

Turkish Studies



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Estimation the Number of Visitor of E-Commerce Website by Artificial Neural Networks During Covid19 in Turkey

Covid-19 Sürecinde Türkiye'deki E-Ticaret Sitelerinin Ziyaretçi Sayılarının Yapay Sinir Ağları ile Tahmini

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Abstract: Developments in the field of internet technology affect human life in every way and cause their daily lives to positively change over time. One of the conveniences and positive effects provided by the internet has been e-commerce technology that has brought a new perspective to commerce and shopping for both the operator and client. Thanks to e-commerce, people can shop online by using websites and mobile applications, without needing to pay attention to the concepts such as easiness, speed, time and location. Due to these advantages, the interest in the e-commerce market is increasing daily in Turkey as it does in the rest of the world, the e-commerce market is also growing rapidly in line with the increasing demand. Through the process of COVID-19, public health is threatened, but also the economy and social life are affected. The process of quarantine and panic environment, which are the effects of a pandemic, affected shopping preferences of the public. The changes in the number of visitors of 4 e-commerce sites operating in Turkey during the COVID-19 period were estimated in this study by artificial neural networks method. The number of visitors of websites were tried to be estimated by using statistical data such as new case, total case, new death, total death, new recovery, total recovery, intubation, intensive care, total test from March 11, which is when COVID-19 was first seen in Turkey, until May 13. The effects of the data that came about during the pandemic process on internet shopping were investigated in the study. The average R² value of the system designed as a result of the test was 90%. Average MSE and MAE values were measured as 0.001 and 0.014, respectively. The fact that these values are close to zero shows that the success of the system is so high. Looking at the results, it can be said that the statistical data during the pandemic process have directly affect online shopping.

Structured Abstract: Introduction and aim of study

Developments in the field of internet technology affect human life in every way and cause their daily lives to positively change over time. One of the conveniences and positive effects provided by the internet has been e-commerce technology that has brought a new perspective to commerce and shopping for both the operator and

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client. Thanks to e-commerce, people can shop online by using websites and mobile applications, without needing to pay attention to the concepts such as easiness, speed, time and location. Due to these advantages, the interest in the e-commerce market is increasing daily in Turkey as it does in the rest of the world, the e-commerce market is also growing rapidly in line with the increasing demand. Through the process of COVID-19, public health is threatened, but also the economy and social life are affected. The process of quarantine and panic environment, which are the effects of a pandemic, affected shopping preferences of the public. The changes in the number of visitors of 4 e-commerce sites operating in Turkey during the COVID-19 period were estimated in this study by artificial neural networks (ANN) method.

Methodology

The number of visitors of web-sites were tried to be estimated by using statistical data such as new case, total case, new death, total death, new recovery, total recovery, intubation, intensive care, total test from March 11, which is when COVID-19 was first seen in Turkey, until May 13. The effects of the data that came about during the pandemic process on internet shopping were investigated in the study. There are thousands of e-commerce sites in the world and Turkey. In order to be objective in the selection of the e-commerce site we used in our study, the number of visitors data was used as a criterion. For this is the number 4 most visited e-commerce sites in Turkey were used in the study. Four Business-to-Consumer (B2C) and Consumer-to-Consumer (C2C) e-commerce websites operating in Turkey were selected in the study, with an average of more than 5 million monthly visitors: N11.com, hepsiburada.com, sahibinden.com, gittigidiyor.com.

Research Findings

Looking at the results, it can be said that the statistical data during the pandemic process have directly affect online shopping. it was found that ANN can be used successfully in estimating this effect. The R^2 value is used to indicate how much of the variation in one variable is explained by the other variable. The average R^2 value of the system designed as a result of the test was 90%. This value shows that 90% of the change in the number of visitors, which is our dependent variable, can be explained by the pandemic statistical data in the system we designed. This result is successful and acceptable for studies in the field of ANN. Another method we use to measure the predictive performance of our model, MSE value, is used to indicate how close the regression curve is to a number of points. The average MSE value was 0.001 and our model is considered successful because it is considered that the models close to zero perform well. MAE value, which is the last method we use to test our model, is used to measure the difference between two continuous variables. The average MAE value of our model was 0.014. Our model is a successful model according to MAE since low value models are accepted to perform better.

R, MSE and MAE values are accepted as a success that we have used to measure the success of the model we have developed. Our dependent variable in our model can be explained and estimated with our independent variables.

Conclusion

As a result of the research, e-commerce companies will be able to estimate the number of visitors in the pandemic with ANN in this study and take measures using this information. The main reason for the increase or decrease in the measures taken during the pandemic is the statistical information taken by the Ministry of Health of the Turkish Republic and used in our study. Citizens and Science Committee interpret the increase and decrease of the outbreak according to this information. According to this information, a series of precautions are taken or there is a blindness.

