

Prediction Analysis of Gaming Cost By Employing Data Mining Algorithms

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ABSTRACT

Video games are a source of entertainment for different age groups. Players who are seeking quality video games spend more money on their systems. In this way they spend a hefty amount on internet, storage, GPU etc. Due to the addictive nature the cost is not negligible and there are not so many researches done on predicting the cost a player has to suffer. In this paper, the gaming cost is being determined by applying different algorithms. Data was collected from different age groups with different characteristics like the choice of storage options, game genres, internet speed and time they spend on games. Different models are being used like Ada boost, logistic regression, Decision tree and Random forest to check the accuracy of prediction analysis. This research will help in development of further models which can measure the gaming cost more accurately.

KEYWORDS: *Ada boost, Decision tree, Graphics Processing Unit, Logistic regression, Random forest, Random Access Memory*

INTRODUCTION

Video games, as we all know, are a sort of fun hobby, but it's not an inexpensive one. Video games industry is one of the huge entertainment form crossing Hollywood record annual revenues. These have a greater impact on human functioning by stimulating the minds of its users. However, most of the people disagree about its effects whether to categorize them as harmful or useful [1]. Many individuals play video games and spend money for higher quality graphics. In this era, of digitization these video games are also becoming the source of earning on many online platforms and so the individual has to spend more on them for getting quality content. Due to the addictive nature of games the costs is not negligible to the individual and the society [2]. Since the first Atari titles of 1970s computer games have come a long way. In present situation, the mind-blowing graphics and sophisticated story lines, however, bear an energy cost. A high-quality game today can draw 50 times more electricity than old games version. Right sizing the GPU has huge importance. If the games played don't need a high-powered GPU then these games are not of that worth top be played. Most gaming PC's have large power draws than consoles like Xbox or PS4 [3].

When the game Call of Duty: Modern Warfare 3 was launched, it earned a great deal of money approximately \$400 million within 24 hours. This compelling success is an enormous manifestation of the growth of gaming industry. The economic value of video games has shifted from a niche to a blockbuster business. This industry is symbolized by not

just growth but also a higher degree of dynamics and innovation. In addition to consoles, video gaming takes place within networks which are interactive and also on variety of mobile devices. It often spurs and bridges innovation in other industries. In virtual worlds, players manipulate and change their surroundings through high quality animations and motion sensor controllers [4]. Players now not only pay for decorative items but also for accuracy, agility and boosting of players' speed. During pandemic, game consoles are also becoming a common sight in houses. So far, players are experiencing a higher cost of development of game in the form of long wait for sequels [5]. Many people are willing to fork out for a new game which can cause its market to move up. Graphics manufacturers are also switching their GDDRS to higher versions which can cause an increase in price. This paper will also discuss the prediction of overall gaming cost through different algorithms which will help the player in anticipating his complete budget with more precision.

LITERATURE REVIEW

The popularity of games has caught attention of many managers and researchers, because main researchers who have analytical approach belong to an earlier generation than the generation grown up with these video games. Many researchers have tried to measure the energy consumption by this growing industry which extends to about 2 or 3 billion people. The way games are coded have energy efficiency ethnic [6]. There is also a little debate that the games industry

How to cite this paper: MD. Rhineul Islam | Nakib Aman Turzo | Pritom Sarker Bishal "Prediction Analysis of Gaming Cost By Employing Data Mining Algorithms"

Published in International Journal of Trend in Scientific Research and Development (ijtsrd), ISSN: 2456-6470, Volume-5 | Issue-3, April 2021, pp.31-35, URL: www.ijtsrd.com/papers/ijtsrd38566.pdf



IJTSRD38566

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growth has a parallel connection with aging gamers with disposable incomes. Entertainment Software Association shows that average gamer ages 29. And spends more time in playing video games [6,7].

India's online industry of gaming dates back to the year of 2000. At that time, consoles and gaming brought several Indians of middle income to this platform. The online market of gaming has seen many opportunities in India. The market is dominated by casual gamers. Limited mobile payment and low levels of online entertainment for online gamers resulted in low monetization levels [7].

Consoles manufacturers are going to manufacture more high performance and high-quality graphics than their predecessors. So with premium specs, game publishers are expected to rise prices due to additional development and marketing cost. Call of Duty 2 when launched in 2005 has a standard rate of \$60 and now reached to \$80. During pandemic, its high demand makes publishers to gamble [8].

Both Xbox controller and PS4 cost \$60, while some retailer also gives discounts. Microsoft and Sony are not so generous and force gamers to pay for a subscription in order to play online. Microtransactions are a common place throughout the gaming world [9].

'God of War' creative director Cory Barlog said that games need to go up in price on cash grab microtransaction filled hellscapes. AAA developers relied on the concept of loot boxes, which became banned later on [10].

