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ASSESSMENT OF THE REVIEURS QUALITY ON THE BASE OF QUALIMETRIC METHOD «THE VALUE OF OPINION»

The paper considers relevance of the subject, dealing with the assessment of the reviews quality, based on the qualimetric method in 2022 within the frame of the market places development, where greater share of purchases takes place after reviews analysis. Quality assessment can be used for the improvement of the quality of recommendation systems.

For the investigation the largest reviews data base in Ukraine on the platform for the motor vehicles search in Ukraine – Automoto.ua was used.

***Aim of the research** is assessment and improvement the reviews quality, systematization of the quality parameters of reviews analysis for their application in the development of the recommendation systems on the base of the qualimetric method and facilities. Available scientific substantiation for the assessment of reviews quality on the base of the qualimetric approach of the reviews analysis, which is the base for the algorithm of motor vehicles recommendations on the base of users "opinion" is – "The Value of Opinion" and for the introduction of the qualimetric method «Cyclogram of reviews quality "The Value of Opinion"».*

***Scientific task** includes: arrangement of the automated collection of the reviews about the motor vehicles in one data base (parsing), systematization of the reviews quality indices on the base of qualimetric method within the frame of parsing; development of new indices of reviews quality indices, based on qualimetric approach; assessment of reviews quality; conclusion, regarding the rationality of usage the index "The Value of Opinion" for the development of the recommendation systems of the collaborate filtering, which comprises the assessment of the users "opinion".*

The expedience of using qualimetric method for reviews quality assessment is characterized. The importance of the reviews of the motor vehicles is described. The usage of machine learning technology for reviews processing within the frame of the set task has been considered.

New qualimetric approach to the reviews quality measuring as a part of data, the recommendation algorithms of modern recommendation systems will be based on, has been considered in the given scientific work. The suggested system of reviews quality assessment in the format «Cyclogram of reviews quality "The Value of Opinion"» contains the set of eight quality indices of the reviews about the motor vehicles. The importance of the given study for business-tasks has been described. Conclusions and final opinions on the scientific work have been formulated.

***Key words:** review, recommendation system, collaborate filtering, quality, qualimetrics, metrix.*

Introduction

Recommendation systems are classified according to the method of the material selection, the user requires. Two basic approaches are mainly used: collaborate filtering and content filtering. Also there exists hybrid filtration, which combines both collaborate and content filtering. In the given study the assessment of the reviews quality is considered as the fundamental parameter for hybrid collaborate filtering on the base of the reviews.

Relevance of the subject of the research. Main drawback of the collaborate filtering is «cold start», when there are no initial data about the item of the recommendation (Item, is our case is motor vehicle), or user (User, in our case is a person, who searches the motor vehicle). The system is not able to generate efficiently the recommendations if greater part of users do not present their interests in the profile or do not give their consent to the personal data processing while the survey in the Internet. However, this problem can be partially solved, knowing in advance the «opinion» of other users (User, is the seller) about the item (motor vehicle), who wrote the reviews. The results of the survey can be included in the system of the recommendations, simultaneously improving the assessment of the quality of the reviews and recommendations.

The relevance of the subject is that on April 11, 2022 the searching system Google updated the core of the searching algorithm under the title «Google product reviews update 2022» [1]. This algorithm fundamentally changes the principle of sites ranking, as first of all it takes into account

the reviews about the items and then takes into consideration the characteristics. That is, the information from the buyer is no less important than the information from the seller (description of the item).

Aim and scientific tasks. **Aim of the research** is the assessment of the reviews quality on the base of the qualimetric method of study. Scientific substantiation is in the fact, that there is no unified indices of the reviews quality, which can be used for the improvement of the quality of the recommendation systems.

For the realization of the aim of the research, the following tasks are to be performed:

- arrange the automated collection of the reviews about the motor vehicles in one data base (parsing);
- formulate the parameters for the determination of the reviews quality, which can be used for the improvement of the recommendations;
- systematize the reviews quality indices on the base of the qualimetric method within the frame of parsing;
- propose the qualimetric method of the reviews quality assessment for the evaluation of the users "opinion" – «Cyclogram of the reviews quality "The Value of Opinion"»;
- perform the assessment of the reviews quality to determine the qualimetric index "The Value of Opinion".

