

A STUDY ON THE CENTRALITY MEASURES TO DETERMINE SOCIAL MEDIA INFLUENCERS OF FOOD-BEVERAGE PRODUCTS ON TWITTER

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ABSTRACT

This research aims to study and identify the Social Media Influencers (SMIs) in the Twitter community in Pizza Hut Industry. In social network analysis (SNA), Eigenvector Centrality (EC) will give the most influential node in a network. A node with the highest eigenvector value among the other nodes is the most influential/important node in a network. Data was collected from Twitter using the Twitter API with the hashtag #pizzahut. It applied the eigenvector centrality to observe the effect of the centrality value for Twitter data. The result shows that there is a significant difference between the three most influential users. This result will be used for future research that will be focused on small and medium enterprise (SME) Twitter data. This research is held a comparison analysis between the four centrality measurements approach: Degree Centrality, Betweenness Centrality, Closeness Centrality, and Eigenvector Centrality. for determining the most influential user with the social network Twitter as its case study.

Keywords: Social Media Influencer, Social Network Theory, Centrality Measures, Food and Beverage (F&B)

1.0 INTRODUCTION

In 2021, the total population of the world is 7.9 billion. The number of Internet users is 4.66 billion and approximately 3.96 billion or 85% of them are active social media users (Dean, 2021). They are actively participating in many online activities on different social media platforms such as Facebook, Twitter, and Instagram.

In these recent years, many people have been influenced by stars, celebrities, and influencers on social media platforms in promoting their online products. Many celebrities who have many followers would start to promote certain products, especially F&B to all their audiences, fans and followers. The influenced audiences, fans and followers have to share and show with their close friends and family members to gain more popularity among other audiences. Celebrities have played a significant role in corporate brands as they manage to promote the brand products and also attracted many people who are interested in purchasing the products. Therefore, the group of celebrities can be called social media influencers (SMI).

A previous study has reported that food products are top interest for Gen Z and millennials (Hanifawati, Dewanti, & Saputri, 2019). Many of Gen Z prefer to spend their money to buy F&B (Cheung, Davis, & Heukaeufer, 2017). Pricing strategy and providing variety are effective approaches for F&B. Gen Z has higher engagement with brands on social media compared to millennials. Either Gen Z or millennials are generally used multichannel to engage with the brands (Hanifawati *et al.*, 2019).

In social network analysis (SNA), a node value influential a network called centrality. Centrality is defined as a value that

represents how many connections are from nodes to other nodes (Wasserman & Faust, 1994). There are many methods to define centrality to identify the effect of each node in a social network such as Degree Centrality (DC), Betweenness Centrality (BC), Closeness Centrality (CC), and Eigenvector Centrality (EC). Among these, the eigenvector centrality will give the most influential node in a network. A node with the highest eigenvector value among the other nodes is the most influential/important node in a network.

Social media platforms have become an essential medium of communication among individuals, and they also play a vital role in brand promotion and marketing (Arora, Bansal, Kandpal, Aswani, & Dwivedi, 2019). In the past two decades, social media content has been used by various brands to stay competitive by promoting products and offering offers to maintain market position and reputation among stakeholders (Croft & Brennan, 2006). One of the key drivers of this change (B. F. Liu *et al.*, 2012) is social media influencers (SMIs), whom (Freberg, Graham, McGaughey, & Freberg, 2011) identify as 'a new type of independent third party endorser who shape audience attitudes through blogs, tweets, and the use of other social media' (p. 90). These "social media creators" (B. F. Liu, Jin, Briones, & Kuch, 2012) engage themselves in content creation of particular issues.

SMIs play an important role in social media platforms. They are considered influential as their opinions have an effect on their followers, media coverage, and organizations. They affect their followers by providing issue-relevant opinion leadership that meets followers' information and emotional needs on particular issues (B. F. Liu *et al.*, 2012). In turn, their followers then influence non-followers through "word of mouth communication" (B. F. Liu *et al.*, 2012).

