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Research Paper



A Study on impact of smartphone addiction on academic performance

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Abstract

Smartphone addiction is increasingly affecting the masses and is negatively impacting the younger generation. Several researches have been done to study the impact of internet and smartphone addiction. However no work has been done to predetermine academic performance from smartphone addiction using data mining techniques. A total of 222 University students participated in the questionnaire. The survey questionnaire consisted of demographic information, internet access pattern and smartphone addiction pattern. Data was analysed using machine learning techniques using classification models. The results further encouraged us to find the correlation between smartphone addiction and academic performance. Pearson' correlation was used to establish that smartphone usage had a negative impact on academic performance. Additionally other attributes like internet connectivity and active involvement in outdoor sports activities were investigated. Experimental results confirmed a negative correlation of these attributes with academic performance. The findings were of immense use and could be used to reduce the internet addiction amongst the student community and also enhance their academic performance

Keywords: *Academic performance; Classification; Internet connectivity; Pearson's correlation coefficient; Smartphone addiction.*

1. Introduction

According to internet Statistics (2017), about 40% of human beings use internet as compared to 1995 when only 1% of the population used internet. Developed countries have highest internet usage as compared to developing and underdeveloped countries. USA, Denmark , Japan have highest internet penetration of 91.1% and developing countries like India , Brazil have internet penetration of 34.8% and 66.4% [1].

Internet usage has changed the dynamics of our lives to a great extent. It touches all the aspect of our lives including the way we interact socially, the way we do banking, the way we book a cab, travelling, social media, e-commerce. These changes have been catalysed by easy access of internet from our smartphones and evolving technologies like 4G providing high speed internet connectivity. The high speed internet connectivity reduces the need of any buffering and enables seamless internet browsing ability. Internet addiction is engulfing a huge section of the society across the globe [2].

The result of these technologies has captivated masses and makes us use internet every day more than intended. People feel inseparable from their smartphones [3]. This effect is more pronounced in the younger generation. Internet addiction causes depression in several adolescents [4]. Smartphone users have increased significantly. As per studies, 35% of Americans used smartphones in 2011 compared to 64 % of Americans in 2015. Developing country like India has more than 220 million smartphone users and has become the second largest smartphone market [5].

2. Related works

Average internet usage on an average daily is 3hrs [1]. As per Dave Chaffey 90 % of the time is spent on using various apps using internet and 10% time used is on browsing various websites [6]. Use of applications like facebook sometimes creates addiction and has been found to reduce academic grades [7]. This high affinity of accessing internet and smartphone has turned the generation to spend days immersed in internet and smartphone. In fact if we simply observe the public places for example: an airport, restaurants, malls, we would see a significant percentage of human beings busy with their smartphones.

This is leading to internet/smartphone addiction. Prior studies define technology addiction as " an obsessive pattern of IT-seeking and IT use behaviours that takes place at the expense of other important activities", leading negative psychological , behavioural and cognitive consequences Survey shows tremendous growth of about 84% on smartphone usage from 2014 to 2016. Smartphone addiction not only creates stress, reduces satisfaction of life and also negatively impacts academic performance [8] [9].

Prior research triggered our interest in investigating how smartphone impacts the engineering under graduate students. First we sought to investigate the relationship between smartphone addiction and academic performance. Then we intend to find out factors that influence the smartphone addiction and find out factors which could reduce the internet addiction.

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3. Experimental setup

3.1. Participants

Data was collected from 222 undergraduate engineering students (Biju Pattnaik University of Technology and Kalinga Institute of Industrial Technoogy University); India. Data collection was in form of questionnaires. Before completing the survey, it was explained the purpose of the survey and that the confidentiality of the participants will be maintained. The sample consisted of 62% of male participants and 38% of female participants.. Around 21 data samples were incomplete and not included in the study. Only 201 data samples were included for the study.

3.2. Measure

The survey was composed of two separate sections to collect data about demographic information, smartphone addiction and internet accessing patterns. The demographic information consisted of gender, age, semester, CGPA, daily internet usage hours, daily outdoor sports involvement hours, internet accessing pattern etc. The remaining section Smartphone addiction- short version (SA-SV) was used. The student attributes obtained from questionnaire is shown in table 1 and consisted of demographic and smartphone addiction, short version (SA-SV). The amount of time required to complete the survey was approximately 10 mins. SA-SV was developed by Kwon, Kim, Cho , & Yang, 2013 [10] , looks at smartphone usage to identify the level of risk for smartphone addiction. It consists of 10 items rated on six point like type scale, from 'strongly agree' to 'strongly disagree'. In the present study the values ranged from 15 to 58. A cut off value of 31 and 33 is advised for boys and girls respectively where low scores are indicative of low internet risk addiction and high scores are indicative of high internet addiction. Based on the scores obtained internet addiction was categorised into three values: low, medium and high.

