Int. J. Nonlinear Anal. Appl.
Volume 12, Special Issue, Winter and Spring 2021, 1411-1421
ISSN: 2008-6822 (electronic)
http://dx.doi.org/10.22075/IJNAA.2021.5746

Review of the research status of wechat based on the theory of use and satisfaction and the theory of planned behavior

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(Communicated by Madjid Eshaghi Gordji)

Abstract

Wechat is the most widely and frequently used mobile social media and has profoundly integrated into the daily life of many people. Sustainable development is a common challenge for all. Under this background, how to promote public participation in environmental communication has become an important topic. In this paper, a method is proposed to understand the motivating mechanism behind Wechat users' environmental information-sharing behavior by taking China's unique social and cultural background into account. A comprehensive theoretical model for this study is constructed based on the theory of use and satisfaction and the theory of planned behavior (TPB).Initially, the dataset is collected and annotated. The data is preprocessed using normalization method. The theory of use and satisfaction and TPB are employed for predicting the research status of Wechat utilization. For enhancing the accuracy of prediction, we employ Improved Grasshopper optimization algorithm (IGOA). The performance of the proposed system is analyzed and compared with the conventional approaches.

Keywords: Wechat, Theory of use and satisfaction, Theory of planned behavior (TPB), Normalization method, Improved grasshopper optimization algorithm (IGOA)

1. Introduction

The rapid development of the Internet and media content has had a significant impact on people's lives. With a 43 % Penetration rate, the number of global Web users has exceeded 3.1 billion. 84.5

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Received: July 2021 *Accepted:* October 2021

percent of individuals in the United States have internet access, according to the Pew Research. In addition, in the U.s, 73 percent of internet adults use Facebook. According to 'The 36th Statistical Report on Internet Development in China,' the number of Chinese netizens reached 668 million in June 2015, mobile Internet users reached 594 million, and mobile Internet surfing accounted for 88.9% of all Internet browsing. WeChat, a free programme launched in 2011 by Tencent, Inc., has become China's most popular and extensively used social networking site, similar to Facebook.

WeChat offers a variety of services for everyday use, including as instant messaging, free phone calls, interest or private groups, browsing and posting for information sharing in real time, mobile payments, and mailing red envelops, among others. According to the most recent data from Tencent, Inc., the number of active monthly customers reached 700 million in March 2016, representing 200 countries and nearly 20 languages; 61 percent of WeChat users open the app more than 10 times per day, 36 percent open it more than 30 times per day, and 32 percent use it for more than 2 hours per day. Furthermore, 61.4 percent of users check moments every time they open WeChat, and 28% of users have more than 200 friends, which is more than double the figure from the previous year. In April 2016, users spent an average of 200 minutes per day on mobile Internet, with WeChat accounting for 35% of that time. Furthermore, 200 million users connected their WeChat accounts to payment cards, 70% of users spend more than 100 RMB (the Chinese currency) each month on the app, and 8 billion RMB was transferred through WeChat Red Envelopes during the 2016 Spring Festival.

WeChat is now more than simply a revolutionary mobile application that is installed on over 90% of smartphones and incorporated into most people's daily routines: it is an unavoidable tool that is changing users' everyday lives in a variety of ways. WeChat is leading a new age of mobile Internet communication as part of a new lifestyle. Most significantly, via the many functionalities of WeChat, a variety of health-related information was constantly produced and distributed among vast numbers of users, giving WeChat with great potential to influence the general public's health condition. According to reports, research into how social media affects people's health is expected to grow rapidly and is critical. Previous research has focused on the acquisition of health information through the Internet and new media, as well as the development of healthy living practises as a result. According to the 'Pew Internet and American Life Project,' 61 percent of adult internet users in the United States actively seek out health-related information. Furthermore, almost 60% of respondents said that Internet health information has influenced their health management approach. The majority of the information obtained through the Internet is related to health care, illness symptoms, and treatments. According to a cancer information survey conducted by the Institute of Public Opinion at Renmin University of China, 76.3 percent of computer-using respondents in Beijing and Hefei obtained health information via the Internet, while 68.8% of mobile terminal-using (e.g. smartphone and iPad) respondents obtained health information through the Internet. With a growing public awareness of health issues, new media's appeal as a source of health-related information has risen as well. Social media, which includes content provided by patients, allows us to get a better understanding of patient perspectives on health care.