SIMs exhibit credibility and persistence in persuading their audience to notice and support their topics of interest (Goodman, Booth, & Matic, 2011). They also affect media coverage by shaping the media agenda. Journalists can tap on alternative information and newsworthy content generated by SIMs, which can be repackaged and disseminated to news audiences to create issue awareness in public. Furthermore, the ability of SIMs to leverage influence could significantly impact a brand's reputation. It also becomes critically essential for brands to identify the right influencers on the Web through social media to promote their products and services (Huang, Zhang, Li, & Lv, 2013). Brands can directly leverage this to improve and enhance public relations by promoting their offerings for higher engagements (De Vries, Gensler, & Leeftang, 2012).

The power of SIMs lies in their ability to affect media coverage, improve key publics' issue awareness, and persuade their followers to assume a course of action (Freberg *et al.*, 2011). A strong relationship with SIMs can help organizations maximize positive media coverage and ultimately create a stronger public presence.

The recent rise in popularity of social network platforms have prompted modern F&B companies to switch their marketing objectives from the traditional top-down strategies to a peer-to-peer approach. Many of these companies have started to utilize SIM to promote products online. The current study investigated the promotion of F&B products on Instagram tagged with #ad (Reagan, Filice, Santarossa, & Woodruff, 2020). According to previous researches, SIM is significantly important tools in promoting F&B on social media platforms.

The presentation of this paper is divided into four sections – The first section discusses the need for Social Media Influencer in different social media platforms. The second section provides research objective, motivation and contribution. Literature in the same direction is discussed in Section 3, followed by network centrality measures and Social Network Theory (SNT). The research methodology for the study is discussed in Section 4 with consists of two subsections: Twitter, Twitter API, and centralities such as Degree Centrality, Betweenness Centrality, Closeness Centrality, and Eigenvector Centrality. Centrality results and results discussions are detailed in Section 5 and 6 accordingly followed by a concluding remark in Section 7.

2.0 RESEARCH OBJECTIVE, MOTIVATION AND CONTRIBUTION

The elementary functionalities of social media platforms differ from each other. The major social media platforms are Facebook as a relationship network, Instagram as a media sharing network, and Twitter as a social publishing network. Influencers end up posting multiple contents across these platforms while availing these services. Normally, influencers post content on multiple social media platforms based on their popularity. Every influencer has a variable influence on varying social media platforms. Influencers on different social media platforms are measured with a set of weighted attributes by that specific application (Arora *et al.*, 2019).

This paper is intended to find out which entities have the most influence in the dissemination of information on pizza in tweets using the hashtag #pizzahut based on the calculation of

Degree centrality, Betweenness centrality, Closeness centrality, and Eigenvector centrality on Twitter.

The research question in this research study is “How would centrality measures determine social media influencers in Twitter?”

The purpose of this study is to investigate whether an influencer has distinctive exposure across social network platforms to contribute to different influence measures on a different social network platform. Based on previous research, information spreading speed among the social media is affected by the users' activity connection which can be represented in centrality values. This research applied degree and eigenvector centrality to observe the effect of centrality value for Twitter data. The results show that there is a significant difference among the three most influential users on Twitter.

3.0 LITERATURE REVIEW

The following sections discuss the importance of Social Network Theory (SNT) and network centrality measures and Two-step flow of Communication.

3.1 Network Centrality Measures

Calculating centrality has been a major focus of social network analysis research for some time (Freeman, 1978). Many references discuss social networks on centrality concepts and calculations (Alain & Michel, 1999; Scott, 2000; Wasserman & Faust, 1994). At least eight centrality measures have been proposed such as degree, betweenness, closeness, eigenvector, power, information, flow, and reach. The most frequently used centrality measures are degree, closeness, betweenness, and eigenvector. The first three were proposed by (Freeman, 1978) and eigenvector was proposed by (Bonacich, 1972). Centrality is important because it indicates who occupies critical positions in the network.

