, and purchasing behaviors. Social networking sites not only provide a space for individuals to interact with each other but also offer immense potential for businesses to reach their target audiences through advertising [2].

To tap into this potential, organizations have implemented various advertising strategies on social networking sites. These strategies range from traditional search engine advertising pioneered by Google to newer forms of advertising, such as creating product groups on Facebook [3]. With the abundance of user data available, organizations have a unique opportunity to precisely target their ideal audience and create tailored content that builds a loyal and trustworthy relationship with their audience.

The objective of this study was to investigate the advertising strategies employed by organizations and determine which groups they should prioritize in their advertising efforts. By understanding the effectiveness and impact of advertising on social networking sites, organizations can optimize their marketing strategies and allocate resources to target specific groups more effectively.

Background:

Social media platforms have revolutionized the way individuals and businesses communicate and interact online. Websites like Facebook, Twitter, and WhatsApp have gained immense popularity, attracting billions of users worldwide. These platforms offer a wide range of features, including the ability to share content, connect with friends and family, join communities, and discover new products and services. Marketers have recognized the potential of social networking sites for advertising and have increasingly utilized them as a means to reach and engage with their target audience.

A. Problem Statement

Despite the widespread use of social networking sites for advertising purposes, there is a need to understand the effectiveness of these platforms in influencing users' purchasing decisions. While Facebook, in particular, has developed an advertising system that allows businesses to target specific user demographics, it is important to investigate whether these advertisements have a significant impact on users' buying behavior. Additionally, the extent to which users rely on social media platforms as sources of information for their purchasing decisions needs to be explored.

B. Objectives:

The main objectives of this study are as follows:

To assess the influence of social networking advertisements, specifically on Facebook, on users' purchasing decisions.

To evaluate the extent to which users actively engage with advertisements on social

networking platforms and perceive them as informative and influential.
To analyze the role of social media platforms, particularly Facebook, in facilitating communication between organizations and users.
To develop and implement a Support Vector Machine (SVM) and Neural Network models for analyzing social networking advertisement data and predicting user purchase behavior.

C. Scope:
This study focuses primarily on the effectiveness of social networking advertisements, with a specific emphasis on Facebook. It considers the influence of these advertisements on users' purchasing decisions and their engagement with the advertisements. The study also explores the role of Facebook as a platform for communication between organizations and users. The implementation of an SVM and Neural Network model is limited to analyzing social networking advertisement data and predicting user purchase behavior within the scope of this study. Other factors and variables related to social media marketing may be considered in future research.

Literature Review
A. Social Networking Advertisement
Social networking advertisement has gained significant attention in recent years due to the widespread use of social media platforms such as Facebook, Twitter, and Instagram. These platforms provide a unique opportunity for businesses to reach their target audience and engage with them directly. Social networking sites offer various advertising options, including display ads, sponsored content, and targeted campaigns [7]. Marketers leverage the extensive user data available on these platforms to tailor their advertisements and increase their effectiveness. Studies have shown that social networking advertisements can positively impact brand awareness, and customer engagement, and even drive purchase behavior [8].

In summary, the literature review highlights the significance of social networking advertisement and the role of machine learning techniques such as neural networks and Support Vector Machines (SVM) in analyzing and predicting user behavior. The use of neural networks enables deep learning and pattern recognition, while SVM provides efficient classification and prediction capabilities. These techniques have proven effective in improving advertisement targeting, engagement, and campaign optimization, ultimately leading to better outcomes for businesses in the dynamic landscape of social media advertising.

Methodology
In the methodology section, the paper describes the process of data collection and preprocessing. The collected dataset is used to train and test both the neural network model and the SVM classification model. The experimental setup details the parameters and configurations used for each model.

To develop and implement models for analyzing social networking advertisement data and predicting user purchase behavior, this study focuses on utilizing two machine learning techniques: Support Vector Machine (SVM) and Neural Network models.

A. Support Vector Machine (SVM) Model:
The SVM model is a powerful classification algorithm widely used in machine learning. In this study, an SVM model is developed to analyze social networking advertisement data and predict user purchase behavior [4][5]. The model is trained on a dataset that

includes relevant features and target variables related to user behavior and purchasing decisions. By optimizing the SVM model parameters and utilizing appropriate kernel functions, the model aims to accurately classify users into purchase and non-purchase categories based on the given data.

B. Neural Network Model:
Neural networks have gained significant attention in various fields, including data analysis and prediction. In this study, a Neural Network model is developed and implemented to analyze social networking advertisement data. The model consists of multiple layers of interconnected neurons that process and learn from the input data [4][5]. By utilizing appropriate activation functions, optimizing the network architecture, and fine-tuning the model parameters, the Neural Network aims to predict user purchase behavior based on the provided dataset.

The implementation process involves the following steps:
Data Preprocessing: The social networking advertisement data is collected and preprocessed to ensure its quality, remove irrelevant information, handle missing values, and transform the data into a suitable format for model training and testing.

Model Development: The SVM and Neural Network models are constructed using appropriate libraries or frameworks. The models are configured with the desired parameters, such as kernel functions for SVM or the number of layers and neurons for the Neural Network.

