-RESEARCH PAPER-

ESTIMATION WITH ARTIFICIAL NEURAL NETWORK ON ELECTRONIC WORD OF MOUTH: OPINION SEARCHING

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Abstract

Consumers make electronic word-of-mouth (e-WOM) on social media, which they trust as a source of information, by talking about products and services. In social media, e-WOM is used in three different ways: "opinion searching" (being the most common), "opinion giving", and "opinion forwarding". In this study, it is aimed to estimate the factors motivating "opinion searching" by artificial neural networks. Data was consisted of 512 questionnaires. Motivational factors were analysis by artificial neural network and Bayesian Regulation method. Results showed that the performance values were acceptable with 90% success rate. Identifying factors that motivate consumers for opinion searching can make a significant contribution to the achievement of marketing objectives of corporations. For this reason, e-WOM has been discussed in the recent literature with various motivational factors and analysis methods. This study differs from other research by combining motivational factors and detailing e-WOM behavior as well as using artificial neural networks.

Keywords: *Electronic Word-of-Mouth, Motivation Factors, Social Networks, Artificial Neural Networks, Bayesian Regulation*

Jel Codes: *M30, M31*

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ELEKTRONİK AĞIZDAN AĞIZA İLETİŞİMDE YAPAY SİNİR AĞLARI İLE TAHMİNLEME: GÖRÜŞ ARAMA

Öz

Tüketiciler bir bilgi kaynağı olarak güvendikleri sosyal medya üzerinde ürün ve hizmetler hakkında konuşarak elektronik ağızdan ağıza iletişim (E-AAİ) gerçekleştirmektedirler. Tüketiciler sosyal medyada e-AAİ'yi "görüş arama", "görüş iletme" ve "görüş belirtme" olarak üç farklı şekilde yapmaktadırlar. En yaygın davranış görüş aramadır. Çalışmada görüş aramayı motive eden faktörlerin yapay sinir ağları yöntemiyle tahminlemesi amaçlanmıştır. Veriler kabul edilen 512 anketten oluşmaktadır. Motivasyon faktörlerinin yapay sinir ağları ve Bayesian Regülasyon geri yayma ile analizi yapılmıştır. Analizler neticesinde performans değerlerinin kabul

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edilebilir değerde ve başarı oranının %90 olduğu görülmüştür. Tüketicileri görüş aramaya motive eden faktörlerin belirlenmesi işletmelerin pazarlama amaçlarına ulaşılmasına önemli katkı sağlayabilir. Bu nedenle E-AAİ, literatürde çeşitli motivasyon faktörleri ve analiz yöntemleriyle ele alınmıştır. Bu çalışma motivasyon faktörlerini bir araya getirmesi, e-AAİ davranışını detaylandırması ve yapay sinir ağlarını kullanması ile diğerlerinden farklılaşmaktadır.

Anahtar Kelimeler: *Elektronik Ağızdan Ağıza İletişim, Motivasyon Faktörleri, Sosyal Ağlar, Yapay Sinir Ağları, Bayesian Regülasyon*

Jel Kodları: *M30, M31*

1. INTRODUCTION

It's possible for consumers to exchange ideas on products and services via the internet or face to face. The face-to-face type of communication is called word-of-mouth (WOM), and the online type is called electronic word-of-mouth (e-WOM). The main purpose of both these communication types is to acknowledge and get some ideas about other consumers' experiences and ideas which are precious for consumers. The search for information, which especially rises during the process of purchase, after the occurrence of the need, is actualized via social media. It is an advantage for the consumers that the internet and social media access disseminates in a short time. Therefore, consumers can access information about the products or the services rapidly and without any difficulty.

After the global spread of the Internet, the changes in the use of the web and technology have fostered social media. Social media is one of the important communication tools of today's consumers. The structure of social media, which consists of a lot of sites developed according to the needs of consumers, enables communication through many channels. For example, consumers can search for information about services they think to purchase on social networks with close friends and their community, they can forward product messages shared by the people followed on the microblogging site, and they can post their opinions on the forums. Transmitting the right message at the right time to the people who are seeking information can be effective in purchasing decision. Social media is seen as an important medium that firms disseminate their messages.

As known by the consumers, social media's most popular site is Facebook (Kemp, 2016). It is possible for the consumers to frequently talk about products or services on Facebook with the people they are familiar to. In addition, brand communities, brand pages and advertisements provide the appropriate environment for talking about products or services on this site. Firms have the opportunities to transmit their messages to a lot of people and receive feedback in a short period of time, with less-cost compared to traditional media (TV, radio, newspaper etc.). At the same time, e-WOM in social media can be used for many important purposes such as awareness, attitude, purchase and post-purchase behaviors (Mangold and Faulds, 2009). To use the e-WOM in social media effectively, it is necessary to know the motivation behind this behavior.

Research for WOM motivational factors started in the 1960s (Dichter, 1966) and formed

a base for e-WOM. One of the most known studies on motivational factor in e-WOM was made by Hennig-Thruau et al. (2004) and other researchers developed it over time. At the same time, the e-WOM behavior can be examined as a whole, and it can be examined in three sections: opinion searching, forwarding, and giving (Chu and Kim, 2011). In this study, "opinion searching" behavior is discussed to overcome, which is frequently used to eliminate the lack of information about products and services since first use of the web.

Besides various analysis method in the field of business research, artificial neural networks have been used in last years. ANN, which first appeared in the 1940s, was examined in many problematic areas of the businesses since the late 1980s. In addition to accounting, finance, human resources and information systems, marketing is seen as an area where neural networks are used. In addition to accounting, finance, human resources, and information systems, analyzes are also conducted with ANN in the marketing, too. In the beginning, it was seen that in consumer and market segmentation (Dasgupta, Dispensa and Ghose, 1994; Fish, Barnes and Aiken, 1995), order estimation (Moon and Janowski, 1993), and marketing messages (Zahavi and Levin, 1995) are used. Transmitting messages to consumers is still a problem.

In this study, it is aimed to estimate "opinion searching" by social media e-WOM motivation factors data and artificial neural networks. Opinion searching behavior, which has an important role in the process of purchase and the most common behavior by the consumers on web, is discussed. The study is conducted on Facebook which is the most commonly used social media site in the world and in Turkey. In this context, e-WOM motivational factor data is collected by a survey, "opinion searching" behavior was estimated by Bayesian Regulation backpropagation method.

1.1. Social Media and Social Networks

Social media, which is an important communication tool for today's consumers, has emerged with the development of internet and web technologies. The internet has become widespread globally at a short time in comparison to other means of communication. The Internet has provided the infrastructure that is suitable for social media due to its ability to provide immediate and direct access to information, and it enabled mutual interaction, and offered efficiency in information transfer, personalizing and integrating with other communication tools (Bauer, Mark and Mark, 2002, p. 44). In addition, the development of web technology has led to the formation of social media.

According to the developing period, the Web is called 1.0, 20 (Fuchs *et al.*, 2010). Content production has increased in Web 2.0 after the Web 1.0 period, where users are often readers. Web 2.0 increased the content production of consumers and made it possible for opinion searchers to access information based on a large number of direct experiences. At the same time, Web 2.0 has created a software basis for social media.