The change in interest in e-commerce sites during the pandemic was interpreted as follows: When the pandemic started, people's interest in e-commerce sites decreased due to the risk of virus transmission of the cargo services and the delivery of the cargo in a long time. When there was a curfew, he turned to e-commerce for the compulsory shopping of people. In addition, when shopping malls and trade centers are closed and shopping is risky, people have turned to e-commerce sites.

Thanks to this study, it was seen that health problems, anxieties, quarantine process and panic environment affect people's shopping preferences. The number of consumers visiting e-commerce sites can be estimated using new cases, total cases, new deaths, total deaths, new recovery, total recovery, intubation, intensive care and total test numbers that change during the pandemic.

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The change in the number of visitors of e-commerce sites directly affects their sales amounts and turnovers. Thanks to the model developed in this study, e-commerce sites will be able to predict the changes in the number of visitors by using the statistical data that change during COVID-19. Thereby, companies will be able to plan the number of employees, campaigns, investments and other different expenses appropriately.

Keywords: Management information system, COVID-19, e-commerce, Artificial neural networks, estimation

Öz: İnternet teknolojisindeki gelişmeler insan hayatını her alanda etkilemekte ve zaman içerisinde günlük yaşantılarının olumlu yönde değişmesini sağlamaktadırlar. İnternetin sağlamış olduğu kolaylıklardan ve olumlu etkilerinden bir tanesi de işletmeci ve tüketici için ticarete ve alışverişe yeni bir bakış açısı getiren eticaret teknolojisi olmuştur. E-ticaret, internet üzerinden web sitelerini ve mobil uygularını kullanarak kolay, hızlı, zaman ve yer kavramından bağımsız olarak insanların alışveriş yapmasını sağlamaktadır. Bu avantajlarından dolayı tüm dünyada olduğu gibi Türkiye'de e-ticaret pazarına olan ilgi her geçen gün artmakta; artan taleple doğru orantılı olarak e-ticaret pazarı da hızla büyümektedir. COVID-19 süreci insanların sağlıklarını tehdit etmekle birlikte ekonomik ve sosyal yasantılarını da etkilemektedir. Pandeminin etkileri olan karantina süreci ve panik ortamı insanların alışveris tercihlerini etkilemiştir. Bu çalışmada Türkiye'de faaliyet gösteren 4 e-ticaret sitesinin COVID-19 süresince ziyaretçi sayılarındaki değişimler yapay sinir ağları yöntemiyle tahmin edilmiştir. Türkiye'de COVID-19'un ilk görüldüğü tarih olan 11 Mart tarihinden itibaren 13 Mayıs tarihine kadar olan yeni vaka, toplam vaka, yeni ölüm, toplam ölüm, yeni iyileşen, toplam iyileşen, entübe, yoğun bakım, toplam test gibi istatistiksel verileri kullanılarak, sitelerin ziyaretçi sayıları tahmin edilmeye çalışılmıştır. Çalışma sayesinde pandemi sürecinde oluşan verilerin, internet alışverişine etkileri araştırılmıştır. Test sonucunda tasarlanan sistemin ortalama R² değeri% 90'dır. Ortalama MSE, MAE değerleri sırasıyla 0.001 ve 0.014 olarak ölçülmüştür. Bu değerlein sıfıra yakın olması, systemin başarısının da o kadar yüksek olduğunu göstermektedir. Elde edilen sonuçlara bakıldığında pandemi sürecindeki istatistiki verilerin internet alışverişini doğrudan etkilediği söylenebilir.

Anahtar Kelimeler: Yönetim bilişim sistemleri, COVID-19, E-ticaret, Yapay sinir ağları, Tahmin etme

Introduction

Thanks to the opportunities provided by the internet in modern societies, living levels of the people improve and the importance of the internet increases each day. With the opportunities provided by the Internet, it becomes more practical and easy to introduce oneself, communicate, facilitate day-to-day endeavors and provide information (Gülkesen et al., 2001).

The Internet has enabled the business environment and consumers to come together more efficiently by providing a strong communication channel and creating new markets for these two assets, which changed the business environment radically. The Internet offers more benefits to consumers with lower transaction costs, including increasing costs and costs spent while search, and a wider range of options than those available in the traditional economic environment (Chun & Kim, 2005:375).

The concept of e-commerce emerged with the developments in internet technology and companies were able to market and sell their products regardless of where and when. Thanks to the e-commerce sector, customers can reach businesses in the shortest way possible. Therefore, there has been a turn to e-commerce from traditonal commerce by many enterprises (Kırık, 2017:525).

E-commerce is increasing its share on the internet market day by day. The open structure of the internet and the low cost of using it, it allowing to connect to new and existing information and communication technologies, and it offering a new and powerful information system and a new form of communication to businesses and consumers are among the main reasons that can be counted for this daily increase. Thanks to this, buyers and sellers can come together more efficiently and new markets and opportunities for reorganizing economic processes are created (Coppel, 2000).