Table 1: Attributes of students collected from questionnaire

Demographic/ Academic	SAS-SV
Age	Planned work getting missed due to smartphone
Gender	Unable to concentrate in class
Type of internet connectivity on smartphone	Smartphone use causing pain in neck and wrist
Daily duration of smartphone usage	Cannot stand without smartphone
Purpose	Not holding smartphone makes me impatient
Overall health condition	Thinking about smartphone even when not using it.
Attendance %	Despite my life getting affected by smartphone, I will not stop using it.
Regular participation in outdoor activities	Keeping updates of conversations in facebook, twitterall the day
Internal grades	Usage of smartphone more than intended
CGPA last semester	People tell me that my usage of smartphone is very high

The questionnaire was designed in consultation with the stakeholders and collected smartphone/ internet accessing pattern along with academic and behavioural patterns . It was also found out that smartphone access was mostly used for social media, entertainment, education, offline applications or ecommerce.

3.3 Data Analysis

Data pre-processing techniques were used to balance data [11] and remove the noise. Classification techniques were used to predetermine the academic results from the data collected in the questionnaire. Classification techniques that used were Naive Bayes classifier, Support Vector machines and RBF neural network. All these three techniques give good classification results and are used in different classification problems [12][13][14]. The results of classification models were measured not only using accuracy but also using f-measure as shown in figure 1 and 2 respectively. The data was analysed using matlab and WEKA toolkit [15]. The results obtained inspired us to further analyse the relationship between smartphone usage, type of internet connectivity, involvement in outdoor sports activities and academic performance. Pearson's coefficient was used further to investigate the relationship between the attributes mentioned in fig. 1.

$$Fmeasure = \frac{2 \times Precision \times Recall}{Precision + Recall}$$

4. Results

The experiments conducted on the data gave some very interesting and useful results. In the data collected, it was found that around 75% of students were having access to 3G and 4G internet connectivity on their smartphones and only 21% of students were regularly involved in some outdoor sports activity. Classification techniques used to predetermine students' academic performance gave good results as shown in figure 1. Academic performance was divided into three categories: poor, average and outstanding. The attributes used for determination of academic performance was internet connectivity type, smartphone addiction scale and participation in outdoor activity.

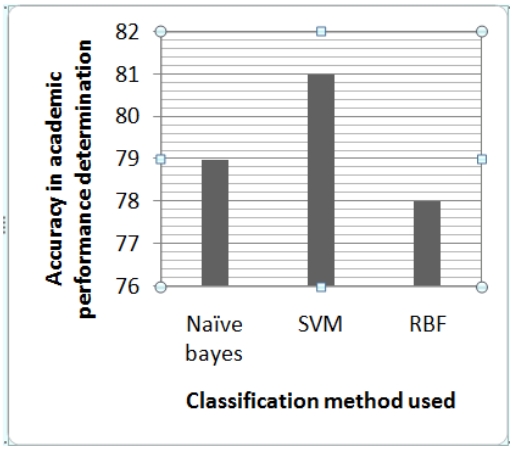


Fig. 1: Classification accuracy of academic performance determination.

Highest classification accuracy was obtained by the classifier SVM, followed by Naive Bayes classifier and RBF classifier. The classification algorithms were evaluated not only by its accuracy but also by error rates like Mean Absolute Error (MAE), Root Mean Square Error (RMSE) and Relative Absolute Error (RAE) as shown in figure 3.