Social media can be defined as "a group of Internet-based applications that build on the ideological and technological foundations of Web 2.0, and that allow the creation and exchange of user generated content" (Kaplan and Haenlein, 2010). The rapidly growing social media has been used by 2.8 billion people, 73% of which are Internet users. In this respect, it can be said that social media has opened a unique place for itself in the communication (Torlak and Ay, 2012, p. 83). The structure of social media, which can

meet the needs of many users, has been effective in increasing the number of users.

The tools in social media can be investigated by separate sub-titles in terms of terminology, usage and purpose differences such as microblogs (Twitter etc.), social networking (Facebook etc.), media sharing (YouTube etc.) review sites (TripAdvisor etc.), and forums. Consumers can use one or more tools according to their needs. For example, consumers can access to the experiences of other consumers in the forums about the products they will buy, look at the posts of the cinema critic whom they follow in microblogs, plan their travels according to comments in the review sites, and get the opinions of the friends on social networking sites about the services. Social media tools can be used in all steps of purchasing decision making, in other words, in the process of realizing the need, evaluating information and alternatives, deciding what, where, when to buy and sharing experiences (Yadav *et al.*, 2013). However, the largest number of active users in social media tools are on social networking sites.

The main features of the social network are that people can create a profile and link list and that they can be viewed by others(Ellison and Boyd, 2007). While there are social networking sites (Business = LinkedIn, Ethnic = Asian Avenue vb.) that appeal to many segments, Facebook, which is open to everyone's use, is the biggest one. Facebook, has 42 million users in Turkey and 2.2 billion users worldwide, it holds about 50% of all social media market(Kallas, 2013; Park, 2018). In Turkey, 40% of Facebook users are female and 60% male. In addition, 88% of Facebook users are between the ages of 13-39 (Kemp, 2016).

Today, Facebook has gone beyond being the place where consumers just socialize with other people. According to the research of the Social Insites Consulting, 55% of consumers follow the brands through social networking sites. Consumers follow an average of 10.6 brands in social networks, 7 of them actively follow and 5 of them are interact (Belleghem, Thijs, & Ruyck, 2012). At the same time, it is known that 74% of consumers, as the result of interaction with the company through social media, have a more positive impression. And purchases increase 51% by consumers who clicked "Like" button for a product or service (Funk, 2010). Consumers show great interest in social media and rely on around 70% of other consumers' views (Nielsen, 2013). It is seen that social media which has an important function in the communication of consumers with brands, have various opportunities. In this context, it is considered that behavior estimation based on the motivational factors of the consumers will be useful for benefit both academia and business.

1.2. Word of Mouth and Motivation Factors:

WOM is as old as communication in the early days of humanity about a product obtained by the barter method whether it is good or not. It is defined as "informal communications between private parties concerning evaluations of goods and services" (Anderson, 1998). In other words, it is communication about the things that are subject to marketing without any commercial concern among the consumers. It is known that this mode of communication has more impact on consumers compared to other communication channels (Douglas R. and Terry G., 2004; Kalpaklioglu and Toros, 2011, p. 4114) Because of the WOM's strong effect on consumers, it's motivators have been the subject

of research since the 1960s.

In his study, Dichter (1966) examined those psychological sources of WOM, and the reasons of consumers for talking and listening about their experiences. In this context, the factors that motivate the consumer are determined as product-involvement, self-involvement, message-involvement, and other-involvement. Product-involvement is caused by the strong emotion and tension that the product or service creates in the consumer. Self-involvement derives from the fact that products are purchased for spiritual needs as well as material needs. Consumers make speeches for attracting attention and showing the information they have. Message-involvement is the result of the fact that the consumers are engaged in promotional messages instead of using products or services. Others-involvement is originated that consumers want other people to choose the right product. Dichter (1966) has established a basis for future studies with these four motivational factors.

In the following period, Engel, Blackwell, and Miniard (1993), in addition to the motivation factors used by Dichter (1966: 148), added "Dissonance Reduction" factor under negative WOM. This motivation was explained as a reduction of consumers' cognitive suspicion by talking after the purchase.

In addition to the work of Ditcher(1966), Sundaram, Mitra, Webster (1998) added five factors (four negatives, one positive) in the study and removed "message involvement" factor. Motivational factors for negative WOM determined as altruism (negative), anxiety reduction, vengeance, and seek advice. Altruism (negative) is a negative approach to the motivation of dealing with other consumers. Altruism (negative) is a negative approach to others-involvement motivation. In this motivation, consumers want to prevent bad experiences from being experienced by others. "Reducing anxiety" is defined as the results of product and service problems. "Vengeance" is defined as taking action against the business, and "seek advice" is defined as receiving information to overcome problem. Added to the positive factors, "help the company" is explained as the desire to help the company for reasons such as social benefits, quality products.

Ditcher (1966), Engel, Blackwell, and Miniard (1993), and Sundaram, Mitra, Webster (1998) conducted research about WOM and their studies are known in the field and considered to constitute the basis for e-WOM studies.

1.3. Electronic Word of Mouth Motivation Factors:

E-WOM is the informal communication among the consumers provided by internet-based technologies such as the features of products or services, the usage, and the vendors of them. Different from mass media, this communication can be between consumers also it can be between consumers and producers. Essentially E-WOM is an electronic version of WOM, however it has many differences arising from technological facilities.

While WOM is conducted with a limited number of people face to face orally (synchronous), E-WOM is usually carried out with a greater number of people by creating posts on the sites (asynchronous). The information in the WOM is limited to the duration of the chat and the listener's memory, and the information is always stored in the e-WOM where consumers can read the information whenever they want or is available(Hoffman

and Novak, 1996). With the development of web technologies, there has been a change in the e-WOM behavior of consumers.

Consumers' E-WOM behaviors have been diversified with Web 2.0. According to Web 1.0, consumers can generate more content or transmit content to other users easily during this period. In this context, it is possible that the E-WOM in today's social media can be examined separately as "opinion searching", "opinion giving", and "opinion sharing". However, the most common form of behavior is still "opinion searching". E-WOM can be investigated as three separate behaviors and have different aspects according to WOM. However, WOM and E-WOM motivations are based on the same principle.

Research by Hennig-Thruau et al.(2004) is one of the leading studies on E-WOM motivations. Their study has revealed factors that motivate E-WOM in web-based consumer ideas platforms, based on virtual communities and traditional WOM literature. Dichter (1966), Engel, Blackwell and Miniard (1993) and Sundaram, Mitra and Webster (1998) carried out research on WOM and Balasubramanian and Mahajan (2001: 125) for the benefits of social interaction, have been utilized. In addition to the "focus-related", "consumption" and "approval" utilizes identified by Balasubramanian and Mahajan (2001: 125), they added "moderator-related" and "homeostase" sourced from the features of the web-based idea platforms.

Contrary to the studies in the WOM literature, "message involvement" is not included in this study. Message involvement is concerned with promotional activities of businesses. It is thought that this motivator was not included in the study since the study was conducted only on the website, which has neutral people's comments and scores. However, there are several studies showing that consumers think posts content is important and react accordingly (Kietzmann *et al.*, 2011; De Vries, Gensler and Leeflang, 2012; Cvijikj and Michahelles, 2013) "Content-related utility" can be defined as that consumers spending a good time talking about the content they like, regardless of their source. Content-related utility can be explained as; consumers reading, create, or forwarding posts that are entertaining, informative, notable or important about brands, products or services.