There are many advantages provided by e-commerce to both the customer and the operator. Since it saves time for the customer by not going to the store, and customers can see the products and deals, compare and examine the special offers and the opportunities, so that they can find products with affordable prices and see more than one variety at the same time (Yaman, 2018:5).

Quarantine and panic processes caused by past epidemics experienced in the world was observed to have had an impact on economic growth, environment and human activities (Arndt & Lewis, 2001: 430; Bermejo, 2004: 165; Hanashima & Tomobe, 2012: 60; Siche, 2020: 3-6). The measures taken as a result of epidemics threatening human life have economically affected countries and people. Shopping centers and stores, where social distance is difficult to maintain and interactions occur, have been temporarily closed off, and public institutions have been operating to a minimum.

On December 31st 2019, the Chinese health authorities reported a cluster of 27 pneumonia cases of unknown etiology in the province of Wuhan, China. These cases were later came to be described as a new coronavirus called Coronavirus 2 (COVID-19), which is a severe acute respiratory syndrome. In the first couple of weeks of 2020, the number of cases increased, and cases outside of China also started being reported (Johnson et al., 2020: 3-5). The first detected case of the COVID-19 epidemic in Turkey, which spread around the world, was announced on March 10th 2020. The first detath due to this virus occurred on March 15th 2020 (Ministry of Health, 2020).

During COVID-19, the vast majority of the world is under social isolation and people stay inside unless they absolutely must. COVID-19 has had a broad and comprehensive impact on e-commerce, technology, business travel and the economy (Hasanat et al., 2020: 87).

There may be many reasons for the increase or decrease of interest in e-commerce sites during the pandemic. But the main reason for these is based on statistical information during the pandemic. For example, as a result of the increase in the number of cases and the number of deaths, measures such as shopping malls and closings, curfews, and transition to distance education were taken. The main reason for the reduction of measures and normalization is the decrease in the number of cases and the increase in the number of recovering. In our study, as we mentioned here, we have developed a model that includes all other reasons.

E-commerce is the process of selling and purchasing of goods and services on the internet. e-commerce can be in many different forms, which depends on who it is selling to: business-tobusiness (such as medical supply companies to hospitals), business-to-consumer (such as hepsiburada.com), consumer-to-business (such as food site blogger), consumer-to-consumer (such as sahibinden.com), from state-to-consumer (such as US Postal Service) (Movahedi-Lankarani, 2003: 135). The categories of E-commerce are shown in Table 1.

Table 1. Typ	CS 01 L-C		ppei, 2000
	Official	Management	Consumer
Official	G2G	G2B	G2C
Management	B2G	B2B	B2C
Consumer	C2G	C2B	C2C

 Table 1: Types of E-commerce (Coppel, 2000)

Business-to-Business (B2B)

Thanks to B2B, an enterprise can interact electronically with another enterprise, especially through the Web (Zeng et al., 2003). It includes a wide range of business-to-business transactions, including B2B wholesale trade as in services, technology, manufactured products and capital equipment purchases by the company. It also includes certain financial transactions such as insurance, commercial loans, bonds, securities and other financial assets in between businesses. Many B2B e-commerce companies act as intermediaries between other companies that purchase and

sell goods and services (Lucking-Reiley & Spulber, 2001: 55-60). B2B has many advantages such as increasing B2B e-commerce efficiency, reducing potential staff expenses and audit (Yang & Papazoglou, 2000: 40-42).

Business-to-Consumer (B2C)

Business-to-Consumer electronic commerce (B2C e-commerce) is an effective tool for companies, in that their customers can make trade online using internet-based technologies (Ranganathan & Ganapathy, 2002: 461). Websites offering B2C e-commerce are more accessible, easier, faster and cheaper methods for retail consumers for their retail transactions (Hartono et al., 2014: 12-17).

Consumer-to-Consumer (C2C)

The Consumer-to-Consumer (C2C) e-commerce type is an environment, where consumers can buy and sell goods directly with other consumers over the web (Weltevreden & Rotem-Mindali, 2009: 85; Wu et al., 2011: 430-435). The main feature of C2C e-commerce transactions is it being between two people. This E-commerce form includes auxiliary environments such as online auctions, websites, web forums, chat rooms, social media platforms among many more, which allow individuals to shop with one another (Jones & Leonard, 2014: 72-75).

There are very few studies in the literature on the number of visitors of websites. These studies are included below.

Anggrainingsih et al. study to predict the number of website visitor of Sebelas Maret University. In this study, they used time series forecasting using exponential smoothing. The data set used website traffic statistics in Google Analytics from January 2008 to June 2014. The MAPE (mean absolute percentace error) value of the developed model was 12%, and it was concluded that the number of website visitor would increase by 13.62% annually (Anggrainingsih et al., 2015:14-19).

