Social Networking Site Data Analytics Using Game Theory Model

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Abstract - *Decision-making tools give businesses important assistance in optimizing their strategy in comparison to their rivals. The happiness of the final users, or the customers, is crucial to decision-making. The application used in this study is based on Facebook and Instagram, two of the biggest social networking platforms. A game theory model must have these rivals or opponents, as well as the variables that govern their interactions. Finding the characteristics that these two players have in common and satisfy the interaction condition is the first stage. These so-called interactive strategies are those being taken into account. Using basic random sampling, a diverse group of regular users of these two social networking sites is chosen. Using the Cronbach's alpha test, the interactive parameters-based questionnaire's reliability is evaluated. The descriptive statistics and graphs show the end users' early patterns. The intercept data is gathered as payoff values before the regression analysis is run. As a result, the two player Game theory model is created. The worth of the game and each player's optimal strategies are calculated as a result. The interpretation of the derived values shows how game theory model-based optimal strategy decision-making affects the calculated values.*

*Key Words***:** Game theory, Interactive strategies, Optimum strategies, Value of the game

1. INTRODUCTION

There is competition in every corporate environment. In these circumstances, making wise decisions is essential since they can directly affect how much money a corporate organization can potentially make. Social media platforms like Facebook, Instagram, Twitter, blogs, and others are used by people to share their knowledge, experiences, and ideas with the world.

Due to this, communication and the way people can affect other people's social, political, and economic conduct have altered. The social network approach offers a number of tools for analyzing social entity structures as well as a wide range of ideas for illuminating their patterns.

According to the forecast made by Edison Research, Instagram will surpass Facebook in terms of overall usage by 2020. These two entities might be seen as fierce competitors in the social media space.

The goal of this research project is to develop a game theory model based on characteristics shared by Facebook and Instagram. Determine which feature, out of all the characteristics, is superior to other features by analyzing the final product. For the two players, the game's worth creates a win-win situation.

Facebook and Instagram both have seven characteristics in common:

1) Chat Interface

2) Live Videos

3) Private or Public Accounts

4) Stories

5) Like and Comments

6) Groups

7) Security.

The interaction between Facebook and Instagram is made possible by these seven shared characteristics, which satisfy the game theory's fundamental premise. Facebook and Instagram are referred to as two players in game theory. The strategies are listed along with the shared traits. The payoff values are necessary to create a game theory model. Responses to a questionnaire on the aforementioned attributes were used to generate the data about these reward values.

The section-by-section breakdown of this research project is as follows: Section II is a survey of the literature that discusses the theoretical foundations for developing a game theory model. The research methodology's Section III discusses the approach's step-by-step specifics. The actual work of data analytics is covered in Section IV, where graphical, statistical, and decision-making tools are used to produce the desired outcomes. The highlights of each end result's interpretation are included in Section V, along with the conclusion. The list of resources that were helpful for this research is in the last section.

1.1 LITERATURE REVIEW

The significant works in the field of social networking were initially the focus of the literature review, followed by the aspect of game theory. [1] This essay illustrates the

relevance of the gratifications theory and how it is applied in social media. Additionally, it offers a thorough grasp of how customers use social media. [2] The first thorough literature review in the field of social media research is the subject of this essay. It also demonstrates a deeper comprehension of the factors that contribute to and are affected by the adoption and use of social media. [3]. This blog includes poll data from YouGov-Mint showing that, as of August 2018, 71% of Facebook users also use Instagram, compared to 85% of Instagram users who use Facebook. [4] The data for current Facebook and Instagram users up to June 2019 are provided on NapoleonCat's blog. 18.6% of India's population as a whole uses Facebook, compared to 4.8% of Indians who use Instagram. [5] In this study, the Facebook pages of for-profit firms were analyzed for their content and the effects of the communication strategy used on the attitudes, purchasing intentions, and perceptions of the organization-public interaction among stakeholders. With a theoretical viewpoint, this exploratory study adds basic understanding regarding Instagram and social networking communication. In this article, the writers describe how text, tables, and graphs are efficient communication tools for presenting and disseminating facts and information that aid in comprehending the research's topic.