The motivations, studied by Hennig-Thruau et al. (2004), and compared with the subsequent studies are shown in Table 1. Motivation factors under different names were used in similar meanings. The study by Hennig-Thruau et al. (2004) showed that the motivators other than "helping the company" and "platform assistance" had a significant effect on E-WOM.

Table 1: Comparative E-WOM Studies

Hennig-Thurau vd. (2004)	Explanation	Studies	
Concern for other consumers	Helping other customers to select for the right product or protection against negative experiences	Aardenburg (2013) Dellarocas, Naranyan (2006) Jeong ve Jang (2011)	Tong, Wang and Teo (2007) Yap, Soetarto, Sweeney (2013)
Extraversion / positive self-enhancements	Positive appreciation by the other people Self-expression, creativity	Aardenburg (2013) Dellarocas, Naranyan (2006) Jeong and Jang (2011)	Tong, Wang and Teo (2007) Yap, Soetarto, Sweeney (2013)
Social Benefits	Social integration with online communities and participation	Dellarocas, Naranyan (2006)	Yap, Soetarto, Sweeney (2013)
Economic Incentives	Economic encouragement or liking the provider of the award	Aardenburg (2013) Tong, Wang and Teo (2007) Yoo, Sanders, Moon (2013)	
Helping the company	Helping company because of satisfaction from products/services or other reasons	Aardenburg (2013) Jeong and Jang (2011)	Tong, Wang and Teo (2007) Yap, Soetarto, Sweeney (2013)
Advice seeking	Obtaining information or writing useful feedback about the product/services	Aardenburg (2013) Yap, Soetarto, Sweeney (2013)	
Venting negative feelings	Reduce anxiety	Aardenburg (2013) Yap, Soetarto, Sweeney (2013)	
Platform assistance	Supporting from platform's admins	-	-

Note: Additionally, "Exerting power", "Brand Involvement" by Aardenburg (2013) and "Product Involvement", "Message Involvement" has been used by Dellarocas, Naranyan (2006).

In accordance with the literature review, altruism, self-enhancement, economic incentives, helping the company, social benefits, content involvement were determined as motivational factors to be discussed in the study.

1.4. Artificial Neural Networks and Feedforward Networks

Artificial neural networks (ANN) are information processing structures developed similar to neural networks in the human brain. It is a parallel and distributed information processing structure that consists of process elements which has its own memory that are connected to each other by weighted connections. In ANN the basic element is the neuron, which consists of connection and learning algorithm (Çuhadar and Kayacan, 2005). ANN's are composed of units in which multiple neurons are connected. Each neuron in the network can receive the input signal to process and generate an output signal. This network

consists of the weighted synapses sequence. This one-way interconnected network has three types: cascade connected, feedback, feed forward. The cascade connected is a single or multi-layer network type having at least one feedback network from the previous layer. In the feedback network, at least one cell is fed by the next layer. In feedforward neural networks, the cells are only fed with cells in the previous layers.

The feedforward network consists of one input, one output, and one or more hidden layers. Although each layer has a number of neurons, there is no communication between the neurons in the same layer. The input layer takes data from the source into the network and the number of the neuron is determined by the parameters in the source. The data in the input layer is then transmitted to hidden layers. In the hidden layers, advanced statistical inferences can be made with data, from the input layer through the neural network. The hidden layers are adjacent to one another and the output of one is the input of the other. The output signal of the last hidden layer is transmitted as the input signal to the output layer. The signal generated by the neurons in the output layer is the whole network response (Cerit *et al.*, 2017; Zhang, 2018, p. 3). The number of neurons in the input and output layer may vary depending on the nature of the study, while the only way to determine the number of neurons in the hidden layer is by trial and error (Efe and Kaynak, 2004). Feedforward network's structure is shown in Figure 1.
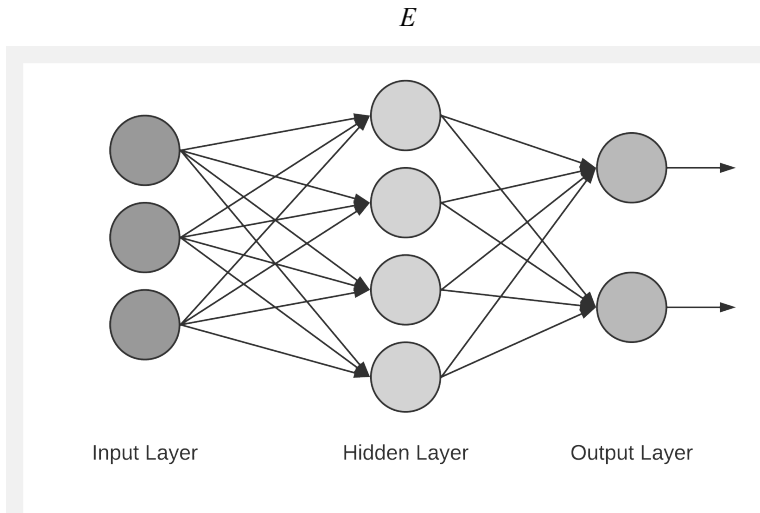
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Figure 1. Feedforward Artificial Neural Network Model (4-3-2)

Neural networks (a)can be learned in complex nonlinear mapping, (b) do not have a prejudice in input and output distribution assumptions as in nonparametric methods, (c) tolerable structure for incomplete, (d) lost or noisy data, (e) can be easily updateable/adaptable (Vellido, 1999, p. 62) This method has led to many academic studies in the field of business.

Wong, Bodnovich and Selvi (1996) conducted a literature survey of 213 academic types of research conducted in the field of business 1988-1995 with the ANN method. These studies are examined as accounting/auditing, finance, human resources, information

processing, marketing/distribution, production/operation and other. Although it is seen that there are more production and finance, 4.7% is related to marketing/distribution. In addition, there were 78 studies in 1995, while 1 in 1988. Therefore, it can be said that the use of ANN has increased significantly over time. In the following period, studies in business with ANN has been investigated interms of optimization problems by Smith(200), production by Zhang and Huang (1995) , and marketing, management and decision-making by Vellido(1999).

1.5. Bayesian Regulation Back Propagation

Successfully used in many areas, the backpropagation method has been used in approximately 75% of the ANN researches in marketing recently (Vellido, 1999). Back propagation neural networks is a common technique used to reduce selected error rates (eg average error square) in the field of artificial neural networks. The links between layers in ANN are stored as weighted values that measure the connection between the two nodes(Garson, 1991). Supervised learning steps change these weights to reduce the error function (Ticknor, 2013). However, in these techniques, overfitting and overtraining lead to fitting to noise and loss of generalization of the network are seen as a significant problem. In the Bayesian Regulation method developed to convert nonlinear systems to well-formed problems, the probability of memorizing the network is reduced (MacKay, 1992). Usually, the training steps aim to reduce the total error square of the model output and target value. This algorithm tries to obtain the minimum error using minimum weights (Payal, Rai and Reddy, 2015).