Object of the research is the site-aggregator of the motor vehicle search in – Automoto.ua. This searching system is specialized in the search of ads of motor vehicles, bikes, motor-cycles, special vehicles and other transport facilities in Ukraine. Automoto.ua enables to perform searching of the proposals regarding the selling of the motor vehicles all over Ukraine, providing maximally complete and actual results. Nowadays the site processes the information from 100 autosites of Ukraine. Every day more than 250 000 ads are in the database, 9 – 16 thousand of which are new acquisitions.

Subject of the research is qualemetric method of reviews quality assessment.

Results of the research

Already existing recommendation system analysis only the behaviour of the «potential buyers», but does not take into account the data from the «real owners» (non-sellers) [2]. Also, the problem of «cold start» is present. That is why, the algorithms of the collaborate filtering must take into consideration the «opinion» of the users on the motor vehicles. It means to collect reviews on the motor vehicles from ten automobile sites of Ukraine and the world and convert the text of the review into the numerical value – «The Value of Opinion», that characterizes the assessment of the reviews quality.

Algorithm of the operation: create the largest in Ukraine sample of the reviews – more than 300 000 reviews; perform the analysis of the whole review, and not only blocks «plus» and «minus; analyze the set of 8 qualimetric matrices, which assess the review quality in a complex maner and formulate complex value «The Value of Opinion»; formulate the conclusion regarding the rationality of the introduction of the index «The Value of Opinion» in the basic form of recommendation systems ranking with the greatest number of ads in Ukraine.

On the base of our studies and experience having analyzed the research, carried out in Ukraine and in the world, we revealed that the recommendation algorithms, which include the analysis of the reviews have some drawbacks:

- Lack of the complex assessment of the review quality;
- There is no correlation of the research impact on real business;
- There is no correlation between the impact of the research and clients usefulness in the

search of the items;

- Lack of the complex assessment of the recommendation quality, based on the qualimetric methods;
- Lack of the systematization and principles of reviews quality determination, which can be used for the improvement of the recommendations.

That is why, within the frame of the qualimetric methods of measuring we introduce the cyclogram of the reviews quality (see Fig. 1), where complex index «The Value of Opinion» is realized [3].

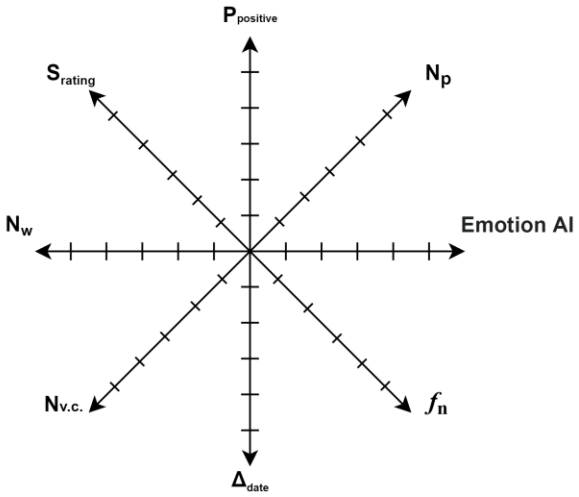


Fig. 1. Cyclogram of the review quality for the construction of the recommendation systems

For the start of studies within the frame of the reviews quality assessment by means of qualimetric method for obtaining the index "The Value of Opinion" the problem of arrangement parsing for 10 subject sites with the reviews on the motor vehicles in a single data base is realized. Also, within the framework of the given research, new section of the site has been developed, it will enable to search the reviews from the whole world in one database.

Minimal viable product (MVP 1.0) is already available on the site Automoto.ua (Fig. 2) under the title «More *N* reviews on the motor vehicles from the whole Internet», where *N* – is a real amount of the reviews.