Mobile game accounts for 33% of all app downloads, consumer spends 74% and 10% is the one spent on all types of applications. Time spent on television has been outpaced by mobile in USA due to which games have grabbed the major share and so the game space has taken increased attention and investment. Now the local gaming businesses are also getting support from government [11].

Figures provided by ESA and Statista showed that average American gamer spend 216.64 on games. A report by analytics firm Asensor Tower claims that Fortnite is making \$1 million per day on average. Moreover, PC has highest average for purchasers who are at age 38, then consoles and smartphones at 33 and 37. The average gamer who uses PC can spend more money on cosmetics, characters, weapon skins etc. But still mobile gaming revenue is higher than PC [12].

When it came to the players pay for their purchases, MMO gamers were separated between debit cards and credit cards. There was clear difference between genders in terms of how much amount they spend on average with male gender spending \$262 while female gamers spent only \$177 [13].

Millennials spend an average of \$112 a month on content of gaming and they not only buy them but also watch game content on various sites. The gender split is even in this case too and their average household income is \$58,000 year [14].

Maximum time that gamers spend in playing is 7 hours. This number is up nearly 20%. The amount of game played by different age groups also increased each week. The lowest number of games played by 18-25 age group which increased the amount they play by 9.9%. Germany has highest average in this regard and then USA and Singapore have the highest average [15,16].

METHOLODOGY

The data for gamers monthly cost has been assimilated. The gaming rig information like processor, graphic card and RAM information was collected. Moreover, player's information like the choice of games, their monthly expenditure and their internet expense and speed was calculated.