(Eq1)

$$O_F = \beta E_S + \alpha E_w$$

In Equation 1., the objective function O_F equals to the sum of the error squares E_S, and the sum of the squares of the network weights E_w, the objective function parameters are *α and β. Bayesian regulation minimizes the combination of quadratic error and weights and determines the correct combination to produce the network* (Aşkın, İskender and Mamızadeh, 2011).

2. METHODOLOGY

2.1. Data Collection and Process

The aim of the study is to predict the users' opinion search behavior in social media using E-WOM scale. In this context, six motivational factors have been identified; social benefits, self-enhancement, economic incentives, altruism, helping the company, and content involvement. The questionnaire was used to collect information from consumers.

In the development of the questionnaire, items for content involvement were adopted from Taylor (2010), Yang (2012), items for altruism, self-enhancement, economic incentive, social benefits, helping the company were adopted from Hennig-Thurau (2004), items for opinion search behavior adopted from Chu ve Kim (2011). Before the questionnaire was completed, a pilot study was conducted with 10 people in the first, 20 in the second and

40 in the third. After each pilot study, invalid items were revised and the questionnaire was reviewed. The questionnaire consists of four parts. In the first part, demographic information (gender, age, education level), in the second part intensity of use of Facebook (number of daily entries, time spent in each entry, sectors) and motivational factors, in the third part opinion search, and in fourth part were examined. In the third and fourth chapter, the participants were asked to choose (1) "strongly disagree", (2) "disagree", (3) "neither agree nor disagree", (4) "agree", (5) "strongly agree".

The population of research consists of Facebook users in Turkey. It was not possible to reach the entire population due to the constraints of time and cost. For this reason, the population was confined to the sample. It was determined by using convenience sampling method. The questionnaire was shared in Facebook user groups in 02 October – 15 November 2016. In this way, a survey was conducted with 637 people who are Facebook users. After the separation of those who were found to be invalid by the help of the control question, the responses of 512 participants were evaluated.

25 Questions were asked in the questionnaire to determine the number of neurons in the introduction layer of the ANN. A single value was obtained by taking the arithmetic average of the four questions that define the behavior of opinion search. The input and output layers' structure is shown in Table 1 and sample data is shown in Table 2. Thus, the number of neurons in the output layer was determined as 1. All neurons from 1-100 in the hidden layer were tested individually and results from neurons were given. In the study, the total data to be analyzed with ANNs is 512. This data is divided into 60% training and 40% testing with a script written in MATLAB. The division of the data was done according to the systematic sampling theorem. According to this theory, initially the first group was formed by 40% and then the second group was formed by the remaining 60%. Training data were used to calculate the function parameters of the network, and the test data were used to estimate the opinion search values. Finally, analyzes were performed using the Bayesian Regulation back propagation method.

Table 2. ANN's Input and Output Layers

Layer	Motivation Factor	Neuron
Input Layer	Altruism	I1, I2, I3, I4, I5
	Self-enhancements	I6, I7, I8, I9, I10
	Economic Incentives	I11 , I12 , I13
	Helping the Company	I14 , I15 , I16
	Social Benefits	I17 , I18 , I19 , I20
	Content Involvement	I21 , I22 , I23 , I24 , I25
Output Layer	Opinion Searching	O1

Table 3. Data Sample

	I1	I2	I3	I4	I5	...	I23	I24	I25	O1
1	4	4	3	4	4	...	4	5	5	3,5
2	5	5	5	4	5	...	3	3	3	4
3	4	4	2	5	4	...	4	4	4	3,75
4	3	3	3	3	3	...	3	3	3	3
...	...	...	...	...	...	...	...	...	...	...
510	5	5	5	5	5	...	5	3	3	4,75
511	5	5	5	3	5	...	3	2	2	4
512	3	5	5	5	5	...	5	5	5	5

2.2. Performance Evaluation Criterion

With the normalization of the data at the entrance of the network, ANN results can provide more efficient results. Normalization transforms input data into a better form when using the network(Jayalakshmi and Santhakumaran, 2011). For this reason, data were normalized to measure the performance of the network. Min-Max method is used for normalization in this study.

(Eq2)

$$MSE = \frac{1}{n} \sum_{i=1}^{n} (R_i - N_i)^2$$

It is indicated that "N" is the network-estimated value of the data set, "R" is the real value, "n" is the data size in Eq2, Eq3, and Eq4. Performance evaluation was carried out with mean squared error (MSE), error rate and Pearson correlation coefficient. MSE approaching zero means that system performance increases. The percentage of the difference between the actual value and the estimated value is called the error rate. Error Rate (H_{err}):

(Eq3)

$$H_{err} = \frac{1}{n} \sum_{i=1}^{n} \frac{|R_i - N_i|}{R_i} \; x \; 100$$

Correlation coefficients are used to determine the direction and degree of relationships between variables. The Pearson correlation method gives better results when the data is normally distributed and the n value is more than 25. Pearson correlation was used in the study because the data provided the conditions. Pearson correlation:

(Eq4)

$$\rho(R,N) = \frac{1}{n-1} \sum_{i=1}^{n} \left(\frac{R_t - \mu_R}{\sigma_R} \right) \left(\frac{N_t - \mu_N}{\sigma_N} \right)$$

where "μ_R" is mean of real value, "σ_R" standard deviation of real value, "μ_N" is mean of

estimated value and "σ_N" is standard deviation of estimated value.

3. RESULTS

3.1. Descriptive

The participants consisted of 261 female and 251 male, total 512 people. Approximately, the proportion of female is 51%, while the proportion of male is 49%. It is seen that the number of male and female participants is close to each other. According to the age distribution, the groups with the highest number of participants were 63% with 18-25 years of age and 22.1% with 26-33 years of age. Participants between the ages of 18-33 constitute 85.7% of the population. Given that people aged 13-39 constitute 78% of the social media users in Turkey (Kemp, 2016), it can be said that the rate of these participants is similar to those of other studies. At the same time, 65.8% of the participants had a bachelor's degree. Details are shown in Table 4 & 5.

Table 4. Age and Education Level

Age			Education Level		
	Frequency	**%**		**Frequency**	**%**
17 and down	4	0,8	**Not finish a school**	1	0,2
18-25	326	63,7	**Elementary School**	3	0,6
26-33	113	22,1	**High School**	33	6,4
34-41	47	9	**Associate Degree**	26	5,1
42-49	18	3	**Bachelor's Degree**	337	65,8
50-57	4	0,8	**Master/Doctoral**	112	21,9
Total	512	100	**Total**	512	100

According to Facebook login "4 times and less" is 42%, "10 times and more" is 33.2%, and the others are 24.8. Percentage of user who is logged in 5 times and more in a day is about 60%. The time spent on each login to Facebook is 81.1% with "14 minutes and less". It is seen that participants frequently use Facebook for short periods of time.