3.2 Social Network Theory (SNT)

Online consumer behaviours and profiles on the social network have begun as a huge source of data and marketers have begun to mine these data to understand consumer behaviours and relationships due to its importance for e-marketing (Dolnicar, 2003).

Understanding the relationships of online consumers helps businesses understand and target their current users well, reach out to potential customers, and to improve communication with them at the right time and place to increase their sales volumes. The consumer relationship also helps to gain a competitive advantage in the international e-marketing field, to control the flow of information in consumer networks, and to make innovations to differentiate themselves from the competitors (Bayer & Servan-Schreiber, 2011).

From the perspective of social network theory (SNT), centrality measures are the most frequently used to find key influential consumers in the network (Valente, Coronges, Lakon, & Costenbader, 2008). The theory has proposed three types of network centrality measures to identify the advantageous position that opinion leaders usually occupy: degree, betweenness, and closeness (Freeman, 1978).

- An online consumer with a high degree of centrality means he or she is highly connected with other online consumers

in the network. Therefore, he receives more information, knowledge, and resources. There are two types of degree centrality: in-degree centrality and out-degree centrality.

- In-degree centrality of a consumer indicates the popularity of the consumer and his or her accessibility to information.
- Out-degree centrality shows the control of a consumer over the network and the dependence of the network upon him or her.
- An online consumer who has high centrality of closeness shows that he or she can reach all online consumers on the network faster than anyone else.
 - A consumer with high in-closeness centrality may listen to most consumers through indirect or direct connections in the network.
 - A consumer having high out-closeness centrality sends messages to most consumers in the network through indirect or direct connections.
- An online consumer having high betweenness centrality indicates that he bridges the subgroups in the network and plays the role of gatekeeper.
- An online consumer having high eigenvector centrality connects to many other consumers that are also well connected.

3.3 Two-Step Flow of Communication

The two-step flow of communication hypothesis was first proposed by Lazarsfeld, Berelson, and Gaudet in the book *The People's Choice* (1944). In their study of voting decisions, they found that personal influence, which was largely derived from people's social contacts and friendship networks, significantly affected voting decisions. The effect was pronounced among people who were less committed to their existing beliefs or who changed their minds during the campaign. The hypothesis is called two-step because the social media platforms initially influence opinion leaders, individuals who are perceived as influential, who in turn influence their social contacts (W. Liu, Sidhu, Beacom, & Valente, 2017). Therefore, central to the two-step flow of the communication process is the concept of opinion leaders, a group of individuals influential in specific domains. Numerous studies have attempted to identify the key characteristics associated with being influential along with three terms (Katz, 1957): who one is, the individual characteristics of opinion leaders, such as personality traits; what one knows, the characteristics of individuals' competence, such as their knowledge or ability to provide information on particular issues; and who knows, the characteristics related to an individual's structural position in a network. In other words, individuals may become opinion leaders not only because they possess certain attributes but also because they occupy the right network positions that enable them to effectively spread information and exert personal influence. Centrality measures such as degree, betweenness, and closeness have been particularly useful for identifying leaders based on their network position (W. Liu *et al.*, 2017).

3.4 Twitter

Twitter is a social network that is widely used by social media users. It plays an important role in the dissemination of information to understand the popularity of a particular brand

product. The dissemination of information through Twitter social networks can be done quickly and can be spread in a very short time through the posts of Twitter users themselves. The information provided by these users will be visible to other users and may be reposted by that user via retweet. Many researchers use Twitter in their research related to social network analysis (Priyanta & Nyoman Prayana Trisna, 2019).

3.5 Social Media Influencer Marketing for F&B Products

Social media influencer marketing for F&B products has become a widespread and successful marketing tactic (Byrne, Kearney, & MacEvilly, 2017) that have got a lot of attention in recent years. Previous study investigated the types of F&B products that influencers promote on YouTube (Coates, Hardman, Halford, Christiansen, & Boyland, 2019) and Instagram (Qutteina, Hallez, Mennes, De Backer, & Smits, 2019) and how influencer endorsement affects brand attitudes and purchase intention (Evans, Phua, Lim, & Jun, 2017). Research has also investigated advertising methods employed by brands on Instagram (Klassen *et al.*, 2018) and how different advertising methods influence audience engagement with advertisements (Adegbola, Gearhart, & Skarda-Mitchell, 2018).