Moreover, social media sites stress a more consumer experience by allowing for the exchange of health data, and a prior research found that using social media had a beneficial impact on health habits. Although the acquisition and use of health information through new media has been examined in other countries, there have been few studies in China. Moreover, professional organizations, institutions, and municipalities offer inadequate health information and services. WeChat, China's fastest-growing and most popular social media platform, plays a significant role in contemporary lives. It's unclear if or how this tendency will impact the general public's health. This was the first quantitative research to look at how the general public obtains health education, specifically

the present availability, issues, and trends of health education through the social media platform WeChat. Further functionalities created as a result of our research may significantly improve the efficiency of health education and disseminate knowledge across the world.

2. Related work

The main contribution in this area is to investigate the causes of users' satisfaction with the official WeChat account. We created Structural Equation study [11] for this aim, integrating System Quality theory, Theory of Planned Behavior, and Acceptance And Use of technology, and relying on a sample of 204 participants. Focused on self concept and the emotion motivational theories [2], this research investigated the essential role of affective states and WeChat usage intensity in the connection between psychological demands fulfilment and excess WeChat use. This research develops a reading environment on a smart phone and uses the WeChat public platform to push reading materials to 60 English majors for three months in order to compare test results before and after the experiment to see whether it has an impact on developing English reading skills [10]. The impacts of educational WeChat public reports were investigated from five major elements of users' behaviour and learning process: recognising, following, reading, sharing, and learning/reflecting. Users' gratifications and characteristics of educational WeChat official accounts were recognised as two key elements in the impacts of educational WeChat official accounts [12]. This study examines the variables that influence users' reading pleasure of articles using the ELM theory. The findings indicate that the quantity of information in the title, the title's activeness, and the article's readability all have a beneficial impact on readers' reading pleasure. Users' happiness is negatively influenced by the quantity of information in an article [15]. The popularity of WeChat-based English learning apps is growing among Chinese English learners. However, we still haven't figured out how the apps operate in terms of affecting users' behaviour.

The current research performed a theoretical analysis within the frameworks of the technology adoption model and the theory of planned behaviour in order to explore this problem. The study results were then presented as a conceptual framework for analysing the behaviour of utilising WeChat-based Reading comprehension apps [1]. [14] Using the expectation-confirmation method of data technologies (ECM-IS/IT), the current research seeks to investigate the impact of facilitating conditions, self-control, and levels of engagement in encouraging users to keep using WeChat. [7] Throughout this paper, we use a distinctive actual information set from a WeChat-based work performance appraisal system developed and used by a moderate Chinese company to investigate the optimization of employees' work strategies, particularly extended work determination, with the goal of maximising total utility, which includes both work and nonwork utility services. [9] In just this paper, an OTTCAP (OTT Services Capture and Analyze Platform) field test platform is developed for capturing and analysing QoS and QoE (Quality of Experience) variables of OTT services in live DC-HSPA+ networks, such as internet backbone Qos requirements, end variables, and OTA (over the air) log data. End-to-end latency behaviour of WeChat video conference services is compared and analysed with the help of OTTCAP in three different situations. [17] Learning on the WeChat large forum is a kind of Internet Plus education. It is essential to investigate the personalised growth of department-level classroom administration, to refresh classroom administration ideas and methods, and to concentrate on the creation of a classroom management system based on public WeChat network. This research finds that the present WeChat system is utilised in the research of vocational schools' colleges, based on the WeChat system for studying learner autonomy of vocational schools' colleges, coupled with the data transmission survey.