Table 5. Login Frequency and Spend Time

Login Frequency to Facebook			Time Spend at Each Login		
Times	**Frequency**	**%**	**Minutes**	**Frequency**	**%**
4 and less	215	42	**4 and less**	147	28.7
5-9	127	24.8	**5-9**	157	30.7
10-14	71	13.9	**10-14**	111	21.7
15-19	37	7	**15-19**	44	8.6
20-24	22	3	**20-24**	27	5.3
25-29	3	4	**25-29**	8	1.6
30 and more	37	7	**30 and more**	18	3.5

| Total | 512 | 100 | **Total** | 512 | 100 |

Total time the users spend and time spend at each login in a day has been calculated with login frequency. The percentage of users who spent 29 minutes and less time is about %40, the percentage of users who spent 30-89 minutes is about %35 (Figure 2).
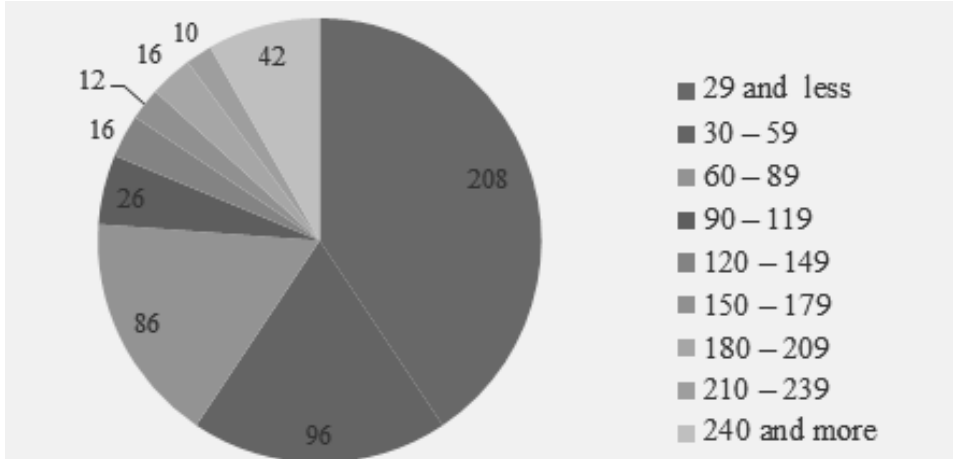

Figure 2. Total Time Spend on Facebook (Minute)

The participants were asked that which sectors they liked, commented and shared on Facebook. The number of newspaper and printed media are 233, cinema and music are 213 being the most preferred sectors. Details are shown in Figure 3.
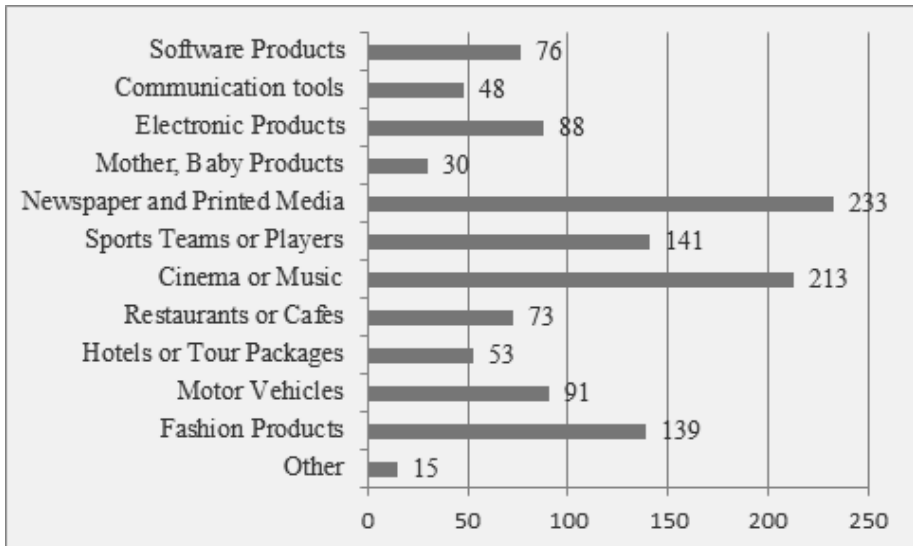

Figure 3. According to Sector, Like, Comment, and Share

3.2. Artificial Neural Network Analysis

In this study, it is aimed to predict the opinion search behavior by a structure in which e-WOM motivation factors questions constitute the input layer of artificial neural network. The network was trained with 308 of the 512 data, and tested with 204 of it. While it is known that there will be 25 in the input layers and 1 in the output layer, 1 to 100 tests have been performed for the number of neurons in the hidden layer. Training and testing data for these tests are shown in Table 6. The training data performance value average is 0.1493, the error rate average is -9.3769, and the correlation value is 0.6894. The test data performance value average is 0.1933, the error rate average is -6.3826, and the correlation value is 0.6372.

Table 6. Training and Testing Performance Values

Neuron Number	Training			Testing		
	MSE	H_{err}%	R	MSE	H_{err}%	R
49	0,1493	-9,3769	0,6894	0,1933	-6,3826	0,6372
25	0,1501	-10,0783	0,6902	0,1937	-7,0746	0,6356
37	0,1495	-9,5558	0,6888	0,1930	-6,9116	0,6356
85	0,1497	-9,0956	0,6884	0,1935	-6,8714	0,6351
20	0,1505	-10,2234	0,6864	0,1927	-7,6233	0,6343
1	0,1494	-10,3728	0,6911	0,1921	-8,3545	0,6339
43	0,1499	-9,1386	0,6882	0,1941	-6,8059	0,6334
17	0,1499	-10,7883	0,6886	0,1926	-8,2848	0,6325
24	0,1489	-10,3428	0,6909	0,1934	-7,8034	0,6322
62	0,1495	-10,1456	0,6891	0,1942	-7,4745	0,6320
12	0,1506	-11,3087	0,6894	0,1930	-8,6204	0,6312
69	0,1488	-8,4950	0,6913	0,1975	-5,8615	0,6305
8	0,1507	-10,5241	0,6868	0,1932	-8,5155	0,6303
33	0,1517	-7,8933	0,6848	0,1982	-5,5305	0,6303
55	0,1491	-9,2229	0,6915	0,1949	-7,3744	0,6300
6	0,1495	-10,0055	0,6896	0,1958	-6,9556	0,6296
46	0,1489	-9,6388	0,6905	0,1954	-7,1858	0,6294
89	0,1490	-9,1787	0,6899	0,1961	-7,0608	0,6292
11	0,1488	-8,3934	0,6911	0,1974	-6,1630	0,6291
76	0,1493	-9,2900	0,6894	0,1982	-5,9319	0,6286
21	0,1509	-8,8016	0,6855	0,1959	-7,0938	0,6284
2	0,1474	-10,5912	0,6950	0,1953	-7,6866	0,6284
77	0,1489	-10,0823	0,6907	0,1958	-7,2946	0,6279
63	0,1515	-8,7355	0,6845	0,1962	-7,0686	0,6278
51	0,1513	-11,0334	0,6858	0,1945	-8,5169	0,6275
5	0,1481	-9,8047	0,6927	0,1953	-7,9131	0,6275
78	0,1492	-10,3210	0,6907	0,1959	-7,5850	0,6272

