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EVALUATION AND ANALYSIS OF ACTIVITY IN SOCIAL NETWORKS IN THE CONTEXT OF THE DIGITAL ECONOMY DEVELOPMENT

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Introduction. In recent years, the Ukrainian economy has been rapidly gaining the leverage of the digital economy, with virtual products created through cloud services, social networks and virtual communications becoming the drivers of development. In these circumstances, the task of evaluating and analysing user activity on social networks, conducting constant monitoring of the number of readers, their groups, reflection and effectiveness of the published publication becomes relevant. That is why today, in the digital economy, special attention should be paid to research on user activity on social networks.

Aim and tasks. The purpose of the article is to study the features of user activity within the model of digital economy, which defined the following tasks: 1) study the principles of the digital economy and the role of social networks; 2) analysing user activity within a specific social network account; 3) development of an approach to activity evaluation based on detailed minute-by-minute data collection on the number of user interactions with each other.

Results. The article examines the impact of activity within a specific account on user choice on the Instagram social network. The best way to gather information on the number of likes and comments you posted under a post has been installed and successfully implemented. The fastest and most effective algorithms for storing, processing, analysing, and cost-effectively evaluating the collected user activity data within a specific account have been researched, substantiated and implemented.

Conclusions. An approach to assessing and analysing user activity within a specific social network account is proposed to be implement into the Digital Economy Model. The proposed approach allows us to collect, detailed manner, the number of Instagram user interactions with the last post in your account, as well as estimate of their growth trends, compare them with the information collected in the past or to the average over the selected period.

Keywords: digital economy, social networks, evaluation, activity analysis.

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ОЦІНЮВАННЯ ТА АНАЛІЗ АКТИВНОСТІ В СОЦІАЛЬНИХ МЕРЕЖАХ У КОНТЕКСТІ РОЗВИТКУ ЦИФРОВОЇ ЕКОНОМІКИ

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Вступ. Упродовж останніх років економіка України стрімко набуває рис цифрової економіки, драйверами розвитку якої стають віртуальні продукти, створені за допомогою хмарних сервісів, соціальних мереж та віртуальних комунікацій. У цих умовах набуває актуальності завдання оцінювання та аналізу активності користувачів у соціальних мережах, проведення постійного моніторингу кількості читачів, їх груп, рефлексії та ефективності розміщеної публікації. Тому саме сьогодні у період формування цифрової економіки особливу увагу необхідно зосередити на дослідженнях активності користувачів в соціальних мережах.

Мета і завдання. Метою статті є вивчення особливостей активності користувачів в межах моделі цифрової економіки, що визначило наступні завдання: 1) вивчення засад цифрової економіки та ролі соціальних мереж; 2) аналізування активності користувачів в межах певного облікового запису у соціальній мережі; 3) розробка підходу до оцінювання активності, що базуються на деталізованому щохвилинному зборі даних про кількість взаємодій користувачів між собою.

Результати. У статті проаналізовано вплив активності в межах певного облікового запису на вибір користувачів у соціальній мережі Інстаграм. Встановлено та успішно реалізовано найкращий спосіб для збору інформації про кількість позначок «Мені подобається» та коментарів під публікацією. Досліджено, обґрунтовано та впроваджено на практиці найшвидші та найефективніші алгоритми для збереження, опрацювання, аналізу та економічного оцінювання зібраних даних про активність користувачів в межах певного облікового запису.

Висновки. Для реалізації моделі розвитку цифрової економіки запропоновано підхід до оцінювання та аналізу активності користувачів в межах певного облікового запису у соціальній мережі. Запропонований підхід дає змогу зібрати в розгорнутому вигляді деталізовані щохвилини дані про кількість взаємодій користувачів платформи Інстаграм з останньою публікацією в обліковому записі, а також оцінити їх динаміку зростання, провести їх порівняння із зібраною інформацією у минулі проміжки часу чи із середнім значенням за обраний період.

Ключові слова: цифрова економіка, соціальні мережі, оцінювання, аналіз активності.