Despite with the rapid development of influencer marketing and a widely distribution of social media, few research has studied influencer marketing in the market, so little is known about how to determine SMI on Twitter community. Thus, there is a gap in the literature on identifying SMI on Twitter in terms of F&B products.

4.0 RESEARCH METHODOLOGY

In this paper, the data used are tweets from Twitter using the hashtag #pizzahut, the data obtained is represented in a graph and processed and analysed by Centrality Measurement using Gephi, which can determine which entities will influence the most dissemination of information provided.

In this research, data is obtained with the help of Twitter API and the data retrieved is in the period from December 1, 2020, to December 10, 2020. When creating the hashtag network, it contains 23 users and 22 relationships between users.

4.1 Twitter and Twitter API

Twitter is a free social networking tool that is widely used and allows people to share information and newsfeeds with people who have the same views and thoughts in real time. Twitter API (application programming interface) is a program or application provided by Twitter to make it easier for other developers to access the information on the Twitter network. Many theories are supporting the calculation of centrality measures used for the search of the most influential entities in the graph of the dissemination of #pizzahut information on the social network Twitter that can be found in (Freeman, 1978).

4.2 Centrality

The idea of centrality as applied to human communication was introduced by Bavelas (Bavelas, 1948). This study will be used the calculation of four kinds of centrality, such as degree centrality, closeness centrality, betweenness centrality, and eigenvector centrality.

4.2.1 Degree Centrality

Degree centrality is used to search for the entities that have the most influence on the dissemination of information on Twitter by looking at the number of direct relationships an account has with another account. The higher the degree centrality value, meaning the more relationship an account has with another.

4.2.2 Closeness Centrality

Closeness centrality is used to search for the most influential entities by looking at how close an account is to another based on the shortest distance obtained.

4.2.3 Betweenness Centrality

Betweenness centrality is used to search for the most influential entities in the dissemination of information based on the extent to which they are required as a link in the dissemination of information on Twitter social networks.

4.2.4 Eigenvector Centrality

Eigenvector centrality is used to search for the most influential entities by identifying the influence of those entities across the network, not just their influence on directly connected nodes.

4.3 Research Framework

The research framework of this study was developed to integrate the SNT and Two-step flow of communication by showing that by showing that the audiences search for what they need. They are likely to search for information from opinion leaders such as F&B Social Media Influencers before making informed purchase decisions. Two steps of communication occur as described below:

Step 1 of Communication: Brand communicates to opinion leaders

The particular F&B brand chooses SMI as opinion leaders to forward the branded messages to the target audiences because the brand wants to be part of their social networks rather than pushing advertising to them.

Step 2 of Communication: Opinion leaders communicate to consumers

As opinion leaders, SMI create the product review content to express their personal identity as F&B expert and then publish their product reviews through Twitter as a communication channel to reach their target audiences.

5.0 RESULTS

The tweet data posted on in the period from December 1, 2020, to December 10, 2020 was collected for this study. From the data, it is determined whether the tweet is the result of a retweet or not. If the tweet was a result of a retweet, then we can find who is the original writer of the tweet. These data can be represented in a simple graph where the nodes represent the Twitter account. If an account retweets from another account, then the two entities will be linked by a side called edge. There are 23 nodes with 22 edges. #pizzahut is being selected because Pizza Hut is a very well-know F&B brand with 1.6 million followers.