By utilizing the idea of a game theory model, the aforementioned studies offer the way to a solution for the two social media giants.

1.2 Research Methodology

A research problem can be solved analytically with the help of research methodology. The actions listed below are part of this section.

1) Creating a questionnaire depending on the goal of the study. A Google form was created to collect demographic data from the respondents. 14 more questions focused on the similarities between the two rivals. The respondents' information was gathered using a linear scale with 10 points. The online form had to be filled out completely before being submitted. The benefit of using an online form negates the presence of outliers, ensuring that the data is legitimate.

2) Determine the extent of the data collection from the end users' responses. A straightforward random sample technique was utilized to gather the data. On a diverse set of responders, a sample size of 100 was chosen. These violets any bias based on any characteristics.

3) Conducting a pilot study to verify the validity of the questionnaire model in accordance with the objectives of the research project. A sample of 20 respondents was initially gathered for the study. Three different methods of the Cronbach's alpha reliability test were used.

4) Graphical Representation- After the reliability test was successfully completed; the remaining 80 respondents were

contacted. The data from a 10-point scale was transformed into five ordinal categories before being plotted as a bar graph. 1–2 are adequate, 3–4 are satisfactory, 5–6 are good, 7–8 are very good, and 9–10 are excellent. The usage of the graphical tools can reveal the overall tendencies of the respondents.

5) Descriptive statistics- To determine the comparison numbers and the consistency of the features, the average value and standard deviation were calculated.

6) Regression analysis: Y on X and X on Y are two applications of the simple regression analysis principle. The results of the regression analysis are split into two components, called the intercept and the default value of Y when X=0. The focal point for gathering payout values is this. The slope, which also determines whether the independent variable has a positive or negative impact on the dependent variable, is the other component. This is not the issue that the game theory model's development is focused on.

7) Game theory model: A 7x7 reward matrix in the form of (axi, ayj) for the I j) cell can be entered based on the intercept data obtained from the two processes of Y on X and X on Y discussed above.

8) The game theory model's resolution in order to determine the game's worth and ideal strategies, all first entries axi among (axi, ayj) are taken into consideration, with player A acting as the major and player B acting as the minor. On the other hand, all second entries ayj among (axi, ayj) are taken into consideration in order to determine the game's value and ideal strategies while keeping player B as the major and player B as the minor. For the player B, the transposition of the original matrix values for ayj is used to find the solution.

9) The final facts and numbers can be seen as the game theory's outcomes for both sides.

The following section of Data Analysis discusses the specifics of points 2 through 9.

2. Data Analysis

Data analysis is used in the process of transforming raw data into useful, comparable information.

This study focuses on the reactions that can be used to create a game theory model. When employing a decision-making tool like the Game theory model, the final outcomes can serve as a basis for choosing the best strategy. The following lists the steps for data analysis.

Base for sample size

According to data and statistics on Facebook and Instagram users in India [3] and [4], an anticipated

5,64,14,500 people will be regular users of both services in 2019.

The margin of error for an exploratory study based on a consumer survey can be increased to 10% [12]. The sample size is 97 when the default values for the confidence level and response distribution are 95% and 50%, respectively.

100 samples were chosen as the approximate round-off amount for this research project. To gather the pertinent information, a questionnaire was distributed to our college's stakeholders using Google Form.

Cronbach's alpha reliability test

One of the most used dependability metrics in the social and organizational sciences is Cronbach's alpha [13], [14]. An initial sample of 20 respondents was used in a pilot poll to gauge the model's dependability. The stakeholders of our college in Nagpur served as the responders for this initial sample. Table I provides Cronbach's alpha values based on replies for each of the 7 features for Facebook and Instagram separately as well as for both of them to determine the overall condition of the model.