Introduction. In recent years, the Ukrainian economy has been rapidly gaining the leverage of the digital economy, with virtual products created through cloud services, social networks and virtual communications becoming the drivers of development. In these circumstances, the task of evaluating and analysing user activity on social networks, conducting constant monitoring of the number of readers, their groups, reflection and effectiveness of the published publication becomes relevant. That is why today, in the digital economy, special attention should be paid to research on user activity on social networks.

Analysis recent research and publications. The problems of the digital economy have been explored by both domestic and foreign authors [1; 2; 3], where a key indicator of this type of economy is the availability of digital data resources and transactions on the network. Some authors [1; 3] share the existence of both digital and information technology, which include: various electronic technologies, unmanned technologies, robotics, 3D printing, biometric technologies, quantum technologies, artificial intelligence, big data processing, cloud computing, blockchain, identification technologies and more. However, everyone agrees that this contributes to improving the productivity of economic activity and increase the well-being of the planet's population.

Among the tools for promoting products produced under Industry 4.0, the authors believe [3; 4], is Internet marketing (digital marketing). The basic tool for this are social networks. Problems of development of social networks were researched by Danko, Halych and Kirpatrick [4], that considers social networks an environment for communication, both mass and internal. Halych's research [5] focuses on typing social networks and analyzing their impact on society. The works of Kirpatrick [6] are devoted to the study of approaches to the evaluation of information resources and their impact on the society, which proposes a method of calculating the potential and true sociality of an online resource. In the works of Bublyk [7-8] considered the principles of economic evaluation of complex economic phenomena, where in [9] proposed to use expert systems based on fuzzy logic models.

In general, a social network is considered to be any interactive, website with a large number of users who self-fill its content, talking about their chosen topic. According to the authors of work [10], social networks have been transformed into tools for conducting business, finding clients or working. Social networks have become a factor in the development of society, which has led to their division into public and private [11], entertaining, recreational, professional (search for work, partners, development of scientific cooperation, etc.) [12]. Among the indicators that measure the level of the social network are the duration and frequency of visits, which is calculated over an average period of time (day, week) [13], the number of visitors. Many researchers [14-15] draw attention to such an interesting indicator - the amount of "Like", which indicates the positive attitude of social network users to the content of the message and socializes the website [16].

However, it should be noted that the problem of evaluating and analyzing user activity on social networks, conducting constant monitoring of the number of readers, their groups, reflection and effectiveness of the publication published there, has not been systematically explained in the works of foreign and domestic scientists.

That is why today, in the digital economy, special attention should be paid to research on user activity on social networks.

Aim and tasks. The purpose of the article is to study the features of user activity within the model of digital economy, which defined the following tasks: 1) study the principles of the digital economy and the role of social networks; 2) analysing user activity within a specific social network account; 3) development of an approach to activity evaluation based on detailed minute-by-minute data collection on the number of user interactions with each other.

Results. To date, the Instagram social network has one of the leading positions in the total number of registered accounts and the number of active users during the month. Each and every time more and more users want to gain popularity, they need to understand what, at this point in time, their account development opportunities are.

Often, the reasons behind the popularity are dramatically different from one user to another. Some users may want to gain additional (or even basic) earnings, while others may simply gain recognition in certain circles. However, regardless of the purpose of each user, they all need to obtain statistics about their account, analyze the data obtained in order to further evaluate the relevance of their publications in order to make in the future relevant clear conclusions about what types of publications are better interacted with, or just random individuals. According to experts, in the coming years the popularity of this resource will only increase and will be able to cover more different areas of activity.

Due to the increasing popularity of this social network, users are creating more accounts for greater benefit, so development prospects can be attributed to the increasing number of publications that can be constantly analyzed, combining the data obtained from different accounts of one user for more deep analysis. Also promising areas are the introduction of deep machine learning to handle not only numbers, but also a combination of understanding or classification of an object in a photo of a particular publication, and of course, analyzing the textual description found under the photo.