[8] In this article, we describe the basic technique for defining the characteristic of an emergency

WeChat platform, as well as the quality framework and emergency WeChat service assessment system, for a specific service quality gap issue. [4] Adaptive Learning Techniques This paper proposes a data-driven integrative assessment methodology that utilises data to modify the strength of sample values and weak scales, using the Adaboost method in statistical learning. Three specific bad evaluation techniques were selected: data-driven Topsis, ensemble classification PCA, and confirmatory factor. [6] To investigate WeChat users' health information sharing behaviour, this study offers a theoretical research model that combines social capital and user satisfaction with the idea of planned behaviour. Correlation analysis and structural equation modelling were conducted sequentially using data from an online poll of 616 WeChat users. WeChat users' health information sharing is influenced by both social capital and pleasure factors, according to the findings.

[13] In this digital age, social media plays an important role in the dissemination of information. Information exchange has become one of the most important study areas in health communication, and health information sharing behaviour is an important component of it. [3] This research creates a mobile digital mapping teaching system in order to investigate successful mobile learning paradigms. To examine fundamental learner characteristics, learning material, learning behaviour, and quality development, descriptive study is coupled with a questionnaire survey. [5] This article makes three major advances to discovering mutual X in social networks with billions of members by presenting a high-performance and memory-efficient method. First, a decentralised method for determining mutual X; second, a based on inter optimal control strategy that includes pipelined workflow, NUMA-aware post, and a SIMD-based Dual Sliding Glass set crossing method; and third, a semicircular computing and networking scheme to enhance internode achievement and prevent overload.

3. Proposed methodology

The proposed approach flow and schematic design illustrated in Figure 1 are described in depth in this section.

A. Data collection

We gathered data from 537 users. Users must complete a self-assessment once the data has been gathered. Four algorithms are used in the trials, and the findings are compared to the self-assessments. Data is alternately utilized as a training dataset and a testing dataset.

B. Data annotation

Annotation is the process that first aligns the data units on a result page into different groups in such a way that data in the same group have the same semantic. Then according to grouping, each group annotates it from different styles. After the successful grouping, labeling is done to give meaningful names to each group of the data units. Next is the annotation wrapper generation phase which is automatically constructed for the search sites, this process is done after the successful labeling of the data units. This can be used to annotate new result pages from the same web database. The procedures of data annotation are as follows:

- Alignment: The alignment process divides all of the data into categories, each of which correlates to a distinct idea.
- Annotation: During the annotation phase, many basic annotators were employed, each of which exploited a different kind of characteristic. Every annotator is used to label the data units and forecast a label for them inside the structured groupings.

- Annotation Wrapping creation: Annotation rules were made for each recognised object or idea during the annotation wrappers creation process. To annotate the data packets, a wrappers is utilised that retrieves data from the same online database each new queries, allowing annotation to be completed fast.