Defibaugh-Chavez et al. used machine learning techniques to classify visitors of a datacentric Web site using minimal amounts of information and without a unique identifier. They used fuzzy classification, artificial neural s, support vector machines, and hidden Markov model methods from machine learning techniques. As a result of the study, the most successful method was ANN and fuzzy classification (Defibaugh-Chavez et al., 2004:394-389).

In this study, the number of visitors of 4 e-commerce sites operating in Turkey with an average of more than 5 million daily visitors during the COVID-19 period was estimated. The number of people visiting e-commerce sites was estimated via ANN using daily new cases, total cases, new deaths, total deaths, new recovery, total recover, number of intubations, intensive care and total number of tests since March 10, which is the first date of when COVID-19 was seen in Turkey. N11.com, hepsiburada.com, sahibinden.com and gittigidiyor.com, which have a high number of visitors as e-commerce sites in Turkey, were chosen for the study.

Material and Method

Data Set

In this study, the COVID-19 data between 11st of March and 14th of May 2020 in Turkey and the number of visitors of the e-commerce sites are estimated. Some of the COVID-19 statistical data of Turkey taken from the Ministry of Health of the Turkish Republic can be seen in Table 2. The graphical representation of these data is additionally given in Figure 1.

	Tab	le 2: COV	VID-19	statistics	in Turkey	(Ministry	of Health, 2	2020)	
Date	New	Total	New	Total	New	Total	Intubation	Intensive	Total Test
	Case	Case	Death	Death	Recovery	Recovery		Care	
11.Mar.20	1	1	0	0	0	0	0	0	0
12.Mar.20	0	1	0	0	0	0	0	0	0
13.Mar.20	4	5	0	0	0	0	0	0	0
14.Mar.20	12	<u>6</u>	0	0	0	0	0	0	0
15.Mar.20	12	18	1	1	0	0	0	0	0
17 Mar 20	<u> </u>	4/	1	2	0	0	0	0	8002
17.Mar.20	93	191	1	3	0	0	0	0	10017
19 Mar 20	168	359	1	4	0	0	0	0	11998
20.Mar.20	311	670	5	9	0	0	0	0	15624
21.Mar.20	277	947	12	21	0	0	0	0	18577
22.Mar.20	289	1236	9	30	0	0	0	0	20345
23.Mar.20	293	1529	7	37	0	0	0	0	24017
24.Mar.20	343	1872	7	44	0	26	102	136	27969
25.Mar.20	561	2433	15	59	0	0	0	0	33004
26.Mar.20	1196	3629	16	75	0	0	0	0	40290
27.Mar.20	2069	5698	17	92	16	42	241	344	47823
28.Mar.20	17/04	7402	16	108	28	105	309	445	55464
29.Mar.20	1610	9217	23	151	<u> </u>	105	<u> </u>	208	<u>65446</u> 76081
31 Mar 20	2704	13531	37	214	<u> </u>	243	<u> </u>	847	02403
$\frac{51.001.20}{1 \text{ Nis } 20}$	2104	15551	63	214	90	333	692	979	106799
2 Nis 20	2456	18315	79	356	82	415	783	1101	125556
3.Nis.20	2786	20921	69	425	69	484	867	1251	141716
4.Nis.20	3013	23934	76	501	302	786	909	1311	161380
5.Nis.20	3135	27069	73	574	256	1042	935	1381	181445
6.Nis.20	3148	30217	75	649	284	1326	966	1415	202845
7.Nis.20	3892	34109	76	725	256	1582	987	1574	222868
8.Nis.20	4117	38226	87	812	264	1846	995	1492	247768
9.Nis.20	4056	42282	96	908	296	2142	1017	1552	276338
10.Nis.20	4747	47029	98	1006	281	2423	1062	1667	307210
11.Nis.20	5138	52167	95	1101	542	2965	1021	1626	340380
12.Nis.20	4/89	56956	97	1198	481	3446	9/8	1005	3/6100
13.NIS.20	4093	65111	98	1290	<u> </u>	<u> </u>	1003	1/80	410550
$\frac{14.185.20}{15 \text{ Nis } 20}$	4002	69392	115	1518	875	5674	1057	1809	443020
16 Nis 20	4801	74193	125	1643	1415	7089	1032	1854	518143
17.Nis.20	4353	78546	126	1769	1542	8631	1014	1845	558413
18.Nis.20	3783	82329	121	1890	1822	10453	1054	1894	598933
19.Nis.20	3977	86306	127	2017	1523	11976	1031	1922	634277
20.Nis.20	4674	90980	123	2140	1454	13430	1033	1909	673980
21.Nis.20	4611	95591	119	2259	1488	14918	1006	1865	713409
22.Nis.20	3083	98674	117	2376	1559	16477	985	1814	750944
23.Nis.20	3116	101790	115	2491	2014	18491	982	1816	791906
24.Nis.20	3122	104912	109	2600	3246	21737	929	1790	830257
25.Nis.20	2861	110120	106	2706	3845	25582	900	1782	868565
26.Nis.20	2357	110130	99	2805	3558	29140	883	1726	898742
$\frac{27.1N18.20}{28 Nis 20}$	2131	112201	90	2900	5018	38800	002 8/15	1/30	910000
29 Nis 20	2936	117589	89	3081	5231	44040	831	1574	991613
30.Nis.20	2615	120204	93	3174	4846	48886	803	1514	1033617
1.Mav.20	2188	122392	84	3258	4922	53808	818	1480	1075048
2.May.20	1983	124375	78	3336	4451	58259	778	1445	1111366
3.May.20	1670	126045	61	3397	4892	63151	766	1424	1135367
4.May.20	1614	127659	64	3461	5015	68166	727	1384	1171138
5.May.20	1832	129491	59	3520	5119	73285	707	1338	1204421