Due to the huge increase in Instagram users and the incredible proliferation of smartphones with high quality cameras, it allows you to create content for your user account without spending extra on expensive equipment such as cameras and camcorders. This leads to an increase in the number of both commercial and private projects requiring a systematic, minute-by-minute analysis of the number of user interactions with the relevant published post.

There are now many different tools available on the market to automatically manage, promote, and collect statistics on relevant accounts and publications on the social network under study [17-18]. But most services that provide such services are paid, and most importantly, require users to provide them with sensitive account password information. Also, all such services are more focused on generating revenue from people who still need to transfer their private data, rather than focusing on providing the highest quality data analysis and evaluation services. They do not guarantee that personal information will be kept secret or that your account will not be locked by Instagram due to a violation of our Terms of Service, which strictly prohibits any automated activities.

It should also be noted that such services cannot collect information every minute or more because they manage a large number of accounts at once, and because of this, Instagram places a limit on the number of identical requests because it defines such accounts as suspicious and managed by automated software security. Don't forget that Instagram itself also provides some statistics that are unique and, unfortunately, inaccessible from external sources, but they are not detailed and reflect only the big picture.

Currently, there are many services that provide statistics collection and analysis services to evaluate the performance of Instagram posts. Now let's take a closer look at which services provide what services and their advantages and disadvantages.

One of the most popular services is Picalytics, which defines itself as a deep analytics service that accurately and clearly displays all activity information in a business profile. It also lets you know how well your competitors' accounts work.

The following points will be included in the advantages:

1. The ability to recognize real users and so-called bots in the readers of your profile.

This feature can be used not only to understand how much of your audience is absolutely "dead" and in no way engaging with your posts, but also to see how effective your account advertising will be in another profile.

2. Calculating the number of received and lost readers.

This metric lets you know the number of people who signed up and unsubscribed from your account in the last day. Immediately you can point out the disadvantages, namely, these statistics are provided only by day, so there is no way to get more detailed information, such as by day or hour, which is very important when publishing a new post.

3. Display the list of photos with the most likes.

With this data, you can gauge what content is in the posts and what photos have caused the most reaction from your readers.

4. Choosing the best time to publish a record.

This data helps you decide what time of day it is best to post a new post on the social network, that is, when the greatest number of your regular readers find the web and interact with your post.

Now it is also worth noting the disadvantages inherent in this service, namely, there are no detailed statistics, all the data are aggregated and graded by a maximum of hours, and for no minutes, or something more often than a minute and there is no language. Also, we cannot guarantee that the service stores all of your collected account information securely and confidentially, as this web service allows us to obtain data about competitors as well, of course, someone will be able to obtain data about us as well, i.e. we give away our competitors for free all the analytics done for your own account. And the main disadvantage is that this service is paid and requires little money to get even such a meager set of analytical data.

To compare, for example, another similar service, minter.io, in fact all services currently operating in this field have the most similar functions and capabilities, all determined by the fact that they all receive data from the same sources and use similar functions and algorithms.

So going back to the minter.io web service, it’s possible to point out these basic ones, and again these are account audience growth statistics, but these data are only detailed by day again, and it is not possible to get values for specific hours in either the free trial or during the free trial. paid subscription. With the new features of this service, you need to add an account reader engagement rate. This coefficient can be calculated both on the likes and comments counts, and can also aggregate all this data. As usual, statistics are provided on the countries where new readers are most likely to come from, their gender and their approximate age.

The activity schedule of readers is already displayed not by hours as in the past service, but even less precisely by several periods in the afternoon, which obviously does not allow to estimate and determine the correct time for new publication in the account.

In addition to all the drawbacks of not being able to retrieve real-time statistics about the last post and analyze immediately, you need to add and that it is not possible to manage multiple accounts at once. Also, this service is not suitable for people who maintain accounts for small businesses, because the price of a paid subscription is just too high. Another downside is that you can only sign up for an account that has a "business account" setting in your settings, that is, an ordinary person with an ordinary account type who just wants to get more statistical information, and even minimally analyze their activity in this social network will not be able to do this.