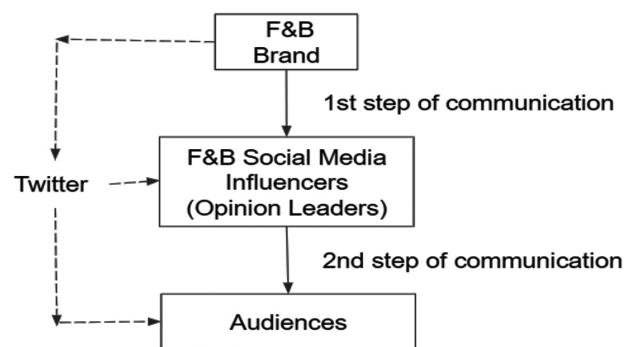


Figure 1: Research Framework

Using Twitter data with hashtag #pizzahut and the help of the Twitter API, a graph is shown in Figure 1.

The basic data roles for network analysis object are Source and Target. In Figure 2, nodes with green represent Target meanwhile nodes with purple represent Source. The Source specifies a data item that contains all of the node values for the plot. The Target specifies a data item that creates the links between nodes.

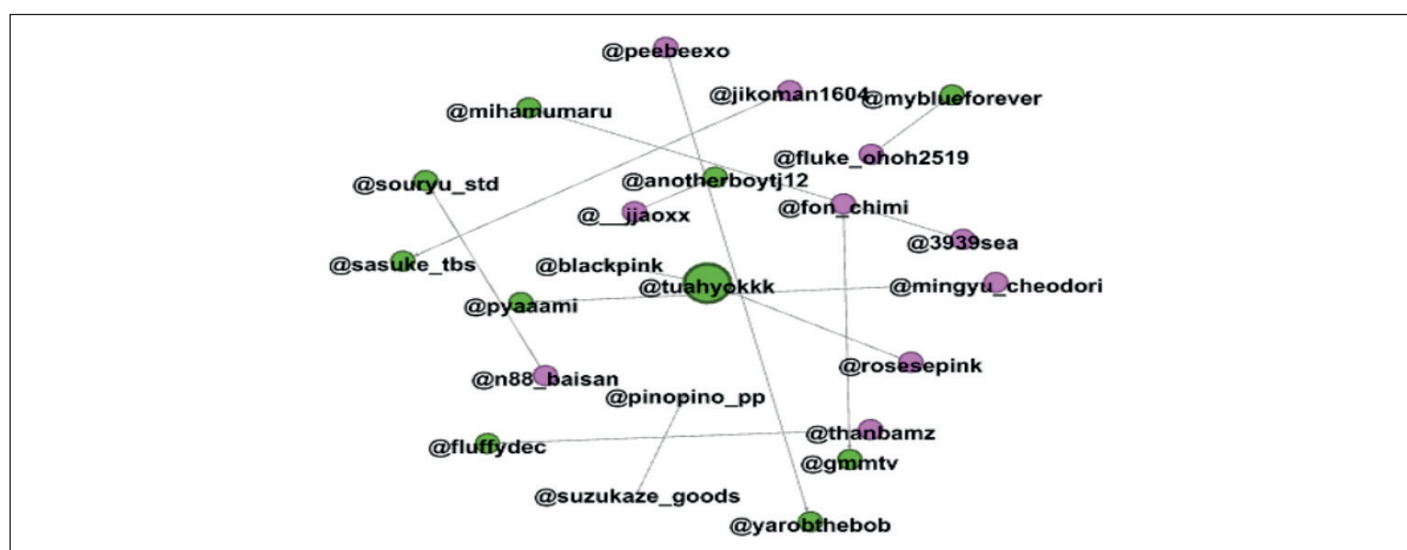


Figure 2: Representation of the tweet data graph with hashtag #pizzahut

5.1 Centrality Measures from Tweet Data with Hashtag #pizzahut

From the data obtained, a tweet data graph is generated. The centrality measure value is calculated for each account from the graph with the purpose of finding the most influential

entities. In Table 1, there are four basic centrality measures: Degree Centrality (DC), Closeness Centrality (CC), Betweenness Centrality (BC), and Eigenvector Centrality (EC). The top three entities with the highest value for each centrality are as follow:

Table 1: Top three ranked Id based on centrality measures

Rank.	Id	EC	Id	BC	Id	CC	Id	DC
1	@blackpink	1	@tuaHyokkk	1.0	@tuaHyokkk	1.0	@tuaHyokkk	3
2	@tuaHyokkk	0.099886	@blackpink	0.0	@fon_chimi	1.0	@fluffydec	2
3	@fluffydec	0.099886	@fluffydec	0.0	@3939sea	1.0	@fon_chimi	2

In Table 1, it shows the centrality calculation for each Id, @blackpink account always gets the highest eigenvector centrality (EC) value which maximum value is 1, which means that this account is the account that has the most connection

with other entities. Besides, it has the closest relationship with other entities, becomes the contact of an account with another account, and has the most interaction with other important entities in the graph.

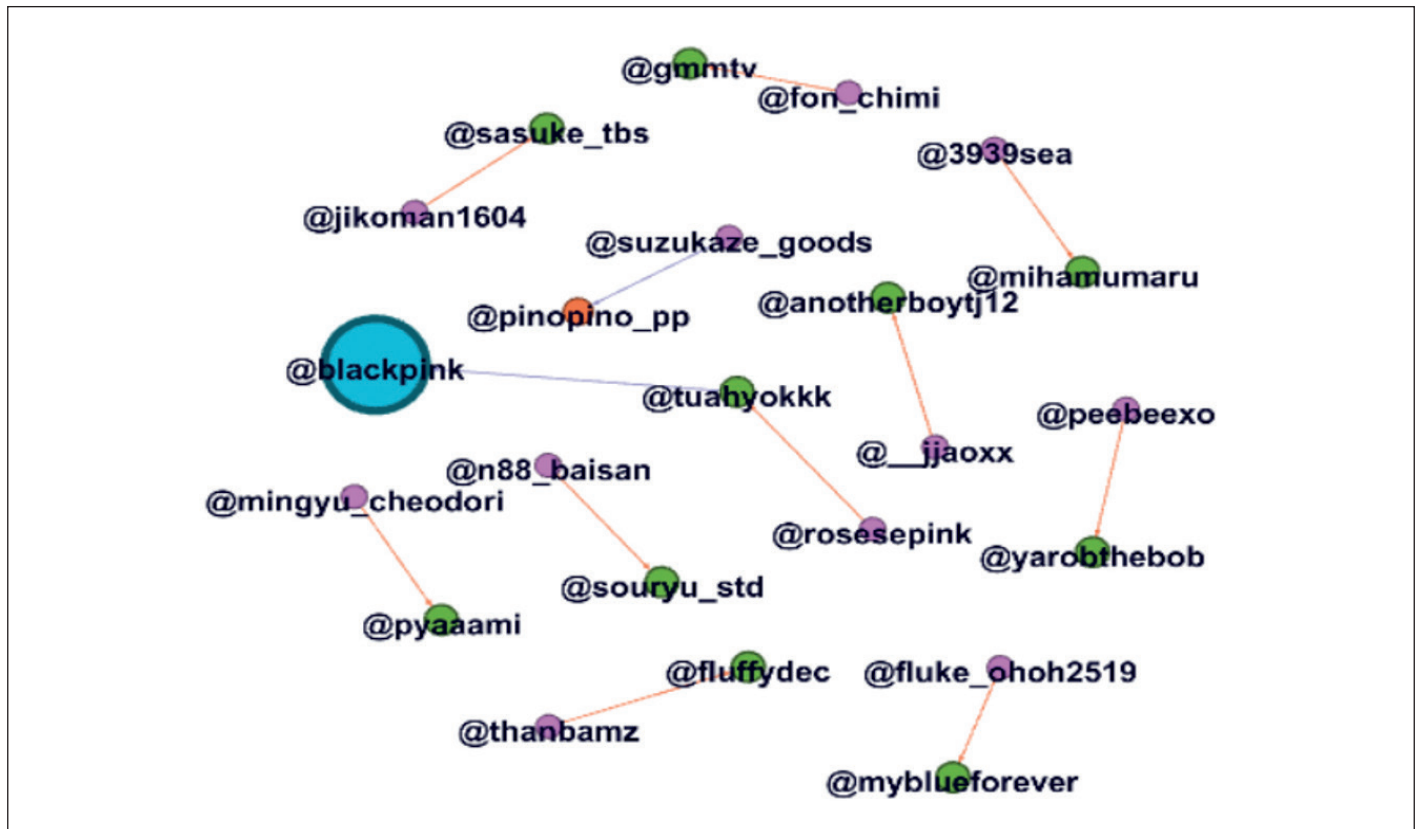


Figure 3: Graph representing the value of eigenvector centrality

From the graph in Figure 3, the node of @blackpink has a bigger size than the other nodes. This means the @blackpink account has higher centrality measures and also is a more influential account based on the degree centrality measures, closeness centrality measures, betweenness centrality measures, and eigenvector centrality measures. Besides, blue node represents @blackpink account obtained

maximum value which is 1 and it has highest EC value among other nodes. It has bigger circle size comparing with other nodes because it has the highest EC value. Orange node represents @pinopino_pp account with EC value 0.049943, purple nodes with 0 value for EC and green nodes with EC value 0.099886. Every edge is carrying same weight with 1.0 value.

6.0 DISCUSSION

The objective of this study is to perform centrality measure analysis on the #pizzahut user network described in earlier section. Figure 3 shows a Gephi graph contains 23 nodes with different EC value. Initially the user network data is loaded into the Gephi tool. Then on, the calculation of centrality measures is carried out. Further using the functions of Gephi tool the centrality measurements are calculated to rank the accounts in the last step of the process.

Visualization of #pizzahut user network based on EC measure by Gephi tool is shown in Figure 3. In this figure, @blackpink with a bigger size of the node than the other nodes in the network. This bigger size of the node is the result of higher EC value as compared to all other accounts in the network.

Table 1 shows the top three accounts ranked on Degree, Closeness, Betweenness and Eigenvector centrality measures. Eigenvector centrality is a measure of the importance of a node in a network. Here, an account is considered important if he/she is connected to other important accounts. In the analysis, an account with a small number of influential contacts may outrank with a large number of mediocre contacts.