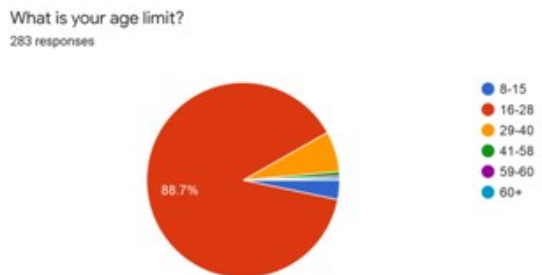


Fig 1

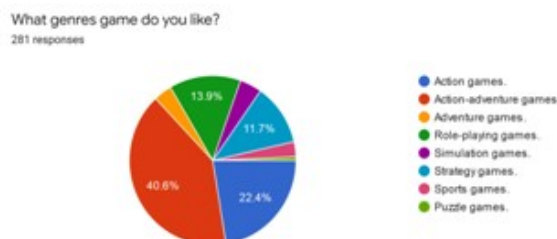


Fig 2

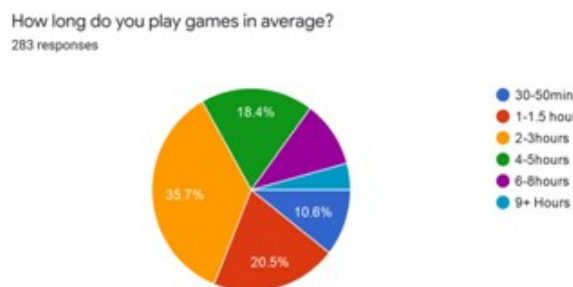


Fig 3

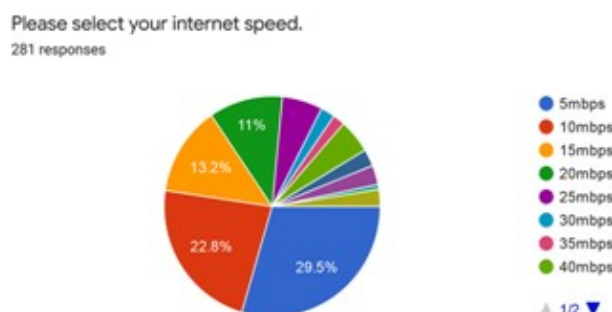


Fig 4

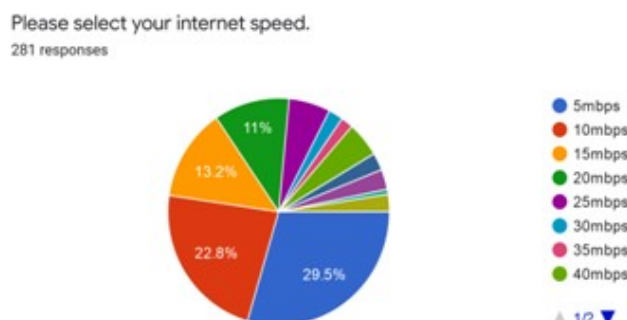


Fig 5

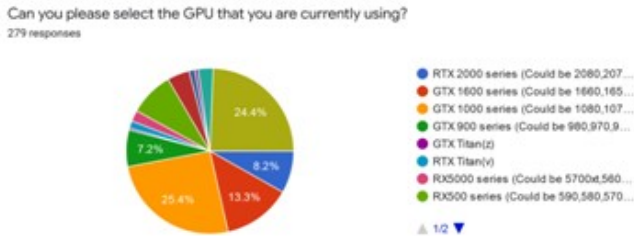


Fig 6

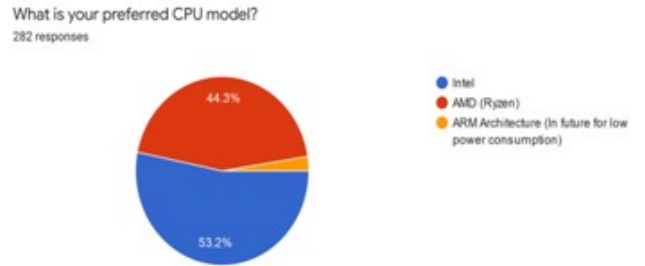


Fig 8

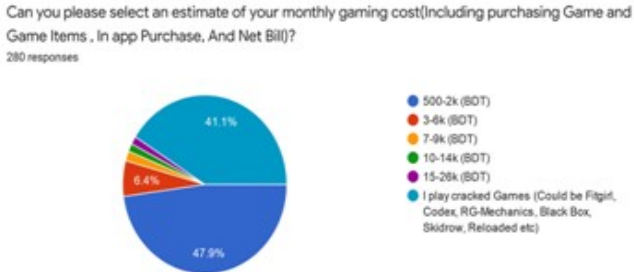


Fig 7

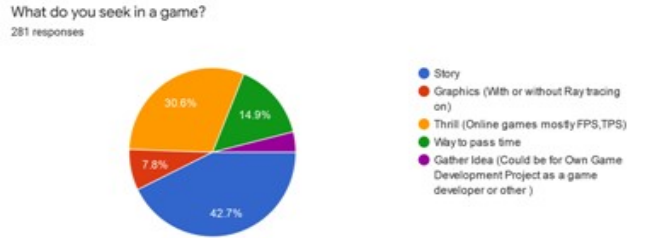


Fig 9

Then a python code was made which takes all information of processor, RAM and graphics etc. A 'Preference' column was made according to their specific configuration. Here data are classified differently by assigning different categories like Very High, High, Medium, Low. Python code made for the datasets will determine the accuracy of the model with provided values. Cleaning of the data was done as shown below:

Table: 1 Cleaning of the data was done as shown below:

	Timestamp	What is your age limit?	What genres game do you like?	How long do you play games in average?	Please select your internet speed.	Can you please select the GPU that you are currently using?	Can you please select an estimate of your monthly gaming cost (Including purchasing Game and Game Items, In app Purchase, And Net Bill)?	What is your preferred CPU model?	What do you seek in a game?	What is your RAM size?	Preference
0	02:01.1	16-28	Action games.	1-1.5 hours	10mbps	RX5000 series (Could be 5700xt,5600xt,5500xt)	500-2k (BDT)	Intel	Thrill (Online games mostly FPS, TPS)	16GB	High
1	04:20.6	16-28	Strategy games.	4-5hours	5mbps	GTX 1000 series (Could be 1080,1070,1060, 1050...)	500-2k (BDT)	Intel	Story	8GB	Medium
2	05:03.8	16-28	Action-adventure games.	4-5hours	5mbps	RX500 series (Could be 590,580,570,560,550)	I play cracked Games (Could be Fitgirl, Codex, RIG-Mechanics, Black Box, Skidrow, Reloaded etc)	AMD (Ryzen)	Story	8GB	Medium

Table:2

Age Limit	Genre	Playtime (min)	GPU	Monthly Cost (BDT)	CPU	RAM (GB)	Preference
16-28	Action games.	1-1.5 hours	RX5000 series (Could be 5700xt,5600xt,5500xt)	500-2k (BDT)	Intel	16GB	High
16-28	Strategy games.	4-5hours	GTX 1000 series (Could be 1080,1070,1060, 1050...)	500-2k (BDT)	Intel	8GB	Medium
16-28	Action-adventure games.	4-5hours	RX500 series (Could be 590,580,570,560,550)	I play cracked Games (Could be Fitgirl, Codex...)	AMD (Ryzen)	8GB	Medium
16-28	Action-adventure games.	2-3hours	RX500 series (Could be 590,580,570,560,550)	I play cracked Games (Could be Fitgirl, Codex...)	AMD (Ryzen)	12GB	Medium
16-28	Action-adventure games.	1-1.5 hours	GTX 1000 series (Could be 1080,1070,1060, 1050...)	I play cracked Games (Could be Fitgirl, Codex...)	Intel	16GB	High