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6.May.20	2253	131744	64	3584	4917	78202	669	1278	1.234.742
7.May.20	1.977	133.721	57	3.641	4.782	82.984	665	1.260	1.265.119
8.May.20	1.848	135.569	48	3.689	3.412	86.396	653	1.219	1.298.806
9.May.20	1.546	137.115	50	3.739	3.084	89.480	628	1.168	1.334.411
10.May.20	1.542	138.657	47	3.786	3.211	92.691	598	1.154	1.370.598
11.May.20	1.114	139.771	55	3.841	3.089	95.780	578	1.126	1.403.320
12.May.20	1.704	141.475	53	3.894	3.109	98.889	576	1.045	1.440.671
13.May.20	1.639	143.114	58	3.952	2.826	101.715	535	998	1.474.003



Figure 1. COVID-19 change in Turkey

There are thousands of e-commerce sites in the world and Turkey. In order to be objective in the selection of the e-commerce site we used in our study, the number of visitors data was used as a criterion. For this is the number 4 most visited e-commerce sites in Turkey were used in the study. Four business-to-consumer (B2C) and consumer-to-consumer (C2C) e-commerce websites operating in Turkey were selected in the study, with an average of more than 5 million monthly visitors: N11.com, hepsiburada.com, sahibinden.com, gittigidiyor.com.

N11.com is an open market e-commerce platform established in March 2013, operating in Turkey and providing sales services from business-to-consumer on internet (Wikipedia, 2020c). Hepsiburada was established in Turkey in 1998 and is a web-site serving only over the internet (Wikipedia, 2020b). Sahibinden.com was established in 2000 and is an online platform, where advertisements and e-commerce transactions are made in multiple categories such as real estate, vehicles, shopping products and services (Wikipedia, 2020d). Having launched in 2001, GittiGidiyor.com is an e-commerce website that brings buyers and sellers together (Wikipedia, 2020a). The number of visitors of these sites between March 11th 2020 and May 14th 2020 is presented in Table 3. Also, the number of daily visitors of the websites is given in Figure 2 graphically.

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able 3: Nun	nber of da	ily visitors of E-	commerce sites	(websiteiq, 202
Date	n11.com	hepsiburada.com	sahibinden.com	gittigidiyor.com
11.Mar.20	503709	604903	911052	206933
12.Mar.20	505170	590146	908434	208216
13.Mar.20	508121	575174	903246	198017
14.Mar.20	488214	558255	900676	196484
15.Mar.20	508865	573239	900676	196960
16.Mar.20	492337	571318	900676	195258
17.Mar.20	480189	561921	903246	198017
18.Mar.20	457144	541524	905832	197247
19.Mar.20	434770	524248	905832	195822
20.Mar.20	434241	510359	900676	195445
21.Mar.20	434770	486857	885581	184837
22.Mar.20	428511	468671	880671	172482
23.Mar.20	427487	466192	875818	171769
24.Mar.20	426977	474354	866286	170291
25.Mar.20	393408	450746	852400	168636
26.Mar.20	372872	449603	832449	167957
27.Mar.20	369485	418990	819700	166615
28.Mar.20	365436	416560	805350	165493
29.Mar.20	330523	418502	785766	163937
30 Mar 20	326764	408059	789600	161910
31 Mar 20	342383	401255	778217	159512
1 Nis 20	342068	401255	770824	153868
2 Nis 20	374497	416560	765378	153000
3 Nis 20	299244	415117	746101	166019
4 Nis 20	298773	439054	732727	167082
5 Nis 20	297602	435832	715162	167082
6 Nis 20	295059	435032	702040	167283
7 Nis 20	318163	440137	688301	168910
8 Nis 20	31780/	469021	67/298	169736
9 Nis 20	31/074	407721	666188	169874
10 Nis 20	330230	486857	655697	169736
11 Nis 20	326764	500813	653130	168024
12 Nic 20	337102	512618	646806	173564
12.NIS.20	226402	512618	625750	194020
15.NIS.20	216092	407052	622026	104920
14.INIS.20	225280	500611	620482	100042
15.NIS.20	255540	520061	619205	170221
10.INIS.20	267264	542001	602802	170631
17.Nis.20	30/204	543234	003823	171062
18.Nis.20	300105	538233	605988	1/1344
19.Nis.20	282042	599101	005988	170781
20.Nis.20	383043	588101	<u>601674</u>	172053
21.Nis.20	384256	601674	590146	174808
22.N1S.20	411320	602746	581063	176523
23.Nis.20	435832	600606	574204	1///3/
24.Nis.20	453630	599542	563774	1/8121
25.Nis.20	462527	598482	574204	1//661
26.Nis.20	461922	607077	573239	170502
27.Nis.20	461319	62/430	572277	178583
28.Nis.20	486181	630967	561921	180300
29.Nis.20	487534	648060	577122	173202
30.Nis.20	488214	651854	580072	174735
1.May.20	473079	686872	573239	177204
2.May.20	490954	681222	585062	177204
3.May.20	491645	682625	598482	165166
4.May.20	492337	666188	600606	175178
5.May.20	509611	678434	610370	175848
6.May.20	525842	689736	621630	185926