Table -1: Reliability test for Pilot survey

No	Index	No. of items	Initial sample size	C. alpha value	Indication
1	Facebook	7	20	0.197	Excellent
2	Instagram	7	20	0.924	Excellent
3	Facebook and Instagram	14	20	0.903	Excellent

Table I interpretation: The questionnaire is a great tool for doing this research because all three Cronbach's alpha values are higher than 0.90. For the remaining samples, the model is trustworthy for conducting the survey.

Graphical representation- This section is divided in two sub-sections as given below

i. Demographic Information

The occupation of a person's demography can have an impact on social networking sites [15]. Figure 1 shows the sample distribution of the heterogeneous groups.
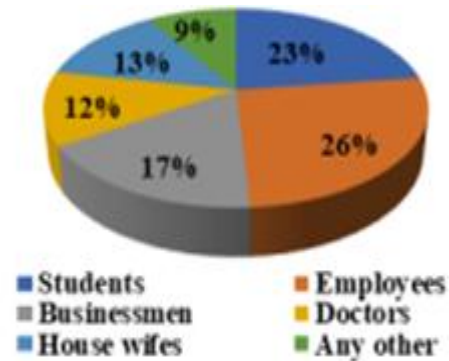

Fig. 1. Sample Distribution based on Occupation

Interpretation of Fig. 1: Students and employees make up over 50% of the sample. The remaining 50% includes them. The range of demographic data based on occupation represents variation and, as a result, mitigates any bias against any one characteristic.

ii. Trend within the responses

As mentioned earlier the data was transformed into 5 different ordinal categories. The general trend can be identified from the responses by using the stack bar chart.

Fig. 2, provides the information regarding the various features of both the competitors.
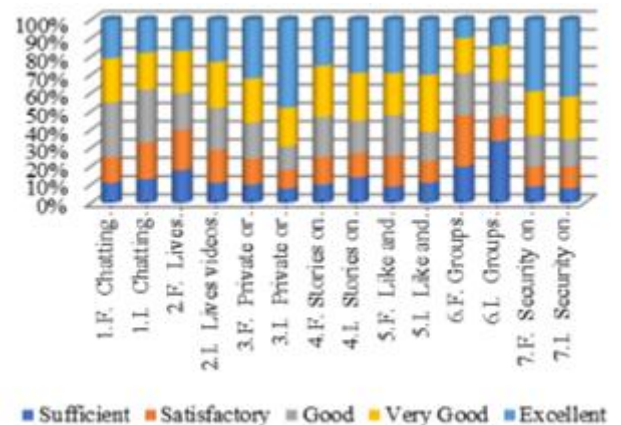

Fig. 2. Trends of responses on the seven features for the two players

Interpretation of Fig. 2: Facebook's chat interface is superior to Instagram's. However, compared to live videos on Facebook, Instagram live videos are more popular with consumers. Facebook accounts, whether private or public, contribute more frequently than Instagram ones. Users enjoy Facebook and Instagram's stories, as well as their likes and comments. The group-created features on both websites don't meet user expectations. The security aspect on both social networking sites is the best.

Descriptive statistics

Finding the overall trend is aided by the data's dispersion and measure of central tendency. The relationship between Standard Deviation and Average Value shows how consistently respondents view Facebook and Instagram. The consistency levels for each characteristic across all Players

Table- II: Player wise Descriptive statistics for various features

Players	Features	Average	Std. Dev.	Coeff. of Variation (%)	Consistent by Ranking
Facebook	Chatting Interface	6.02	2.61	43.34	5
	Live videos	5.50	2.85	51.78	6
	Private or Public	6.57	2.83	43.12	4
	Stories	6.41	2.56	39.93	2**
	Like and Comments	6.57	2.72	41.35	3
	Group Created	4.83	2.66	55.14	7
	Security	6.90	2.75	39.92	1*
Instagram	Chatting Interface	5.62	2.57	45.79	5
	Live videos	6.25	2.78	44.53	4
	Private or Public	7.38	2.78	37.68	1*
	Stories	6.38	2.98	46.67	6
	Like and Comments	6.68	2.84	42.44	3
	Group Created	4.81	3.15	65.46	7
	Security	7.15	2.90	40.61	2**