Neuron Number	Training			Testing		
	MSE	H_{err}%	R	MSE	H_{err}%	R
56	0,1486	-9,8552	0,6912	0,1959	-7,5972	0,6269
87	0,1503	-9,1811	0,6871	0,1976	-6,4682	0,6268
57	0,1512	-10,1703	0,6856	0,1956	-7,9983	0,6261
99	0,1495	-10,1280	0,6893	0,1964	-7,4542	0,6261
23	0,1514	-11,0677	0,6849	0,1946	-9,0976	0,6260
45	0,1511	-7,7467	0,6860	0,2019	-4,9975	0,6259
31	0,1486	-10,0197	0,6928	0,1966	-7,4944	0,6259
68	0,1502	-10,6422	0,6877	0,1956	-8,3334	0,6255
13	0,1508	-10,5865	0,6883	0,1969	-7,6532	0,6248
58	0,1483	-8,3659	0,6933	0,1987	-6,5786	0,6246
73	0,1487	-9,1062	0,6912	0,1988	-6,9924	0,6244
90	0,1500	-10,2865	0,6901	0,1970	-7,7342	0,6243
26	0,1505	-10,9623	0,6881	0,1964	-8,1731	0,6243
96	0,1509	-8,7346	0,6855	0,1997	-6,4148	0,6242
48	0,1498	-8,7003	0,6883	0,1997	-6,1885	0,6241
66	0,1510	-11,0882	0,6861	0,1966	-8,2606	0,6240
94	0,1512	-9,2788	0,6848	0,2002	-6,1921	0,6239
98	0,1501	-10,3629	0,6877	0,1983	-7,1560	0,6233
70	0,1492	-9,7880	0,6910	0,1976	-7,5860	0,6233
82	0,1499	-10,2706	0,6900	0,1983	-7,2754	0,6230
74	0,1497	-9,2770	0,6886	0,1989	-6,8481	0,6229
100	0,1492	-8,8248	0,6898	0,1999	-6,4190	0,6228
15	0,1496	-10,0557	0,6899	0,1969	-8,1836	0,6228
50	0,1502	-9,5463	0,6871	0,2003	-6,3382	0,6220
10	0,1478	-9,4990	0,6938	0,1986	-7,2291	0,6220
86	0,1508	-10,7991	0,6864	0,1970	-8,6856	0,6219
64	0,1504	-11,4285	0,6881	0,1966	-8,7009	0,6218
4	0,1489	-9,1238	0,6905	0,1991	-7,1493	0,6214
88	0,1500	-9,6276	0,6877	0,1992	-7,6785	0,6212
54	0,1486	-9,6648	0,6911	0,1997	-6,8196	0,6211
19	0,1499	-9,9451	0,6898	0,1993	-7,1743	0,6210
65	0,1493	-10,1799	0,6907	0,1986	-7,5946	0,6208
80	0,1510	-11,9382	0,6875	0,1972	-9,1224	0,6207
91	0,1492	-9,9748	0,6899	0,1992	-7,4122	0,6204
34	0,1488	-8,8921	0,6909	0,1998	-7,1617	0,6202
95	0,1500	-10,3684	0,6895	0,1980	-8,2180	0,6202
28	0,1496	-10,3300	0,6891	0,1983	-8,0823	0,6201

Neuron Number	Training			Testing		
	MSE	H$_{err}$%	R	MSE	H$_{err}$%	R
29	0,1483	-10,2430	0,6931	0,1984	-8,1779	0,6196
81	0,1506	-10,3706	0,6868	0,1990	-7,8357	0,6196
27	0,1506	-10,4369	0,6871	0,1986	-8,1041	0,6192
40	0,1500	-9,1876	0,6876	0,2015	-6,5725	0,6190
67	0,1486	-10,2951	0,6924	0,1991	-7,7686	0,6189
59	0,1501	-9,7323	0,6882	0,2005	-7,1736	0,6178
44	0,1516	-8,6940	0,6836	0,2043	-5,5886	0,6177
18	0,1505	-9,6613	0,6866	0,2016	-7,0013	0,6176
79	0,1494	-10,9780	0,6903	0,1988	-8,5000	0,6173
38	0,1514	-10,3473	0,6853	0,1996	-7,9149	0,6172
9	0,1496	-9,7179	0,6889	0,2004	-7,5589	0,6171
47	0,1505	-9,2599	0,6871	0,2028	-7,2838	0,6168
75	0,1492	-9,0478	0,6898	0,2018	-7,0388	0,6160
7	0,1493	-9,7317	0,6898	0,2012	-7,2483	0,6159
52	0,1496	-9,9042	0,6890	0,2012	-7,4539	0,6155
71	0,1489	-10,1677	0,6908	0,2010	-7,7504	0,6150
39	0,1509	-9,2280	0,6853	0,2023	-7,0966	0,6149
14	0,1494	-9,5997	0,6892	0,2017	-7,2630	0,6148
35	0,1513	-10,5435	0,6860	0,2004	-8,1080	0,6147
53	0,1500	-10,9785	0,6897	0,1996	-9,0070	0,6145
61	0,1499	-8,2087	0,6885	0,2050	-5,7772	0,6144
36	0,1498	-8,7403	0,6885	0,2039	-6,3815	0,6140
42	0,1486	-10,4590	0,6915	0,2013	-8,1461	0,6138
92	0,1518	-11,3935	0,6843	0,2009	-8,2824	0,6135
16	0,1493	-8,7984	0,6896	0,2026	-7,2280	0,6132
83	0,1485	-9,9248	0,6914	0,2018	-8,4201	0,6126
22	0,1491	-8,9000	0,6901	0,2046	-6,6476	0,6119
30	0,1517	-8,7328	0,6835	0,2031	-7,5497	0,6117
93	0,1504	-8,0619	0,6873	0,2061	-6,1125	0,6115
32	0,1498	-9,6729	0,6887	0,2045	-7,1619	0,6093
97	0,1498	-8,6829	0,6884	0,2051	-7,0866	0,6086
84	0,1496	-10,5599	0,6896	0,2028	-8,4249	0,6079
41	0,1496	-9,4155	0,6885	0,2052	-7,7708	0,6069
72	0,1513	-9,0643	0,6843	0,2048	-7,9764	0,6064
60	0,1499	-8,3654	0,6881	0,2072	-6,8267	0,6059
3	0,1409	-8,6591	0,7105	0,2108	-7,4943	0,6012
Average	0,1497	-9,7402	0,6890	0,1987	-7,3814	0,6220