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7.May.20	511110	681222	630967	185842
8.May.20	514899	663531	620483	185171
9.May.20	501533	655697	609268	196200
10.May.20	485507	658286	613701	204106
11.May.20	507380	663531	623936	205247
12.May.20	514899	674298	633349	200663
13.May.20	534799	686872	649320	201261





When the data between March 11th and May 13th were examined, it could be seen that the COVID-19 data announced by the Ministry of Health of the Turkish Republic may have affected the preferences of the users. Therefore, the method as one of the artificial intelligence methods was utilized to investigate the effect of daily data published by the Ministry of Health of the Turkish Republic on the number of visitor entries to the shopping sites.

Artificial Neural Networks (ANN)

Having developed through the inspiration of human brain, ANN are parallel and distributed information processing structures, i.e. computer programs that imitate biological neural networks, which are inter-connected through weighted connections, each of which consisting of their own memory processing elements (Gershenson, 2003).

ANN are computational structures, which are designed to mimic the cumulative information harnessed by biological central nervous system. Contrast to traditional computational techniques, they can solve non-linear and unidentified problems based on parallel composition. Past two decades, the use of ANN in the business world has greatly increased. This evolution has not only led to the development of many different scientific practices, but also to practical problems being intensively researched. ANN characteristics such as efficiency, robustness and adaptability have made them a valuable tool in the fields such as classification, decision-making support, financial analysis or credit scoring etc. (Tkáč & Verner, 2016: 790-792).

In the basis of ANN lies the mathematical modeling of the principle that a biological nerve cell carries information to a value nerve cell and this principle being applied with algorithms. Therefore, there is a similarity between the inspiring biological nerve cell and the created artificial nerve cell. Figure 3 shows the biological nerve cell and artificial nerve cell. Similarities between the biological nervous system and the artificial neural network are additionally indicated in Table 4 (Sağıroğlu et al., 2003).



 Table 4: Similarities between biological and artificial nervous system



Figure 3. Similarity between biological nerve cell and artificial nerve cell

Neurons are inter-connected with the help of weights in the network structure indicated in the artificial neuron structure shown in Figure 3. The elements that are used to provide this connection are inputs, weights, addition function and activation function. All neurons are interrelated. The level of this relationship indicates the weight value of that neuron called W_i . In the connections between the layers, one neuron's output constitutes another neuron's input. For the neuron input, the weight value is multiplied by the previous neuron output known as called X_i , and all inputs to that neuron are summed up, then the net input is calculated. This resulting sum is subjected to activation function and the neuron output is calculated.

Inputs: these are the information that come from the outside world into an artificial cell. These are determined by the samples that the network wants to learn.

Weights: they show the importance of the information coming to an artificial cell and its effect on the cell. The weight W_i in the figure shows the effect of X_i input on the cell. Weights being large or small does not mean they are important or unimportant. A weight being zero may be the most important phenomenon for that network.

Addition Function (Conjunction Function): This function calculates the net input to a cell. Different functions are used for this. The most common one is the weighted sum. Here, each incoming information is totaled by it being multiplied with its own weight. Thus, the net input to the network is found.

Activation Function: This function determines the output that the cell will produce in response to the input, by processing the net input to the cell. The activation function is usually chosen as a non-linear function. "Non-linear" activation functions of artificial neural networks, which is a feature of artificial neural networks, come from the non-linear feature of activation functions. Another point to be considered while choosing the activation function is that the derivative of the function is easy to calculate. Since the derivative of the activation function is also used in feedback networks, an easy-to-calculate function is selected so that the calculation does not slow down.

Linear, step, sigmoid, tangent hyperbolic, threshold value and sinus activation functions are activation functions used in artificial neural networks. In the "multilayer Perceptron" model, which is the most widely used today, the "sigmoid function" is used as the activation function in general.