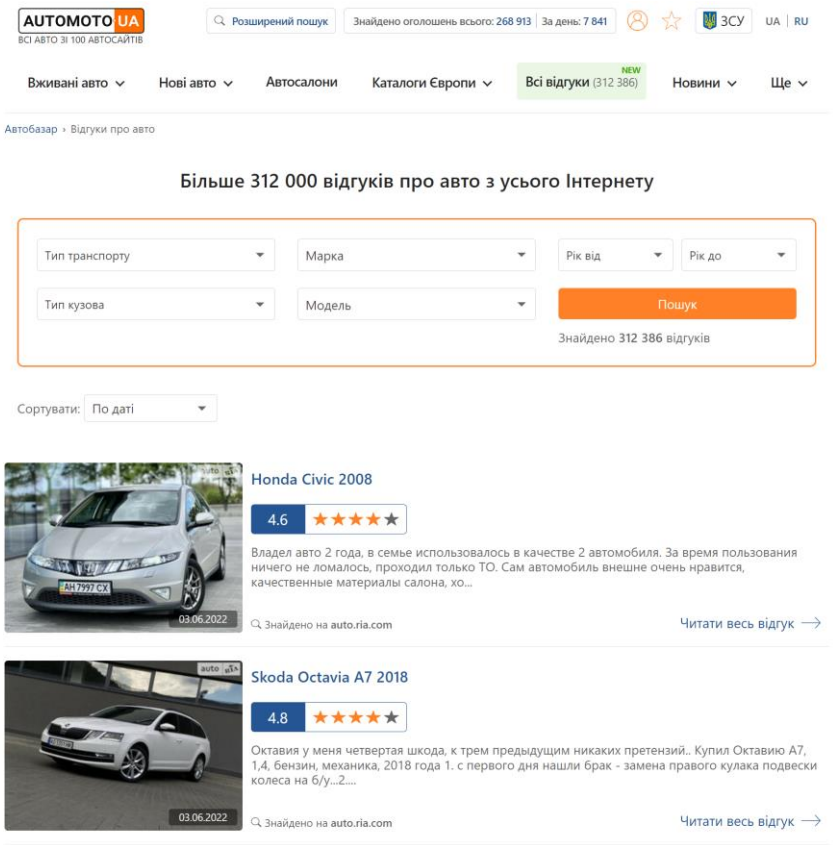


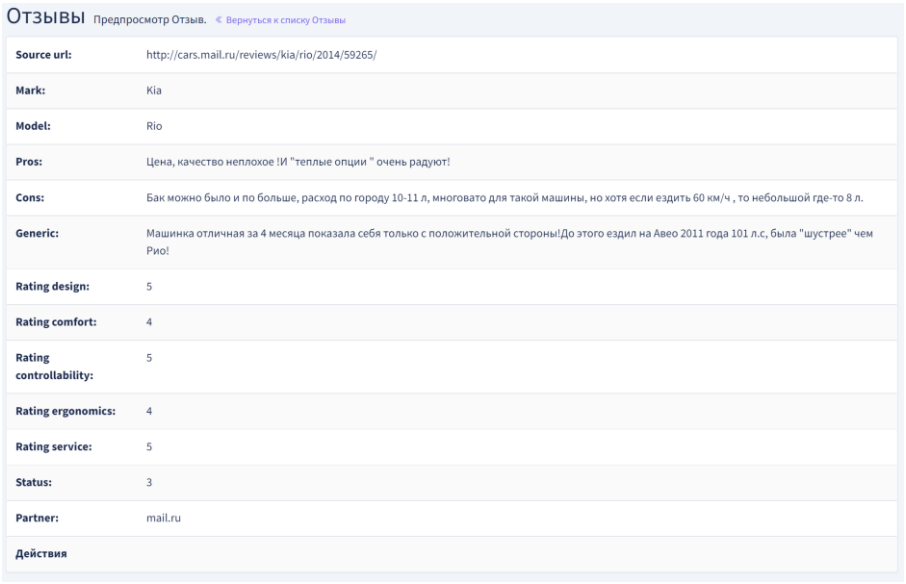
Fig. 2. Section with the reviews on the site Automoto.ua

As on today, this MVP 1.0 product has the greatest number of the reviews on the motor vehicles in Ukraine. According to the forecasts, by the end of the year the number of the reviews in the database will be from 2 mils to 3 mils, and this database will become one of the reviews in the world.

Data, the parsing is adjusted on:

- Name of the site (from which the review is taken from);
- Ratings/assessment (reduced all to one value from 0 to 5);
- Vehicle brand;
- Vehicle model;
- Year of manufacture;
- Author of the review (if available);
- Text of the review;
- Block «Plus/minus», or «Advantages/disadvantages» (if any);
- Photo to the review.