7.0 CONCLUSION

In this paper centrality measure analysis carried out on #pizzahut user network was deliberated. Analysis results assisted in identifying invisible patterns in the user network, for example, relationship between accounts shown by visualization and top-ranking accounts.

Analysing user account information on a larger database of F&B network will assist in identifying groups of people who interact closely together. Focusing future research work on categorization and ranking of accounts based on their preference will assist other people to identify main influencers of their interested preferences. This will aid in strengthening and improving interaction with marketers.

Centrality's calculation in the study was used to study for an account that was most influential in the dissemination of information from tweets that used #pizzahut hashtags on Twitter user social networks based on four centrality measurements: degree centrality, closeness centrality, betweenness centrality, and eigenvector centrality.

In this research, we only implemented and analysed centrality measurements, but not analysing the effect of interaction follow, mention and reply. This research still has limitations in measuring the performance of the most influential user rank. Future research will be conducted on an experiment to improve customer engagement by implementing SNA for Twitter SMIs. ■

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PROFILES



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PROFESSOR LIM has about 10 years of industry experiences in the design, development, implementation and maintenance of commercial software from 1989 to 1999 after departing from TARC where he spent his early days with TARC as an IT lecturer from 1987 to 1989 after returning from Mississippi State University USA with a Master of Computer Science degree. He is currently the Director for CBIEV at TAR UC, Professor at FOCS at TAR UC and Head for Big Data Analytics Centre. His research interest involving Natural Language Processing, Sentiment Analysis and Code-Mixed language analysis. In the last 15 years, his work has consistently focused on organizational knowledge sharing and technology acceptance, social media analytics and social influence maximization in Sunway University and Tunku Abdul Rahman University College (TAR UC). Professor Lim has graduated more than 20 master and 2 PhD students while he was with Monash, UTAR and Sunway University.
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