And finally, you can use a service like Application for comparison. This is one of the most amazing services in the field of services. It provides very unambiguous statistics and in a very unambiguous way, perhaps for someone it will be a plus, but more an exception than the choice of the majority. To begin with, the set for analysis is very sparse and contains only a few points, namely potential audience reach, that is, not even real data at the moment, but some ephemeral data that is not clear by what algorithms were calculated and what was the basis for that. The subscriber engagement rate is again calculated, but this time there is no clear formula for this indicator, so we cannot verify whether even this data is true. And finally, you don't need a feature that allows you to see only the total number of photos and videos on your account, it's a built-in feature across all Instagram accounts. And the biggest downside is that all these statistics cannot be viewed on the web site itself, it comes only once a day at a clearly defined time in the form of a simple e-mail that does not detail all of the above data. Of course, there is no need to speak about this kind of security of your data if the service treats its customers and most importantly requires you to buy a subscription, since neither a trial period nor a free set of functions is provided.

So to summarize the comparison, it can be noted that there are many companies on the market that provide analysis and evaluation services for social media posts on Instagram, but all these services are paid, sometimes they do not even have a free trial period, work with unknown algorithms and even do not can ensure the integrity and reliability of your sensitive data.

So, as a result, it can be argued that research in this field is worth pursuing, because Instagram services are developing at a very fast pace and there is an influx of very large numbers of new users, and the services market in this area is only developed for very large accounts, which are run for big profits and are usually not run by individuals, but by those companies that have great ability to use paid services. And for this type of non-detailed data there are no particular disadvantages.

But it should be noted that for regular accounts of ordinary users, or small business organizations, this software is being developed is very relevant. This is due to the provision of detailed, clear data for very frequent periods of time, followed by analysis from previous periods. Consideration should also be given to the security of users who do not need to enter any personal data at all from their account to obtain results in the views of analysis and evaluation of statistics. Also, all of this collected data will be stored securely on users' computers and cannot be sold to third parties who wish to obtain other people's account information and use it for their own purposes. And do not forget that this software product will be absolutely free of charge and will be able to replace many of the paid features provided by other services on a monthly subscription.

The novelty of this software is to admit that in order to collect information, do not need to transfer your private data to third parties, and do not even need to enter such data in the developed software. Not only does it provide complete security and protection against the loss of account access or theft of sensitive information by attackers, it also makes it impossible to get your account blocked on this social network since all requests are not related to any user. It is also worth noting that since each user can run the program on their own computer and only monitor their account, it allows to increase the number of data updates up to several times per minute. For this, a semi-anonymous method is used when Instagram identifies a software tool as a real person, but at the same time receives no additional information, or this information constantly changes from one request to another. Also, for privacy reasons, all collected data is stored only on the user's computer and again, is not accessible by any third parties. This is a great advantage of the developed software and can be considered a novelty in this area, because before that all such collected data could be sold by companies (services) to other interested parties.

Issues within a given field include the need to obtain detailed personal statistics and analytics regarding posts on the Instagram social network, without opening private and confidential data to third parties, and spending it at their own expense. There are currently two ways to get services for this issue, the first is a free method that will provide only generic data that is as detailed as possible by day and only by the number of readers, and the second is paid services that already display more detailed statistics, but will not conduct any analysis or evaluation of the quality of the publication you made.

In our case, can only define one feature of the software that is being developed, "Selecting an Account to Analyze," not at the user level, but at the user level. We will describe this function further. The values of the coefficients are shown in table 1. And the values of the parameters relative to the defined function are located in table 2.