For the convenience of the experiment and content management, data, regarding the reviews were introduced in the control panel of the site in more convenient format. The example of the specific review with structured data is shown in Fig. 3.

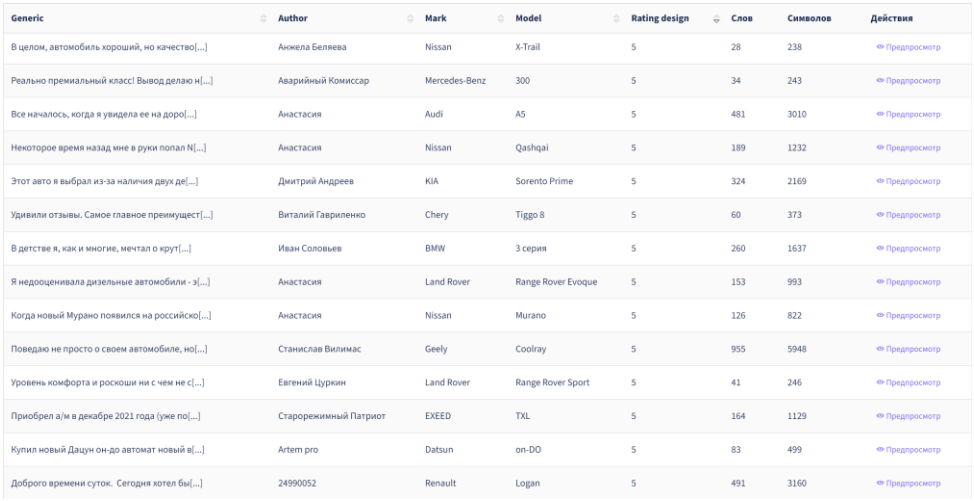


Отзывы Предпросмотр Отзыв. « Вернуться к списку Отзывы

Source url:	http://cars.mail.ru/reviews/kia/rio/2014/59265/
Mark:	Kia
Model:	Rio
Pros:	Цена, качество неплохое !И "теплые опции " очень радуют!
Cons:	Бак можно было и по больше, расход по городу 10-11 л, многовато для такой машины, но хотя если ездить 60 км/ч , то небольшой где-то 8 л.
Generic:	Машинка отличная за 4 месяца показала себя только с положительной стороны!До этого ездил на Авео 2011 года 101 л.с, была "шустрее" чем Рио!
Rating design:	5
Rating comfort:	4
Rating controllability:	5
Rating ergonomics:	4
Rating service:	5
Status:	3
Partner:	mail.ru
Действия	

Fig. 3. Example of the review with all the determined data

Initial calculations of the index «The Value of Opinion» is carried out automatically by each review and indices are shown for further research in the control panel of the site (Fig. 4).



Generic	Author	Mark	Model	Rating design	Слов	Символов	Действия
В целом, автомобиль хороший, но качество(...)	Анжела Беляева	Nissan	X-Trail	5	28	238	Предпросмотр
Реально премиальный класс! Вывод делаю н(...)	Аварийный Комиссар	Mercedes-Benz	300	5	34	243	Предпросмотр
Все началось, когда я увидела ее на доро(...)	Анастасия	Audi	A5	5	481	3010	Предпросмотр
Некоторое время назад мне в руки попал N(...)	Анастасия	Nissan	Qashqai	5	189	1232	Предпросмотр
Этот авто я выбрал из-за наличия двух де(...)	Дмитрий Андреев	KIA	Sorento Prime	5	324	2169	Предпросмотр
Удивили отзывы. Самое главное преимущест(...)	Виталий Гавриленко	Chery	Tiggo 8	5	60	373	Предпросмотр
В детстве я, как и многие, мечтал о крут(...)	Иван Соловьев	BMW	3 серия	5	260	1637	Предпросмотр
Я недооценивала дизельные автомобили - э(...)	Анастасия	Land Rover	Range Rover Evoque	5	153	993	Предпросмотр
Когда новый Мурано появился на российско(...)	Анастасия	Nissan	Murano	5	126	822	Предпросмотр
Поведаю не просто о своем автомобиле, но(...)	Станислав Вилимас	Geely	Coolray	5	955	5948	Предпросмотр
Уровень комфорта и роскоши ни с чем не с(...)	Евгений Цуркин	Land Rover	Range Rover Sport	5	41	246	Предпросмотр
Приобрел а/м в декабре 2021 года (уже по(...)	Старорежимный Патриот	EXEED	TXL	5	164	1129	Предпросмотр
Купил новый Дацун он-до автомат новый в(...)	Artem pro	Datsun	on-DO	5	83	499	Предпросмотр
Доброго времени суток. Сегодня хотел бы(...)	24990052	Renault	Logan	5	491	3160	Предпросмотр