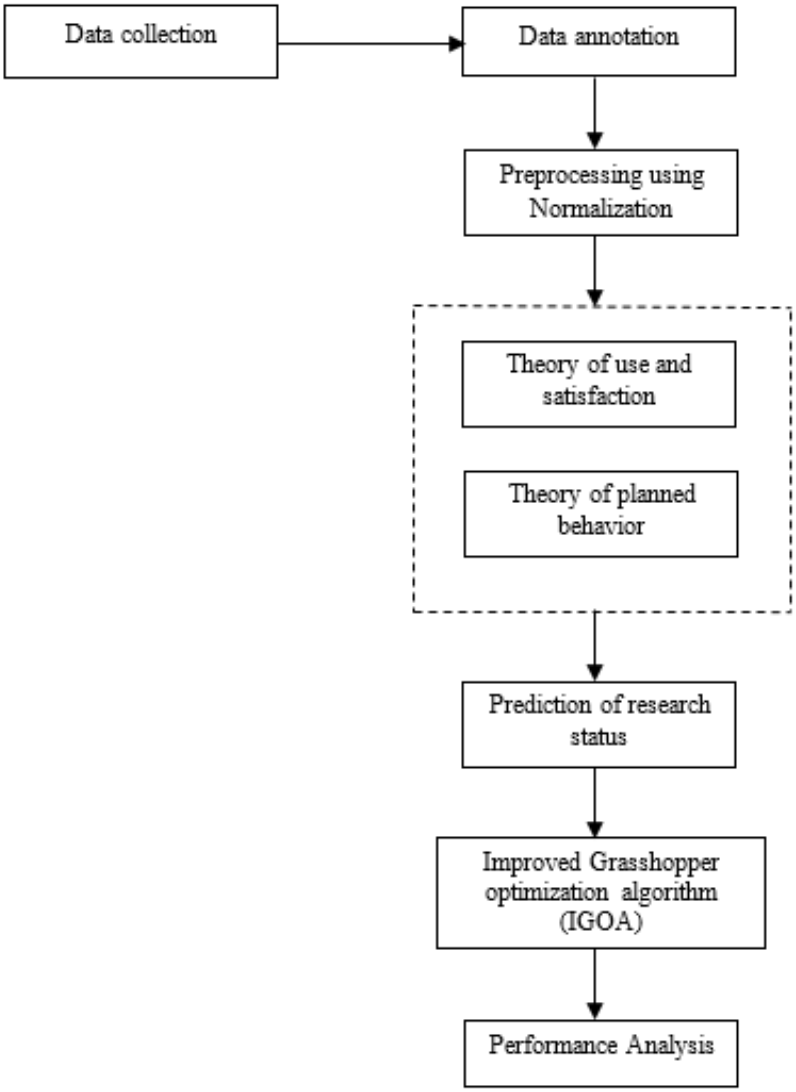

Figure 1: Schematic representation of proposed flow framework

C. Pre-processing using normalization

The process of data processing necessitates the normalising of observed values on a separate balance to a conceptually similar scale, which is typically done before averaging. To get values linked to a distinct variable, some forms of normalisation need a rescaling procedure.

$$\hat{\partial}_k^2 = \frac{1}{i-j-1}\sum_{n=1}^{i}\bar{\epsilon}_n^2 \tag{1}$$

Here j denotes parameter, ∂ denotes SD (Standard deviation)

After then, the mistakes must no longer be dependent on one another. It is written as follows:

$$RV_i \sim \sqrt{o}\frac{s}{\sqrt{s^2+o-1}} \tag{2}$$

Here RV_i denotes random variable.

The standard deviation must then be applied to the movement of the variable.

$$Sm = \frac{\beta^{sm}}{o^{sm}} \tag{3}$$

Here Sm denoted moment scale.

$$\beta^{sm} = T(Z-\beta)\hat{}Sm \tag{4}$$

Z represent random variable

T represent intended value

$$o^{sm} = \sqrt{(T(Z-\beta)\hat{}Sm)\hat{}2} \tag{5}$$

The mean is used to normalise the distribution of the variable, especially for the normal ordered distribution.

$$Coe_\nu = \frac{t}{\overline{Sm}} \tag{6}$$

Here Coe_ν coefficient of the variance.

Then, using the function scaling method, any values between 0 and 1 may be entered. Depending on the application, this technique is known as standardization.

$$Z^{'} = \frac{(Z-Z_{min})}{(Z_{max}-Z_{min})} \tag{7}$$

D. Theory of use and satisfaction

Some media scholars argued in the 1970s that audience usage of media is also a mode of consuming. Cardozo stated that if a client is satisfied, they are more likely to buy from you again. User motives, happiness, and attitude following usage may all influence the assessment of user satisfaction on social networking sites. Among the customer satisfaction assessment methods for conventional industries, ACSI, the most comprehensive model that has shown to be the most successful in satisfying the customers inside a single nation, has been used in a wide range of industries and sectors.