Cell Output: It is the output value determined by the activation function. The produced output is sent to the outside world or another cell. Own output of the call can be sent as input to itself. Although a processing unit has multiple outputs, it can only have one output.

The most commonly used neural network in the literature is called feedforward ANN. This network fundamentally consists of an input, a latent and an output layer. Function of the input layer is to process the information in the input layer. Since the latent layer contains neither input nor output data and the output of the latent layer is usually not known to the user, it is referred to by this name. The output layer is, where the results of the system are represented. These networks, which use controlled learning by researchers, are called Multilayer Perceptron's (MLPs) (Öztemel, 2003). A standard MLP is shown in Figure 4.



Figure 4. Feedforward MLP-ANN

In this study, the process of modeling with ANN and estimating the effects of COVID-19 data shared by the Ministry of Health of the Turkish Republic for Turkey on e-commerce sites has been applied. Four business-to-consumer (B2C) and consumer-to-consumer (C2C) e-commerce websites operating in Turkey were selected in the study, with an average of more than 5 million monthly visitors (n11.com, hepsiburada.com, sahibinden.com, gittigidiyor.com). 64 records from March 11th 2020, when the first case in Turkey was seen, until May 13th 2020, when the study was carried out, was utilized. New case, total case, new death, total death, new recovery, total recovery, intubation, intensive care, total test columns in these lines are determined as the input value of ANN. The number of visitors of the site on that day was taken as the output value. The network designs were separately made for the estimation of each website. Which is way, ANN was modeled in 4 different structures consisting of 9 inputs and 1 output. There are 3 latent layers in the network structure and 30 neurons can be found placed in each layer. The designed ANN structure is given in Figure 5.



Figure 5: ANN structures designed within the scope of the study

For the study implementation, the Knime open source package software, which is frequently used in the literature and very effective in modeling data science, was used. 70% (51 records) of the obtained data was used for the training of the designed ANN and the remaining 30% (13 records) dataset was used for the system test. The cross-validation method, which is used to prove the modeling validity of samples with low data amount in the literature, was additionally applied in the study. The data were arbitrarily divided into 4 equal parts (4 sets of 16 records for a total 64 records) and the training-test process was repeated 4 times. The data were replaced in each training-test process. In this way, all the data used in the study were subjected to training and testing, thus demonstrating the validity of the system. Structure of the designed system and its design in the software are shown in Figure 6.



Figure 6: Network structure designed within the scope of the study

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Results

ANN learning coefficient was determined as 0.001 and 10.000 steps were run. Since the cross verification value designed separately for each web-site is 4, it was run 4 times with these settings and the results were logged in. Mean Squared Error (MSE) (Gupta, 2009), Coefficient of Determination (\mathbb{R}^2) (Nagelkerke, 1991), Mean Absolute Error (MAE) (Chai and Draxler, 2014). evaluation metrics were utilized, which are frequently used in the literature for the evaluation of the system. MSE, \mathbb{R}^2 and MAE indications are shown in Equation 1-3. The n used in the equation represents the number of samples, y_i represents the values that should be determined, \hat{y}_i represents the estimated values. SS_{RES} indicates the sum of residue squares or the remaining sum of squares, SS_{TOT} indicats the sum of squares (it is proportional to the variance of the data).

$$MSE = \frac{1}{n} \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$
(1)

$$MAE = \frac{1}{n} \sum_{i=1}^{n} |y_i - \hat{y}_i|$$
(2)

$$R^{2} = 1 - \frac{SS_{RES}}{SS_{TOT}} = 1 - \frac{\sum_{i=1}^{n} (\hat{y}_{i} - \bar{y})^{2}}{\sum_{i=1}^{n} (y_{i} - \bar{y})^{2}}$$
(3)

Values created using evaluation metrics are constituted by taking the averages of the system that is run 4 times. The test result set created for each website is given in Table 5.

Table 5. System test results							
	MSE	MAE	R2				
n11.com	0.001	0.017	0.896				
hepsiburada.com	0.001	0.014	0.910				
sahibinden.com	0.000	0.008	0.992				
gittigidiyor.com	0.001	0.006	0.773				

Moreover, Table 6 shows 5 randomly selected results for each web page, containing actual values and estimated values.