Interpretation of Table -II: Facebook's security is always reliable, but among all of its services, Stories are always reliable. In contrast, Security is Instagram's second-most constant feature after Private or Public accounts. The group that was formed was judged to be the least reliable of the two players. In both situations, security is a constant aspect that is crucial to the world of social networking sites.

Game theory model

The intercept payoff matrix for both players is provided below following the regression analysis. Due to the fact that these participants do not communicate their internal policies, it is a 7x7 game theory model on a non-cooperative basis [10]. The points of contact between these two athletes make up the shared characteristics.

Table- III: Formation of 7x7 Game theory model

		Player B (Instagram)						
Features		Chatting Interface	Live videos	Private or Public	Stories	Like and Comments	Group Created	Security
Player A (Facebook)	Chatting Interface	(5.52, 5.10)	(4.79, 4.91)	(5.29, 6.70)	(5.51, 5.75)	(6.26, 6.93)	(5.74, 4.31)	(5.41, 6.51)
	Live videos	(4.23, 4.61)	(3.97, 4.97)	(3.86, 6.22)	(5.25, 6.15)	(5.48, 6.66)	(5.12, 4.28)	(6.15, 7.67)
	Private or Public	(5.50, 4.59)	(4.84, 4.49)	(3.67, 4.90)	(6.14, 5.90)	(5.84, 5.96)	(5.73, 3.39)	(6.20, 6.79)
	Stories	(5.80, 4.91)	(5.87, 5.60)	(5.57, 6.53)	(5.42, 5.03)	(5.67, 5.81)	(5.95, 3.87)	(6.13, 6.83)
	Like and Comments	(5.09, 4.07)	(4.87, 4.38)	(5.66, 6.53)	(5.13, 4.60)	(4.31, 4.26)	(5.54, 2.91)	(6.16, 6.71)
	Group Created	(3.57, 4.61)	(2.57, 4.34)	(2.89, 5.96)	(2.89, 4.54)	(2.74, 4.97)	(2.63, 1.72)	(4.88, 7.19)
	Security	(6.23, 4.90)	(6.52, 5.82)	(5.50, 6.03)	(6.93, 6.42)	(7.26, 7.08)	(7.19, 5.36)	(4.83, 4.93)

Interpretation of Table -III: The intercepts' values are all positive. The majority of the values fall between 5 and 7, indicating strong cell value bonds. Values between 1 and 3 on the other hand, show weak cell value connection.

Solution of Game theory model

Matrix Game Solver offers the ability to solve games online a matrix game in which Player I selects a row and Player II chooses a column concurrently. entry in the matrix the mutually chosen row and column displays the standard behavior, winnings of the row selector and the column selector's loss chooser.

Case 1: Keeping player A as major (row chooser) and player B as minor (column chooser), the game can be solved as –

The matrix is
5.52 4.79 5.29 5.51 6.26 5.74 5.41
4.23 3.97 3.86 5.25 5.48 5.12 6.15
5.50 4.84 3.67 6.14 5.84 5.73 6.20
5.80 5.87 5.57 5.42 5.67 5.95 6.13
5.09 4.87 5.66 5.13 4.31 5.54 6.16
3.57 2.57 2.89 2.89 2.74 2.63 4.88
6.23 6.52 5.50 6.93 7.26 7.19 4.83

The solution is: The value is 5.59.