MSE is mean squared error, H_{err}% is error rate, R is correlation

When 49 neurons were used in the hidden layer, the performance value for the training data was 0.1493, the mean error was -9.3769% and the correlation was 0.6894. In the test data, it was observed that the performance value was 0,1933, the mean error was -6,3824 and the correlation was 0,6372. The distribution table and the histogram of the training and testing data are shown in Figure 4.
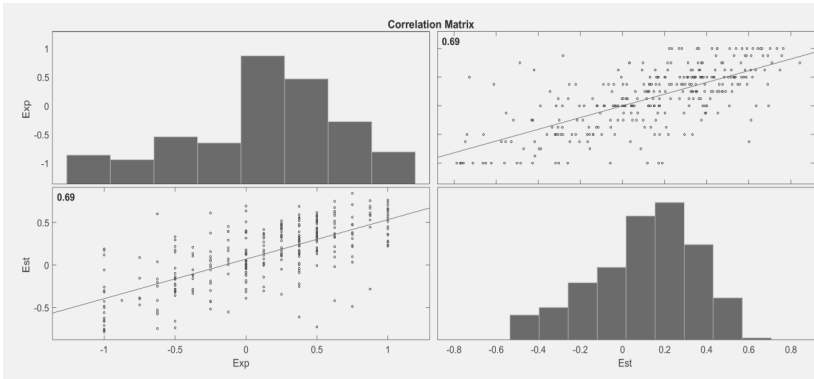
Training
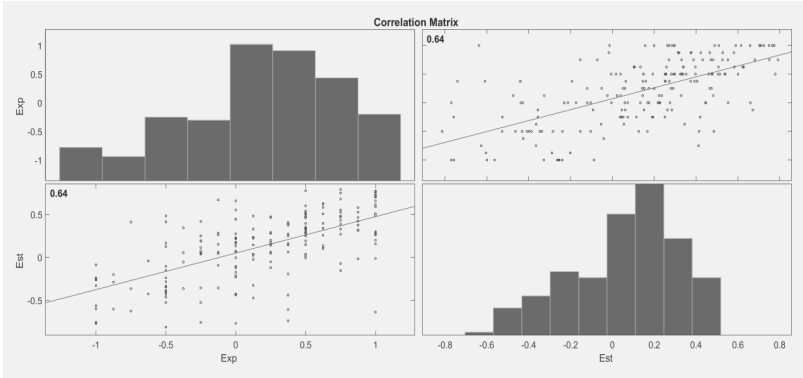
Testing

Figure 4. Training and Testing Data Correlation Distribution Histogram

4. DISCUSSION AND CONCLUSION:

Internet and web technologies have entered the lives of consumers as a multidimensional communication field. Thanks to the new features this communication channel provides, it allows people for opinion searching, opinion giving and opinion forwarding. In this study, opinion search behavior was tried to be estimated, especially in order to meet the pre-purchase needs, by using artificial neural networks. At the same time, inference was made by using descriptive data.

E-WOM communication motivational factors have been researched several times in

many ways because of its impact on consumers. By artificial neural network method, the aim is to contribute to academic research, both in business administration of Turkey and in e-WOM motivation factors.

In the estimation of opinion searching, feedforward ANN model was trained with Bayesian Regulation back propagation method. As a result, the training and testing correlation values are over 0.60 which is considered to be an acceptable value in the social sciences. At the same time, the correlation value is similar to the ANN studies performed in the field of business (King, Abrahams and Ragsdale, 2014; Atsalakis, Atsalaki and Zopounidis, 2018). However, the error rate is approximately 10%. In other words, the study has 90% success. As a result, the motivation factor expressions used in the study can be predicted by the consumer's opinion search behavior.

Opinion search behavior often occurs before the purchase, which is made in newspapers, magazines, cinema, music and fashion sectors by the young people who spend a long time on Facebook. In this context, Facebook is an ideal communication channel that marketing professionals and business managers can use to access and communicate their messages to young people seeking information in specific sectors. Social media, which is seen as a reliable source of information by consumers, can help businesses establish healthy relationships with consumers and achieve their goals.

For further research, studies on opinion giving and opinion forwarding on different platforms in specific sectors can be carried out.

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ELEKTRONİK AĞIZDAN AĞIZA İLETİŞİMDE YAPAY SİNİR AĞLARI İLE TAHMİNLEME: GÖRÜŞ ARAMA

1. GİRİŞ

Tüketiciler ürün veya hizmetler hakkında ticari kaygı gözetmeksizin yaptıkları konuşmalar ağızdan ağıza iletişimi (AAİ) oluştururken bu davranışın internet üzerinden yapılması ise elektronik ağızdan ağıza iletişim (E-AAİ) olmaktadır.

Günümüz tüketicisinin iletişim şekli, internetin hızla yaygınlaşması ve kullanımındaki değişikliklerden etkilenmiştir. Tüketiciler ihtiyaçlarının farkına varması ve satın alma sonrası işlemlere kadar birçok satın alma karar sürecini internet üzerinden gerçekleştirebilmektedir. Tüketiciler özellikle, ihtiyacın ortaya çıkmasından sonraki bilgi ihtiyacı için internette görüş aramaktadırlar.

İnternetin teknolojisi ve kullanımındaki değişiklikle ortaya çıkan sosyal medya tüketicilerin ürün veya hizmetler hakkında fikir, görüş ve tavsiyelerinin hızla yayılmasında önemli bir araçtır. Tüketiciler sosyal medyayı kullanarak üç temel işlevi yerine getirebilirler bunlar; görüş arama, görüşünü belirtme ve görüş iletmedir.

Sosyal medya, Web 2.0 üzerine kurulu bilginin oluşturulması ve alışverişine imkan tanıyan internet tabanlı uygulamalar olarak tanımlanmaktadır (Kaplan and Haenlein, 2010). Günümüzde sosyal medya, internet kullanıcılarının dörtte üçü olan 2,8 milyar kişi tarafından kullanılmaktadır. Sosyal medya, mikroblog, medya paylaşım, sosyal ağlar gibi birçok araçtan meydana gelmektedir. En çok aktif kullanıcıya sahip araç ise sosyal ağ sitelerinde ve bu siteler arasında da Facebook'tur. Tüketicilerin arkadaş ve yakın çevreleriyle iletişimde kalmaları maksadıyla kurulan Facebook, ürün ve hizmetler hakkında görüş alışverişinin yapılabildiği bir platformdur.

Tüketiciler arasında geçen AAİ veya E-AAİ'nin satın alma davranışları üzerinde önemli etkileri olabilmektedir. Yüz yüze ve tanıdık biri olmamasına rağmen tüketicilerin internetteki gerçek tüketicilerin yorumlarına %70 oranında güvendikleri görülmektedir (Nielsen, 2013). Böylece gerçek arkadaş çevresinden oluşan kişilere duyulan güvenin daha yüksek olması beklenebilmektedir.

Tüketicileri davranışlarında büyük etkisi olan AAİ'yi yapmaya motive eden faktörlere yönelik araştırmalar 1960'larda başlamıştır. Bu alanda göze çarpan çalışmalar Ditcher (1966), Engel, Blackwell ve Miniard (1993) ve Sundaram, Mitra ve Webster (1998) tarafından ortaya konmuştur. Birbiri üzerine inşa edilen çalışmalarda zaman içerisinde motivasyon sayısı artmış ve AAİ'nin pozitifin yanında negatifte olabileceğinden bahsedilmiştir.