E. Theory of planned behavior

The theory of reasoned action (TRA), which aims to explain practically any human behaviour and has been proven to be successful in predicting and explaining human behaviour in a range of circumstances, supports TPB. According to TRA, a person's actual behaviour when doing a specific activity is impacted from his or her behavioral intention, which is influenced by the enabling circumstances and attitude toward the action. According to the descriptions, theory of planned behaviour is a measure of a person's willingness to try new things when participating in specified tasks. Based on TRA's work, it is proposed that TPB be used to eliminate the limitations of the original model when working with behaviour over which people have partial volitional control. TPB

varies with TRA in that it incorporates perceived behavioral management, that has the potential to directly affect performance expectancy. The level of a people's positive or negative assessment or appraisal of the conduct in issue is referred to as AT- Attitude. An average life model may be used to create a positive or negative attitude that is directly proportional to the intensity of behavioral beliefs about probable outcomes calculated as,

$$AT = PrAiBeDei \tag{8}$$

Where,
AT denoted as Attitude
$AiBe$ denoted as Attitudinal Belief
Dei denoted as Desirability of the outcome
"Perceptions of social pressure to do or not execute the action" is referred to as a behavioral intention. In other terms, attitude is linked to normative views about what other people should anticipate.

$$MN = nq - - - - - - \tag{9}$$

n denotes normative belief.
q denotes Motivation.
Though attitude may be divided into normative and informational effects, most TPB implementations consider just the normative influence to be personal factor. This restriction may explain why the variables of perceived norm and behavioral intention have such a weak connection. Furthermore, in a required use environment, behavioral intention would favorably impact the subjective norm, while in voluntary usage situations, the effect was negligible. People's perceptions of ease or difficulty in executing the action of interest are referred to as perceived behavioral control. It's connected to ideas about the presence of control factors that may help or hurt the behavior's performance. Although subjective norm may be divided into informational and normative effects, most TPB applications regard just the normative influence to be subjective norm. This restriction may explain why the perceived norm and behavioral intention have such a little connection. Furthermore, in a required use context, behavioral intention has a positive impact on the subjective norm, while in voluntary usage settings, the effect is negligible. People's perceptions of ease or difficulty executing the action of interest are referred to as perceived behavioral control. It's linked to thoughts regarding the existence of control variables that may help or hinder the behavior's success. As a result, given a combination of opportunities and resources, there is an underlying feeling of behavioral control, which is generated when control beliefs (CB) are weighed against the perceived strength was observed factor.

F. Improved Grasshopper optimization algorithm

The grasshopper optimization method mimics the natural swarm behaviour of grasshoppers. Related to PSO swarm methods, each grasshopper represents a potential solution that is created at random at startup, and the best grasshopper is chosen as the leader based on evaluation functions. Other grasshoppers will flock to it because of the presence of the lead. All of the grasshoppers eventually migrate to the leader grasshopper.

Z_j represent position of jth grasshopper in number of space dimension. The improved Grasshopper optimized Algorithm mathematical expression is given in equation (10).

$$Z_j = N_j + M_j + B_j \tag{10}$$

Here
N_j- Social interaction

$$Z_j = \sum_{i=1, i\neq 1}^{N} z(e_{ji})\widehat{e_{Jl}} \tag{11}$$

Here, e_{ji} denotes Euclidean distance among 2 grasshoppers.
z denotes The intensity of social contact may be estimated using the following function.

$$Z_f = rs^{-\frac{f}{l}} - s^{-f} \tag{12}$$

Here,
r- intensity attraction
l- the length scale attractive
The gravity factor is calculated using the equation 13

$$Gr_j = grs^{\wedge}_{gr} \tag{13}$$

Here gr denotes Gravitational Constant.
$s^{\wedge}_{gr}$ denotes vector that pointed to earth center.

$$B_j = -cs^{\wedge}_{wt} \tag{14}$$

Here c denotes Drift Constant
$s^{\wedge}_{wt}$ vector unit.

$$Z_i = \sum_{i=1, i\neq j}^{N} z(|Z_i - Z_j|)\frac{Z_i - Z_j}{d_{ij}} - grs^{\wedge}_{gr} + cs^{\wedge}_{wt} \tag{15}$$

Here Z_i, Z_j denoted jth and ith improved grasshopper correspondingly.....
Where X_i, X_j represents ith jth Grasshopper respectively and X_i is the next position of grasshopper X_j

$$X_i^d = c_1\left(\sum_{j=1, j\neq i}^{N} c_2\frac{ub_d - lb_d}{2}s(|X_j^d - X_i^d|)\frac{X_j - X_i}{d_{ij}}\right) + T_d^{\wedge} \tag{16}$$

Where ub_d and lb_d represents the upper and lower bound in dth dimension respectively.

$$c_i = cMax - l\frac{cMax - cMin}{L} \tag{17}$$

Where $cMax, cMin$ are the maximal value and minimum value of c_1, c_2 respectively.