Fig. 4. Example of the reviews set in the control panel of the site

In Fig. 4 it is seen that besides the basic data, regarding the review (text of the review, author, brand, model and rating), other parameters for the research, for instance, number of words and reviews are additionally determined while parsing.

Taking into account the fact that the database contains almost 312 000 reviews, which comprise approximately 312 000 000 symbols (312 million), it allows to make a conclusion that in general, the data are representative for the research. As the number of reviews increases in the data base with every passing day. For certain uncommon models of the motor vehicles there are few reviews or they are missing.

In only 30 days after the release of the first MVP-version of the data the section received more than 30 000 pageviews (Fig. 5) according to Google Analytics. Users viewed approximately 7000 reviews about the specific motor vehicles.

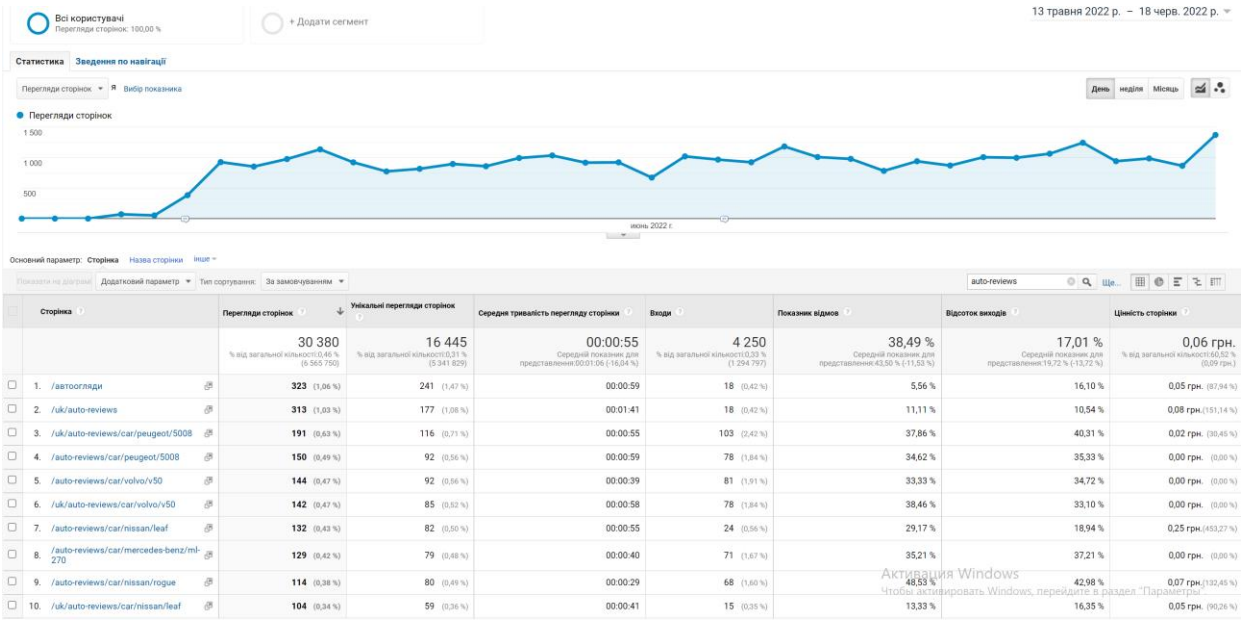


Fig. 5. Statistics of the reviews browsing during 30 days according to Google Analytics

After the successful setting of the reviews parsing, the calculations of all the indices in the cyclogram is performed: N_w, S_{rating}, $P_{positive}$, N_p, *Emotion AI*, f_n, Δ_{Date}, $N_{v.c.}$

$N_{v.c.}$ – (*number of visual content*), it is a binary value on the level of the review and quantitative value on the level of the reviews, that is responsible for the availability of the visual content (photos, video). It provides the additional value and quality of the review for the user and is an important factor of Google quality in the process of the reviews analysis.