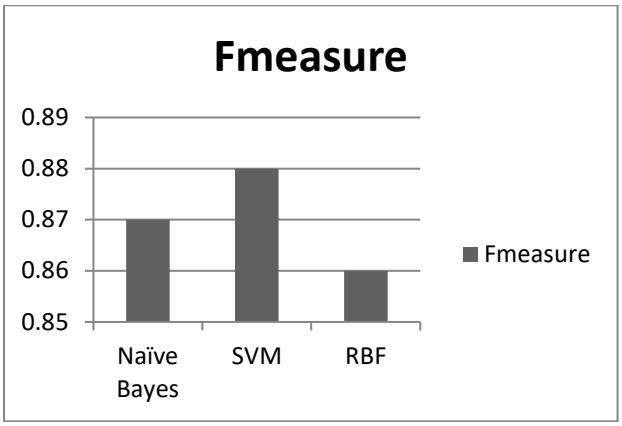


Fig.2: F-measure for the classification models

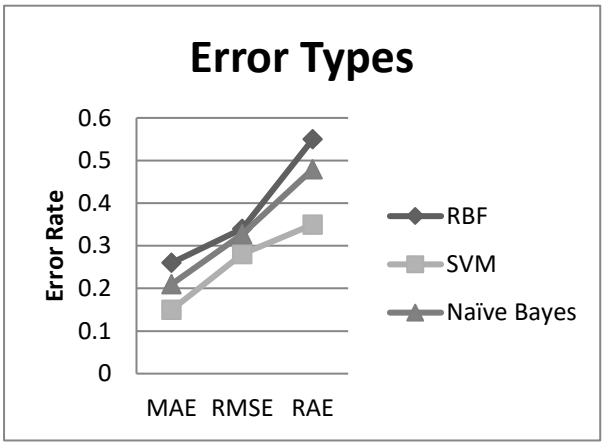


Fig. 3: Different types of errors obtained in the classification model.

The correlation between risk of smartphone addiction and the type of internet connectivity was investigated using Pearsons product moment correlation coefficient. Between smartphone addiction and internet connectivity (3G/ 4G) it was found that a positive correlation r = 0.291, N= 101 and p = 0.0001 existed. Additionally the relationship between smartphone addiction and academic performance was investigated using Pearson's coefficient. A negative correlation of r = -0.748 and p < 0.0001 was found between smartphone addiction and academic performance. Also a small negative correlation was found between the smartphone addiction and regular participation in outdoor sports or hobbies with r = -0.491 and p <= 0.0018 was found by Pearson's correlation coefficient. The conceptual framework for the same is shown in figure 4.

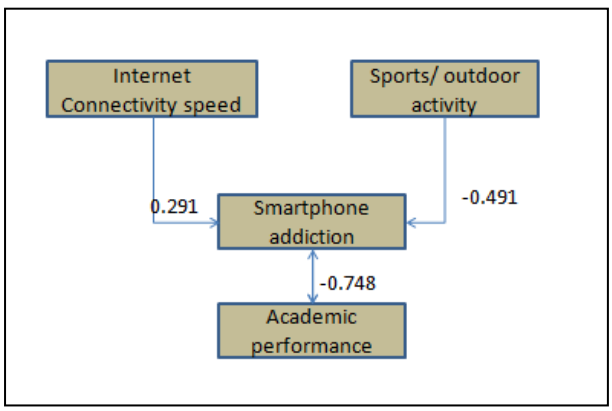


Fig.4: Depiction of correlation between internet connectivity, smartphone addiction, outdoor activity and academic performance

4.1 Discussion

The objective of this study was to examine the relationship between smartphone addiction and academic performance. It was found that high addiction of smartphone did have a negative impact of the overall academic performance. This finding helps parents and teachers to motivate the students to limit their usage of internet. Figure 4 depicts the relationship between the variables. The absence of an arrow between academic performance and involvement in sports/ outdoor activity indicates that no correlation exists between the two variables. However it was found that students who were highly active in outdoor activities like sports had little or no addiction to smartphone. Also a strong relation between type of internet connectivity and smartphone addiction was found. For instance university students who had 4G or 3G internet connectivity on their smartphones had a higher risk of smartphone addiction and the frequency of their internet usage was very high. Internet access was mostly done for highly addictive applications, social networking and online gaming over the internet.

Our research confirmed several studies that showed a negative relation between technology use and academic performance. For example Paul A. Kiscner , Aryn C. Karpinski revealed that facebook non users outperformed facebook users in academics and had higher mean GPA and studying hours. Maya Samaha, nazir S. Hawi confirmed a negative correlation between academic performance and smartphone addiction.

5. Conclusions

The experiments conducted gave significant results. Smartphone usage patterns along with academic attributes could be used to pre-determine academic performance. Classification algorithms like SVM, RBF neural network and Naive Bayes classifier were used to pre-determine academic results. SVM gave an accuracy of 81%. Effectiveness of these algorithms were also tested using f-measure. Further experiments were conducted using Perasons correlation coefficient. Three important observations were made. Firstly, a positive correlation existed between the internet connectivity (4G/ 3G) and smartphone addiction. Secondly, there was a negative correlation between academic performance and smartphone addiction. This clearly indicates that the use of smartphone should be discouraged amongst the student community. Thirdly, there was a negative correlation between high participation in sports activity and smartphone addiction. This important result can help educational institutions and parents to encourage students to get involved in sports activities to reduce the internet addiction.

These results were extremely useful in guiding the students about the negative impact of smartphone addiction and encouraging the students to use their free time to outdoor sports activities. Smartphone addiction is increasing at an alarming rate and impacting negatively the younger generation. Intervention programs must be developed and implemented to prevent the smartphone epidemic from spreading further. In future we will implement intervention programs for a section of students and check whether the impact of smartphone addiction has reduced. Using classification models we would further test the improvement in academic performance.

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