Training and Validation: The models are trained on a portion of the dataset using appropriate algorithms and techniques. The training process involves adjusting the model's internal parameters to minimize prediction errors. The trained models are then validated on a separate portion of the dataset to evaluate their performance and make any necessary adjustments.

Performance Evaluation: The accuracy, precision, recall, F1-score, and other relevant metrics are calculated to assess the performance of the SVM and Neural Network models in predicting user purchase behavior.

Comparison and Analysis: The results obtained from the SVM and Neural Network models are compared and analyzed to determine their effectiveness and suitability for the given social networking advertisement data. Factors such as accuracy, computational efficiency, and interpretability are considered in the comparative analysis.

Results and Discussion
By developing and implementing both SVM and Neural Network models, this study aims to provide valuable insights into the prediction of user purchase behavior in the context of social networking advertisements. The comparative analysis helps identify the strengths and weaknesses of each model, allowing marketers and advertisers to make informed decisions regarding their advertising strategies.

We used the Python programming language to test our proposed calculations, specifically utilizing the Python Scikit-learn package for data manipulation, modeling, evaluation, and visualization. Our study involved implementing SVM-based feature selection methods for analyzing a dataset called "Social Network Ads," which we obtained from the Kaggle website [6].

The dataset consists of 400 instances, each representing a user in a social network. It includes various attributes such as User ID,

Gender, Age, and Estimated Salary. The final column in the dataset is a binary indicator that shows whether each user clicked on the advertisement (denoted as "not purchased") or made a purchase (denoted as "purchased").

To evaluate our approach, we divided the data into two sets: a training set, which accounts for 70% of the data, and a test set, which constitutes the remaining 30%. The results of our exploratory analysis are summarized in Table 1.

Table 1: Experimental Results

Algorithm	Accuracy	Precision	Recall
SVM	95.47	95.5	95.5
Neural Network	93.82	93.83	93.82

In our experimental study, we evaluated the performance of SVM and Neural Network algorithms using the Social Network Ads dataset. The results, as shown in Table 1, indicate that the SVM algorithm achieved an accuracy of 95.47%, while the Neural Network model achieved an accuracy of 93.82%.

Upon comparing the two algorithms, we observed that the SVM model exhibited the highest precision, with a precision score of 95.5%. In contrast, the Neural Network algorithm achieved a precision score of 93.83%. The SVM algorithm demonstrated a 1.65% higher accuracy than the Neural Network algorithm.

These findings suggest that the SVM algorithm outperformed the Neural Network algorithm in terms of accuracy and precision for predicting user purchase behavior in social networking advertisements. The results highlight the potential of SVM as an effective classification method for this particular dataset.

Conclusion

In conclusion, this study conducted an experimental analysis to compare the performance of Support Vector Machine (SVM) and Neural Network models for predicting user purchase behavior in social networking advertisements. The evaluation was carried out on the Social Network Ads dataset obtained from Kaggle.

Based on the experimental results, it can be concluded that the SVM algorithm exhibited slightly better performance in terms of accuracy and precision compared to the Neural Network model. The SVM algorithm demonstrated a higher level of accuracy, making it a more reliable choice for predicting user purchase behavior in the context of social networking advertisements.

However, it is important to note that the choice of algorithm may depend on various factors such as the specific dataset, computational efficiency, interpretability, and other application-specific requirements. Therefore, further research and experimentation are necessary to explore the performance of these models in different scenarios and datasets.

Overall, the findings of this study provide valuable insights into the effectiveness of SVM and Neural Network models for analyzing social networking advertisement data. Marketers and advertisers can utilize these models to optimize their advertising strategies and better understand user behavior on social media platforms.

References

[1] Alexa (2010). The top 500 sites on the web. Retrieved August 15, 2010, from http://www.alexa.com/topsites/global

[2] Chaffey, D. Smith, P. R. (2005). eMarketing eXcellence: The heart of business (2nd ed.). Oxford: Elsevier Butterworth-Heinemann.

[3] Charlesworth, A. (2009). Internet marketing: A practical approach. Amsterdam: Elsevier Butterworth-Heinemann.

[4] Ian H. Witten and Eibe Frank. Data Mining: Practical machine learning tools and techniques. 2nd ed. San Francisco: Morgan Kaufmann, 2005.

[5] J. Han and M.Kamber," Data Mining concepts and Techniques", The Morgan Kaufmann Series in Data Management Systems, 2nd ed.San Mateo, CA; Morgan Kaufmann, 2006.

[6] Yating Pan, Ivonne M. Torres, and Miguel Angel Zunuga, Social Media Communications and Marketing Strategy: A Taxonomical Review of Potential Explanatory Approaches, Journal of Internet Commerce, Volume 18, 2019 - Issue 1

[7] Yating Pan, Ivonne M. Torres, Miguel Ángel Zúñiga & Reza Fazli-Salehi, Social Network Advertising: The Moderating Role of Processing Fluency, Need for Cognition, Expertise, and Gender, Journal of Internet Commerce, Volume 19, 2020 - Issue 3