N_w – is a number of words in the written review from the owner. The more words the more qualitative is the review from the point of view of the description completeness and characteristic of the item.

S_{rating} – is an average assessment of the item by the user, set during the review writing. As a rule, assessment is in the range from 1 to 5.

$\mathbf{N_p}$ – is **a** total number of the reviews about the selected brand/model/year of manufacture of the motor vehicle, which were found for the recommendations. This index is necessary for understanding the impact of the number of reviews on the general ranking formula. In case of small number of the reviews regarding the specific models of the motor vehicles the impact on the recommendations will be less, as the representativity decreases.

Indices N_w *(*number of words in the review), S_{rating} (assessment of the motor vehicle owner), N_p (number of the reviews about the brand/model/year of manufacture) are calculated immediately at ads parsing and are presented in the control panel of the site in the section of the reviews. The example is shown in Fig. 6.

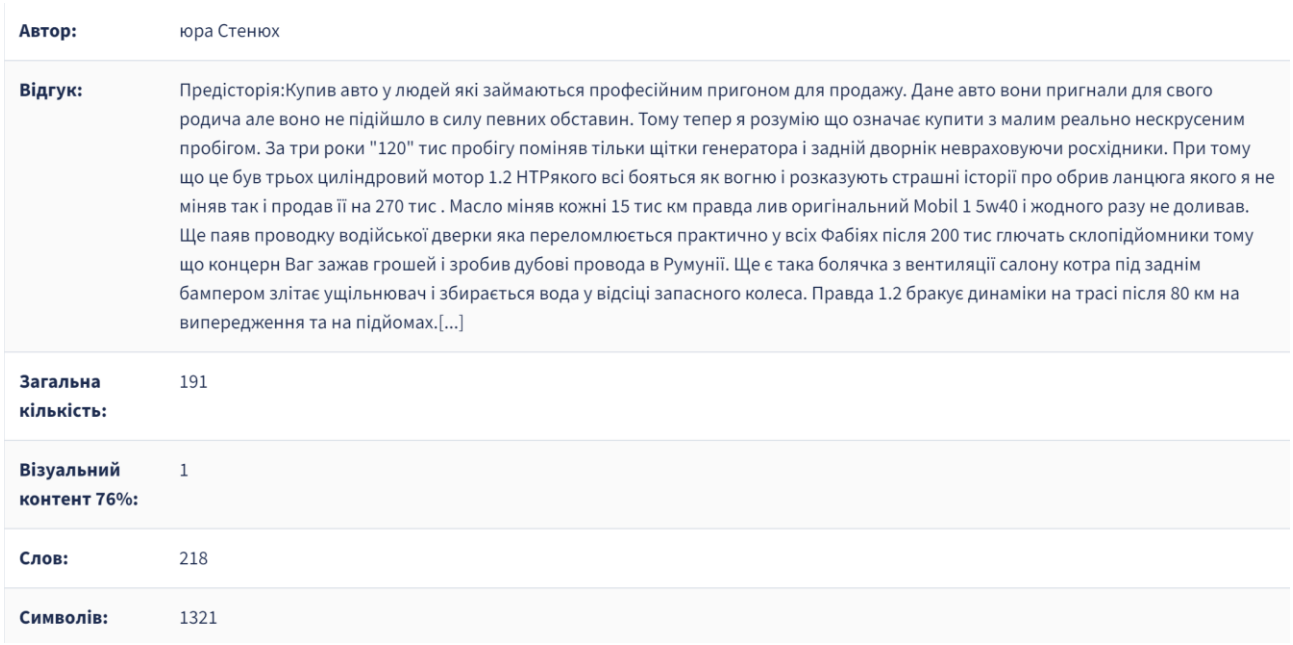


Fig. 6. Indices of the review quality in the control panel of the site

$P_{positive}$ – is the percent of the positive opinions (words, statements, word-combinations) about the motor vehicle. The index is needed for the basic understanding if the owner liked the motor vehicle.

$$\boldsymbol{P_{positive}} = \frac{\boldsymbol{N_{positive\ opinion}}}{\boldsymbol{N_{positive\ opinion}} + \boldsymbol{N_{negative\ opinion}}}; \quad (1)$$

For measuring $\boldsymbol{P_{positive}}$ it is necessary to create the semantic core of equally divided positive and negative words, which will be read during the analysis of each review. The example of the semantic core in presented in Table 1.