Table 1. The value of the coefficients of complexity

Parameter	Easy	Medium	Difficult
Exterior entrances	3	4	6
Exterior exits	4	5	7
External requests	3	4	6
Internal logical files	7	10	15
External logical files	5	7	10

Source: author's own calculations

Table 2.Parameter values

Parameter	Easy		Medium		Difficult	
	Number	Coefficient	Number	Coefficient	Number	Coefficient
Exterior entrances	1	3	0	4	0	6
Exterior exits	1	4	2	5	1	7
External requests	1	3	0	4	0	6
Internal logical files	0	7	1	10		15
External logical files	0	5	1	7	0	10

Source: author's own calculations

Accordingly, the size of the function will be equal to:

*AF=1*3+1*4+2*5+1*7+1*3+1*10+1*7=44*

This number is a preliminary estimate and requires adjustment by weighting each project characteristic. In addition to the functional requirements of the product imposed system-wide requirements, which limit the developers in the choice of solutions and increase the complexity of development. An equalization factor (VAF) is used to account for this complexity. Its value depends on 14 parameters. These parameters are rated on a scale of 0 to 5. These characteristics are shown in Table 3.

Table 3.Characteristics value

Characteristic	Value	Characteristic	Value
1	3	8	0
2	0	9	2
3	2	10	5
4	0	11	0
5	0	12	0
6	0	13	0
7	0	14	0

Source: author's own calculations

The calculation of the total effect of 14 system characteristics (total degree of influenza, TDI) is a simple summation and equal to 12.

The specified functional size is calculated by the formula:

$$VAF = AF * (0{,}65 + 0{,}01 * TDI)$$

Given the specified functional size of the function, the choice of method is as follows:

$$VAF = 44 * (0{,}65 + 0{,}01 * 12) = 33{,}88$$

The resulting VAF value can then be converted to a unit of measure of software volume, or a performance assessment can be made, based on which project labor complexity can be estimated [19].

The first one shows the account information: the number of readers and the number you follow. The following is the main information about a post that contains a unique Instagram ID, as well as the exact time and date of the post. The following line shows the time and date when the latest Instagram post information about the post was received and the number of minutes that elapsed from the time of posting to the time of the request.

After all the technical information has been displayed, the information about the analytics that was conducted over all the collected data is displayed. First of all, the analysis and evaluation are conducted because there are two main points on which users can interact with the publication: "I like the comments" and "the comments". The values of these two parameters, which were obtained when prompted for Instagram service, are immediately displayed.

Due to the fact that this software stores all the data in the database, we have the opportunity to get the minimum, maximum and average values of the amount of "I like" and comments. With access to such data, we can safely analyze the status of a new publication based on past data and evaluate how much better or worse is the coverage of that publication.

In the proposed approach, after the current value of "I like" and comments reflects an increase in the amount of past requests made by the software, also indicates the percentage value of this increase under the current number of "I like". When the number of comments is displayed, the information in brackets is identical.

The program window then displays information on the minimum, maximum and average "likes" or comments, respectively. Each corresponding number in square brackets indicates the difference from the given number to the current number that was obtained when requesting the Instagram service. Also, this difference is calculated as a percentage, which simplifies the perception and understanding of the user not only the number but also the relationship between the data. Also, for better visualization for better user perception, this line is colored in red or green, depending on whether the number of comments is less or larger, respectively.

Having analyzed the data thus obtained, we can now make an appropriate assessment. So, the next line shows three estimates for each of the parameters (minimum, maximum and average). Each score can be in three different states, namely, "Below", "Just Like", and "Greater than". At the end of these messages is added the name of the parameter that was evaluated.

Just like in the past, their color changes quickly for a clear understanding of such estimates. In the case of "Below From" the text is colored in red, "Just as" – in white and in the case of "More than" – in green.

These parameters also give a score in points, which is signed as "Rating" and has a numeric integer value. It can acquire positive or negative values and also be colored in green or red, respectively. The comments each have their own rating, which is then summarized, which is due to the fact that for Instagram social network these options are the same in importance. The summary value is displayed in the last line and also has the ability to change the color from positive or negative to green and red respectively. The testing and validation of the created software product was successful, the finished project fully meets the expectations and needs. All features are fully implemented.

Conclusions. An approach to assessing and analysing user activity within a specific social network account is proposed to implement the Digital Economy Model. The proposed approach allows us to collect, in a detailed, detailed manner, the number of Instagram user interactions with the last post in your account, as well as estimate their growth trends, compare them with the information collected in the past or the average over the selected period.

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