Table: 3

	Age Limit	Genre	Playtime (min)	Internet Speed (Mbps)	GPU	Monthly Cost (BDT)	CPU	RAM (GB)
93	0	1	420	5	1	4	2	8
423	0	0	550	5	1	4	0	8
154	0	4	420	5	1	0	2	12
35	0	4	150	30	11	3	2	16
150	0	1	150	5	5	0	2	8

Table: 5

Logistic Regression Model				
	precision	recall	f1-score	support
0	0.92	0.75	0.83	16
1	0.59	0.56	0.57	18
2	0.62	0.72	0.67	29
3	1.00	0.80	0.89	5
accuracy			0.69	68
macro avg	0.78	0.71	0.74	68
weighted avg	0.71	0.69	0.70	68

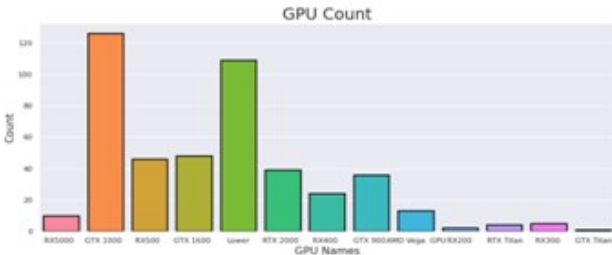


Fig: 10

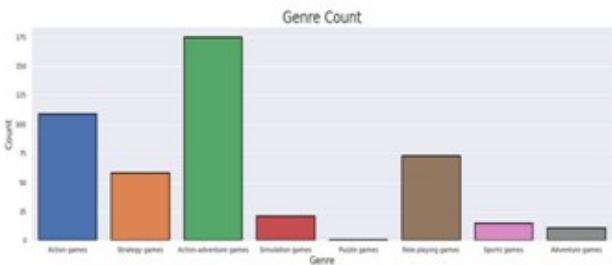


Fig: 11

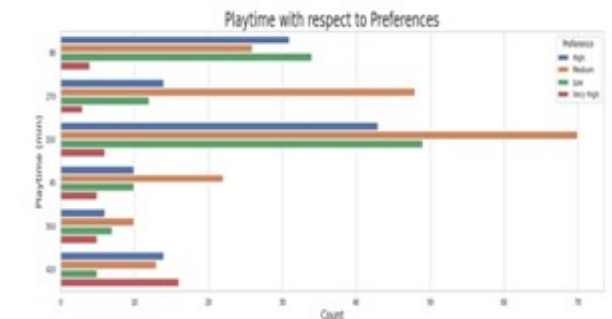


Fig: 12

In the last, cost was calculated with respect to time. After all this accuracy of prediction by different models was determined.

Table: 4

No	Column	Non-Null Count	Dtype
0	Age Limit	447 non-null	int64
1	Genre	447 non-null	int8
2	Playtime (min)	447 non-null	int64
3	Internet Speed (Mbps)	447 non-null	float64
4	GPU	447 non-null	int8
5	Monthly Cost (BDT)	447 non-null	int8
6	CPU	447 non-null	int8
7	RAM (GB)	447 non-null	int64
8	Preference	447 non-null	object
9	Preference label	447 non-null	int8

Table: 6

Ada Boost Model				
	precision	Recall	f1-score	support
0	0.88	0.88	0.88	16
1	0.53	1.00	0.69	18
2	1.00	0.41	0.59	29
3	0.67	0.80	0.73	5
accuracy			0.71	68
macro avg	0.77	0.77	0.72	68
weighted avg	0.82	0.71	0.69	68

Table: 7

Decision Tree Model				
	precision	Recall	f1-score	support
0	0.94	0.94	0.94	16
1	0.94	0.89	0.91	18
2	0.97	0.97	0.97	29
3	0.67	0.80	0.73	5
accuracy			0.93	68
macro avg				
weighted avg				

Table: 8

Random Forest Model				
	precision	recall	f1-score	support
0	0.94	0.94	0.94	16
1	1.00	0.94	0.97	18
2	0.96	0.93	0.95	29
3	0.57	0.80	0.67	5
accuracy			0.93	68
macro avg	0.87	0.90	0.88	68
weighted avg	0.94	0.93	0.93	68

After doing this operation the accuracy of logistic regression and Ada boost model comes out to be 0.73 for both. Random forest and decision tree has given an accuracy of 0.93.

Table: 9

No	Classifier Name	Accuracy
1	Logistic Regression Model	0.69
2	Ada Boost Model	0.71
3	Decision Tree Model	0.93
4	Random Forest Model	0.93

RESULT

Taking the cost of gaming that every player needs to spend on good quality graphics, speed and storage parallel to different models, precision comes out to be 0.93 for our model. The regression logistics and Ada boost model has an accuracy of 73 % while the Random forest and Decision tree has given an accuracy of 93%. This shows that players can estimate their whole budget when they need to upgrade their systems for better playing options and high-quality graphics. It will also help in future for the development of new models which can give prediction with more accuracy.

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