4. Performance analysis

The outcomes of the suggested method for data annotation and optimization in the Wechat databases are shown in this section.

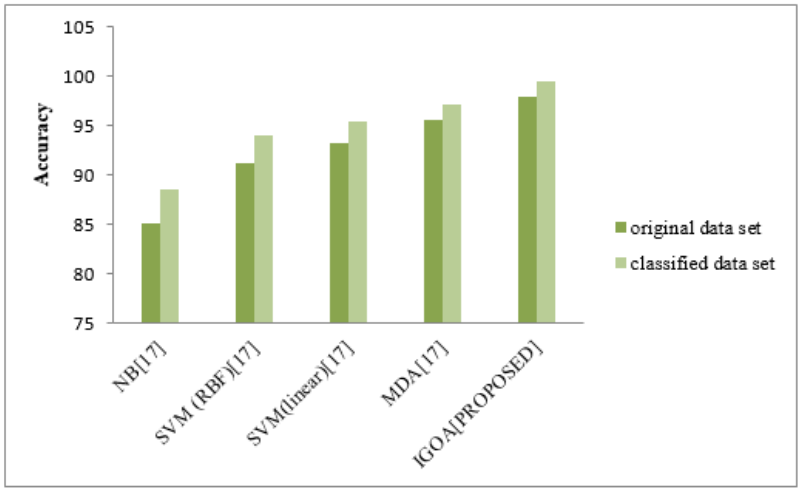

Figure 2: Comparison of Accuracy

i) Accuracy

The simplest obvious performance metric is accuracy, which is just the ratio of properly outcome expectations to all observations. Equation (18) calculates the accuracy value for wechat data mining.

$$AUC_{wc} = \frac{tp_{wc} + tn_{wc}}{tp_{wc} + fp_{wc} + fn_{wc} + tn_{wc}} \tag{18}$$

The Accuracy of optimized and suggested method approach is compared with various algorithm. The chart clearly demonstrates that the suggested results are more accurate than the existing methods shown in figure 2.

ii) Precision

The ratio of properly predicted positive data to total anticipated positive observations is known as precision. Equation (19) calculates the precision value for wechat data mining.

$$Pre_{wc} = \frac{tp_{wc}}{tp_{wc} + fp_{wc}} \tag{19}$$

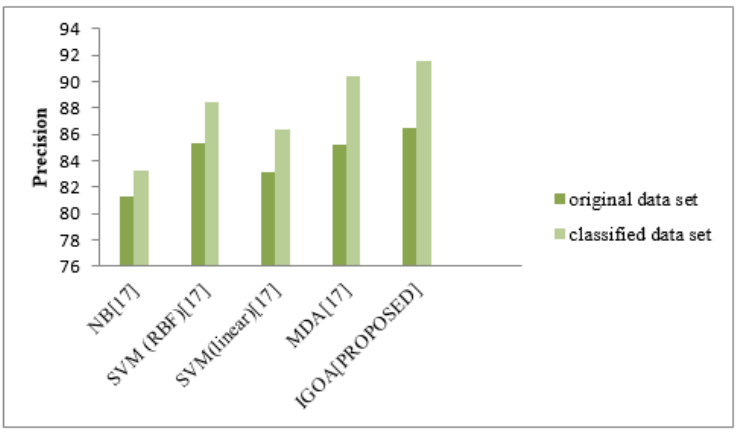

Figure 3: Comparison of precision

The comparison of precision for optimized and suggested method are shown in figure 3. The chart clearly demonstrates that the suggested results are more accurate than the existing methods.