Table 6: System test results								
	New		Intubation	Intensive Care	Total	Real	Predicted	Difference
	Case	••••	Intubation		Test	Values	Values	Difference
	2786		867	1251	141716	299244	301426	-2182
	4281		1052	1820	477716	335280	336972	-1692
n11.com	3977		1031	1922	634277	380643	378736	+1907
	1848		653	1219	1298806	514899	514994	-95
	168		0	0	11998	434770	434000	+770
_	2704		622	847	92403	401255	402929	-1674
	5138		1021	1626	340380	500813	500698	+115
hepsiburada.com	2188		818	1480	1075048	686872	686798	+74
_	1542		598	1154	1370598	658286	656308	+1978
	4674		1033	1909	673980	588101	586895	+1206
_	1610		523	725	76981	789600	788718	+882
_	1832		707	1338	1204421	610370	610914	-544
sahibinden.com	93		0	0	10017	905832	904235	+1597
_	4062		1087	1809	443626	623936	625810	-1874
	2131		882	1736	918885	572277	569805	+2472
	3135		935	1381	181445	167082	167385	-303
-	3783		1054	1894	598933	171344	171289	+55
gittigidiyor.com	3122		929	1790	830257	178121	177228	+893
	2615		803	1514	1033617	174735	175237	-502
	4353		1014	1845	558413	171062	170404	+658

Conclusion and Discussion

Due to the advantages e-commerce has provided in technology, it has affected human life from the field of trade as well as in important fields such as health, education and transportation. While the concept of traditional trade includes business-to-consumer and business-to-business concepts, as the internet has entered our lives, it has started to take place in our life in consumer-toconsumer trade.

In traditional trade, there are difficulties such as transportation, logistics and advertisement for sellers, and for consumers there are difficulties such as comparison, cheap price and quality product. Sellers can sell their products in their own region and at certain times; consumers were able to shop at certain time intervals and close to their locations. All these difficulties disappeared with the concept of e-commerce. The demand for e-commerce sites, which offer shopping opportunities regardless of when and where, is increasing day by day and the number of e-commerce sites is increasing rapidly in proportion to this demand. The number of daily visitors has reached millions due to the advantages offered by e-commerce sites such as time saving, comparison opportunities and price advantages to their clients. Health affects human life in many areas, just as it does in human shopping preferences and priorities.

In the study conducted, a model was developed to estimate the number of consumers visiting e-commerce sites during the COVID-19 process from March 11th 2020 until May 13th 2020, when the first case of COVID-19 was observed in Turkey. Since the data could be obtained from the date the pandemic started, all data available through the cross-validation test were used both in the training and testing stages, since there were not that many of them. This method has enabled the data to give more accurate and reliable results. The pandemic data used in the study were obtained from the website of the Ministry of Health of the Turkish Republic.

Monthly number of visitors was taken into consideration from the selection of e-commerce sites used in the developed model. The visitor data of the 4 e-commerce web-sites with more than 5 million monthly users in Turkey were used. Operating in business-to-consumer (B2C) and consumer-to-consumer (C2C) e-commerce types, N11.com, Hepsiburada.com, sahibinden.com and gittigidiyor.com sites were used in the study. Daily visitor numbers have been used from the pandemic start date of these sites until the day of the study. A model based on Neural Networks was proposed for the estimation of the system and a separate design was made for each e-commerce site. R^2 , MSE and MAE values were used for the analysis of test results.

The R^2 value is used to indicate how much of the variation in one variable is explained by the other variable. The average R^2 value of the system designed as a result of the test was 90%. This value shows that 90% of the change in the number of visitors, which is our dependent variable, can be explained by the pandemic statistical data in the system we designed. This result is successful and acceptable for studies in the field of ANN. Another method we use to measure the predictive performance of our model, MSE value, is used to indicate how close the regression curve is to a number of points. The average MSE value was 0.001 and our model is considered successful because it is considered that the models close to zero perform well. MAE value, which is the last method we use to test our model, is used to measure the difference between two continuous variables. The average MAE value of our model was 0.014. Our model is a successful model according to MAE since low value models are accepted to perform better.

 R^2 , MSE and MAE values are accepted as a success that we have used to measure the success of the model we have developed. Our dependent variable in our model can be explained and estimated with our independent variables.

The main reason for the increase or decrease in the measures taken during the pandemic is the statistical information taken by the Ministry of Health of the Turkish Republic and used in our

study. Citizens and Science Committee interpret the increase and decrease of the outbreak according to this information. According to this information, a series of precautions are taken or there is a blindness.

The change in interest in e-commerce sites during the pandemic was interpreted as follows: When the pandemic started, people's interest in e-commerce sites decreased due to the risk of virus transmission of the cargo services and the delivery of the cargo in a long time. When there was a curfew, he turned to e-commerce for the compulsory shopping of people. In addition, when shopping malls and trade centers are closed and shopping is risky, people have turned to e-commerce sites.

Thanks to this study, it was seen that health problems, anxieties, quarantine process and panic environment affect people's shopping preferences. The number of consumers visiting e-commerce sites can be estimated using new cases, total cases, new deaths, total deaths, new recovery, total recovery, intubation, intensive care and total test numbers that change during the pandemic.

The change in the number of visitors of e-commerce sites directly affects their sales amounts and turnovers. Thanks to the model developed in this study, e-commerce sites will be able to predict the changes in the number of visitors by using the statistical data that change during COVID-19. Thereby, companies will be able to plan the number of employees, campaigns, investments and other different expenses appropriately.

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