An optimal strategy for Player A (Facebook) is: (0, 0, 0, 0.02935, 0.55025, 0, 0.4204)

An optimal strategy for Player B (Instagram) is: (0.07944, 0, 0.90232, 0, 0.01824, 0, 0)

Case 2: Keeping player B as major (row chooser) and player A as minor (column chooser), the game can be solved as

The matrix is
5.10 4.61 4.59 4.91 4.07 4.61 4.90
4.91 4.97 4.49 5.60 4.38 4.34 5.82
6.70 6.22 4.90 6.53 6.53 5.99 6.05
5.75 6.15 5.90 5.03 4.60 4.54 6.42
6.93 6.66 5.96 5.81 4.26 4.97 7.08
4.31 4.28 3.39 3.87 2.91 1.72 5.36
6.51 7.67 6.79 6.83 6.71 7.19 4.93

The solution is: The value is 5.93.

An optimal strategy for Player B(Instagram) is: (0, 0, 0.32607, 0, 0.29481, 0, 0.37912)

An optimal strategy for Player A (Facebook) is: (0, 0, 0.23636, 0, 0.31427, 0, 0.44937)

Interpretation of Solutions of games: The value of the game in both cases lies between 5 to 6, which is good enough for both the players. In both cases optimum strategies are three for both players.

In scenario 1, where Facebook dominates, features like Instagram stories, likes, and comments, as well as security, offer the best possible solutions. The main contribution came through likes, comments, and shares. However, Instagram may best compete with Facebook thanks to features like the Chatting Interface, private and public accounts, likes, and comments. Both the private and public features contribute significantly in this case.

Features like Private or public accounts, Stories, and security offer the best solutions in Case 2, where Instagram outweighs Facebook. Finally, Facebook's best strategies in this case are the same characteristics. Security elements contribute significantly in both situations.

3. CONCLUSIONS

Thus, a useful and workable solution can be provided with the right flow and use of data analyzing tools. The key findings of this study include

1) According to the Cronbach's alpha test, the model's dependability for each of the seven features has been excellent.

2) The data and information using graphical tools and descriptive statistics are adequate and place all seven features under consideration above the average values.

3) The group that was created was proven to be the least reliable of the two players. Comparing their other features, Instagram's private and public account features were more consistent than Facebook's security feature. The use of these features on the relevant platforms might therefore give end users additional privacy.

4) Positive intercepts from regression analysis performed for both players are utilized as payoff values to create a 7x7 non-cooperative game.

5) The game's value is above average in both situations, creating a win-win scenario that is suitable for both competitors. This demonstrates that the shared characteristics of these two social networking sites are satisfying to the end users.

6) Despite Facebook's dominance, it can be shown that Instagram's features are the most popular among all the techniques. However, Instagram's dominance over Facebook reflects the same traits as their most effective techniques.

Even in complex situations, the game theory model is a useful tool for decision-making. Given the generality of the game theory model, we can use another social networking site, such as Twitter [18], LinkedIn, etc., in place of Instagram. The basis of interaction between them can be found in the shared characteristics of each competitor.

REFERENCES

[1] Whiting and D. Williams, "Why people use social media: a uses and gratifications approach", Qualitative Market Research, vol. 16, no. 4, August 2013, pp. 362-369.

[2] Eric W.T. Ngai, Spencer S.C. Tao, Karen K.L. Moon, "Social media research: Theories, constructs, and conceptual frameworks", International Journal of Information Management, vol. 35, issue 1, February 2015, pp. 33-44.

[3] N. Kwatra (2018, August 27),"Why Instagram has become the next Facebook". Available: https://www.livemint.com/Companies/MAEImnLVCnNqCntNtk31AJ/Why-Instagram-has-become-the-next-Facebook.html

[4] J. Pokrop, (2019, June 5), "Facebook and Instagram users in India". Available: https://napoleoncat.com/blog/facebook-and-instagram-users-in-india/

[5] M. Haigh, P. Brubaker and E. Whiteside, "Facebook: examining the information presented and its impact on stakeholders", Corporate