iii) Recall

The ratio of properly predicted positive data to all observations in the actual data is known as recall. Equation (20) calculates the recall value for wechat data mining.

$$Recall_{wc} = \frac{tp_{wc}}{tp_{wc} + fn_{wc}} \tag{20}$$

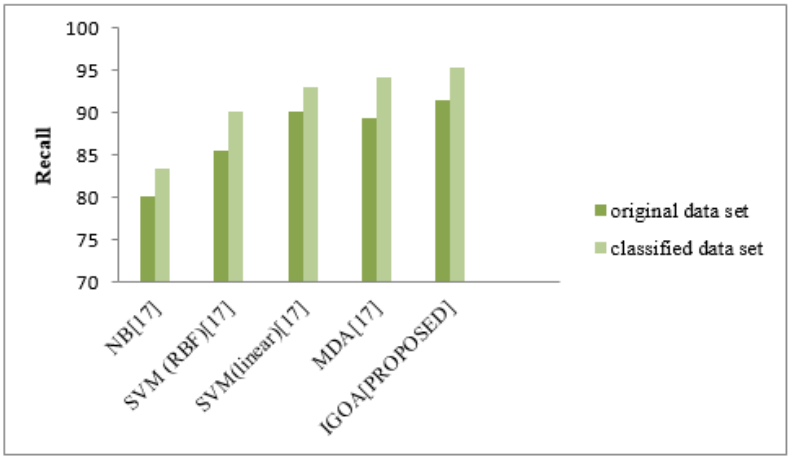

Figure 4: Comparison of recall

The Recall of optimized and suggested method approach is compared with various algorithm. The chart clearly demonstrates that the suggested results are more accurate than the existing methods shown in figure 4.

iv) F1-Score

The weighted mean of Recall and Precision is the F1 Rating. As a result, this score considers both fp and fn. Equation (21) calculates the F1-Score value for wechat data mining.

$$F1\ Score_{wc} = 2 \times \frac{(Recall_{wc} \times Pre_{wc})}{(Recall_{wc} + Pre_{wc})} \tag{21}$$

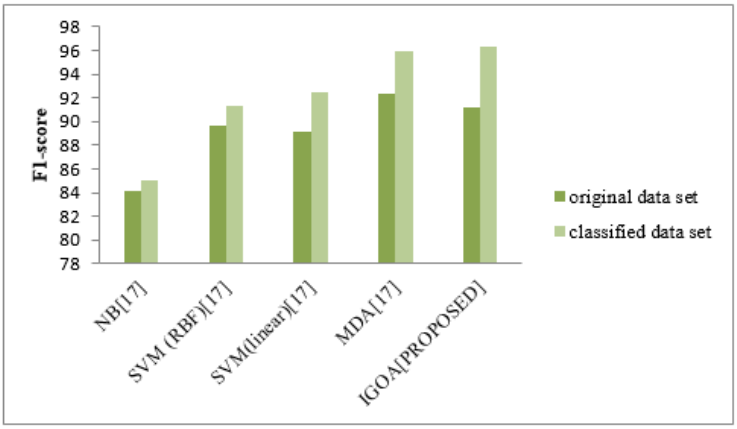

Figure 5: Comparison of F1-Score

The F1-Score of optimized and suggested method approach is compared with various algorithm. The chart clearly demonstrates that the suggested results are more accurate than the existing methods shown in figure 5.

5. Conclusion

Customers' qualities on the WeChat platform will have a significant impact on their app use behaviour, according to the website design study. The findings of this study have significant significance for the WeChat app design guide. Our results indicate that the behaviour of WeChat users be used to influence the design of the apps webpage. The findings of our study revealed that certain variables such as theory of use or satisfaction and theory of planned behavior analysis by using Improved Grasshopper optimization algorithm for WeChat application. The benefit of the previous design ideas will be significantly enhanced in the app website setup by taking into consideration the browsers' experience, such as gender, frequent WeChat chatting, rich process of online buying, and etc. In conclusion, our research adds to the ideas of app design and browser behaviour analysis by giving empirical weight data on additional variables.

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