E-AAİ, asenkron olması, mesajların çok daha fazla kişiye ulaşması, hızla ve mesajın oluşturulduğu şekliyle yayılabilmesi gibi özellikleriyle AAİ'den ayrışmakla birlikte temelde motivasyon olarak benzerdir. Bu nedenle E-AAİ araştırmaları AAİ motivasyonları temelinde yapılmıştır. Bu alanda en bilinen çalışmalardan bir tanesi Hennig-Thurau vd. (2004)'dır. Çalışmasında geçmiş AAİ çalışmaları ve Balasubramanian and Mahajan (2001) üzerinde E-AAİ motivasyon faktörlerini incelemiştir. E-AAİ'de sekiz motivasyonun olabileceğini araştırmış ve diğer tüketiciler için kaygılanma, dışa dönüklük/pozitif kendini

geliştirme, sosyal faydalar, ekonomik teşvikler, tavsiye arayışı ve olumsuz duygulardan kurtulma olarak altı adet motivasyonun etkili olduğunu tespit etmiştir. Sonraki yıllarda yapılan birçok farklı topluluk ve platformlarda yapılan araştırmalarda bu ve benzer motivasyonların kullanıldığı görülmüştür.

Bu çalışmada, Hennig-Thurau vd. (2004) ve diğer güncel E-AAİ araştırmaları karşılaştırmalı olarak incelenmiştir. E-AAİ davranışının görüş arama, görüş belirtme ve görüş iletme olarak üçe bölünebileceği de dikkate alınarak en sık gerçekleşen görüş arama üzerine odaklanılmıştır. AAİ'de Ditcher (1966) ve E-AAİ'de Dellarocas ve Naranyan (2006) da kendine yer bulan içerik ilgilenimi ayrı bir motivasyon olarak ele alınmıştır. Kişileri görüş aramaya iten motivasyonlar olarak diğergamlık, kendini geliştirme, ekonomik teşvikler, şirkete yardım, sosyal faydalar, içerik ilgilenimi araştırılmıştır.

İşletme alanında 1980'lerden günümüze yapay sinir ağları kullanılmaktadır. Wong, Bodnovich ve Selvi (1996) tarafından 1988-1995 arasında 213 çalışmada finans, insan kaynakları, bilgi işleme ve pazarlama gibi bölümlerde yapay sinir ağlarının kullanıldığı gösterilmiştir.

Yapay sinir ağları insan beynindeki yapıya benzerdir. İleri, geri ve kademeli olarak üç çeşidi bulunmaktadır. Bu çalışmada ileri beslemeli yapay sinir ağları kullanılmaktadır. Bu yapıda giriş katmanından bilgi girişi olmakta, sonrasında gizli katmandaki nöronlara iletilmekte ve son olarak ise çıkış katmanından sonuç elde edilmektedir. Giriş katmanı ve çıkış katmanları araştırmanın yapısına göre şekillenmekteyken gizli katmandaki nöron sayıları denenerek en iyi performansın elde edilmesi amaçlanmaktadır.

Çalışma ile E-AAİ motivasyon faktörleri ölçeği ile sosyal medyadaki görüş arama davranışının yapay sinir ağları yöntemiyle tahmin edilmesi amaçlanmıştır.

2. YÖNTEM

Araştırmanın verileri anket yöntemiyle elde edilmiştir. Dört bölümden oluşan anket, demografik bilgileri, Facebook kullanım yoğunluğunu, görüş arama davranışını, motivasyon faktörlerini ve görüş arama davranışına yönelik sorular içermektedir. Soruların yanıtlanmasında 5'li likert ölçeği kullanılmıştır. Anketin oluşturulmasında içerik ilgilenimi için Taylor (2010), Yang (2012) diğer motivasyonlar için Hennig-Thurau (2004) ve görüş arama davranışı için Chu ve Kim (2011) çalışmalarından faydalanılmıştır. Anket birkaç pilot çalışma sonrasında kullanılmıştır.

Araştırmanın ana kütlesini Türkiye oluşturmaktadır. Ana kütleye ulaşılması maddi ve zaman kısıtları nedeniyle mümkün değildir. Bu nedenle, kolayda örnekleme yöntemi kullanılmıştır. 02 Ekim- 15 Kasım 2016 yılları arasında Facebook kullanıcı gruplarında paylaşım yapılarak 637 anket toplanmıştır. Kontrol sorusu ile yapılan eleme ile 512 anket değerlendirmeye alınmıştır.

Analiz için ileri beslemeli yapay sinir ağları kullanılmıştır. Bununla birlikte sonuçların performansının iyileştirilebilmesi için analiz öncesi Min-Max normalleştirme yapılmıştır. Ayrıca Bayesian Regülasyon quadratik hatayı minimize ederek ve ağın üretilmesinde doğru kombinasyonu vererek performansı iyileştirmesi nedeniyle tercih edilmiştir. Ankette 25 motivasyon sorusu olması nedeniyle giriş katmanındaki nöron sayısı 25 olarak belirlenmiştir. Çıkış katmanında görüş arama davranışına yönelik soruların ortalaması

alınarak tek bir değer elde edilmiştir. Böylece çıkış katmanındaki nöron sayısı 1 olmuştur. Gizli katman için 1-100 arası deneme yapılmıştır. Veriler %60 eğitim ve %40 test olarak ayrılarak denenmiştir.

3. BULGULAR

Araştırmanın tanımlayıcı bulguları, Türkiye geneli ile benzer yolarak 18-25 yaş aralığında Facebook kullanımının yoğun olduğu görülmüştür. 29 dakika ve daha az kullanım %40'ta 30 ile 89 dakika arası kullanım ise %35 oranındadır. Aynı zamanda tüketiciler Facebook'ta en çok gazete, basılı medya ve sinema ve müziğe ile gösterilmektedir.

Performans kriterleri olarak Ortalama Hata Karesi (MSE), Ortalama Mutlak Hata Yüzdesi (Herr) ve korelasyon (R) kullanılmıştır. Buna göre yapay sinir ağı gizli katmanda 49 nöron ile test verileri için en iyi sonuçları verdiği görülmüştür. Eğitim verisi için MSE 0,1493, Herr -9,3769 ve R 0,6894 test verisi için MSE 0,1933, Herr -6,3826 ve R 0,6372 olduğu görülmüştür.

4. TARTIŞMA VE SONUÇ

Çalışmada sıklıkla satın alma öncesi gerçekleştirilen ve en yaygın davranış olan görüş arama ele alınmıştır.

Akademik yazında E-AAİ üzerine araştırmalar olmakla birlikte, bu çalışmayla birlikte motivasyonlardan değişik bir kombinasyon oluşturulmuştur. Ayrıca yapay sinir ağları kullanılarak hem işletme hem de E-AAİ motivasyon faktörlerine yönelik çalışmalara katkı sağlanmıştır.

Çalışmanın sonucunda 0.60 çıkan korelasyon değeri sosyal bilimlerde kabul edilebilir bir değerdir ve çalışmada bu değerin üzerine çıkılmıştır. Aynı zamanda hata oranı %10'nun altındadır. Diğer bir deyişle %90'nın üzerinde başarı ile görüş arama davranışı tahmin edilmiştir.

Gazete, sinema, müzik ve moda sektörleriyle ilgilenen, çoğunluğu genç olan ve Facebook'ta uzun zaman geçiren kitlenin sıklıkla satın alma öncesinde yapılan görüş arama davranışının tahmin edilmesi pazarlama uzmanlarınca değerli olabilir.

Gelecek çalışmalarda, görüş belirtme ve görüş iletme davranışları da incelenebilir.