Table 1

Semantic core

	Positive opinion	***Negative opinion***
1.	Low fuel consumption	High fuel consumption
2.	Engine does not need repair after 100 000 km	Engine needs repair after 100 000 km
3.	Gear box functions well	Gear box functions bad
N	…..	…..
50.	Nozzle was replaced two times	Nozzle was not replaced

$\boldsymbol{P_{positive}}$ is basic index that does not complicate the calculations of the review quality but functions as a stabilizing parameter for *Emotion AI*, where complex solution is realized. For instance, simple review in Fig. 7.

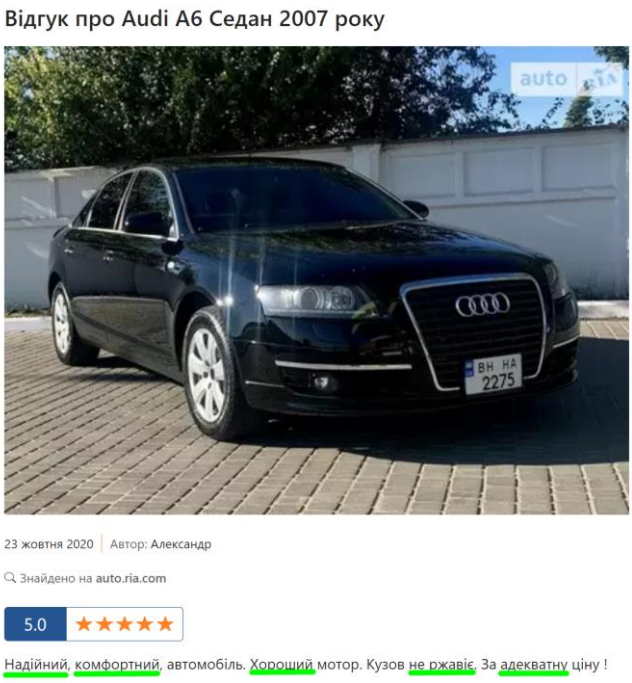


Fig. 7. Example of the simple review of Audi A6

$$P_{positive} = \frac{5_{positive\ opinion}}{5_{positive\ opinion}+0_{negative\ opinion}} = 100\% ; \quad (2)$$

Thus, for such review index $P_{positive}$ = 100 %, as all opinions are positive. But such case seldom happens. Let us consider more common example of the review in Fig. 8.

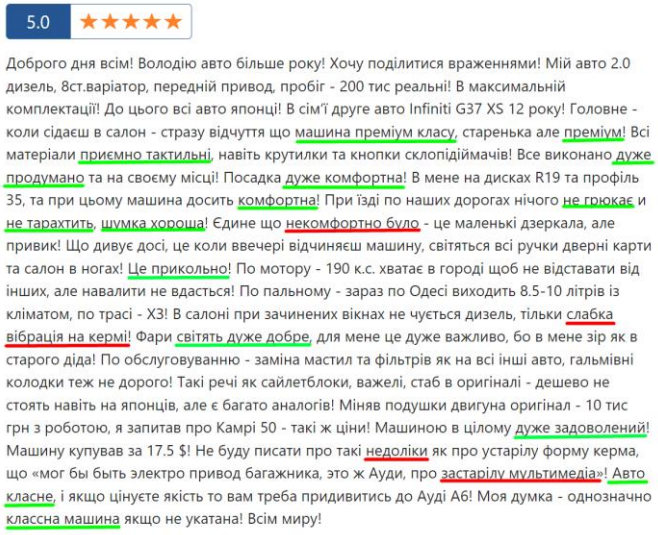


Fig. 8. Example of the volume review of Audi A6

$$P_{positive} = \frac{14_{positive\ opinion}}{14_{positive\ opinion}+5_{negative\ opinion}} = 73{,}6\% ; \quad (3)$$

Measuring $P_{positive}$ for the real review equals 87.5 %, as it is seen in Fig. 9. The greater the volume semantic core the greater is the quality of assessment.

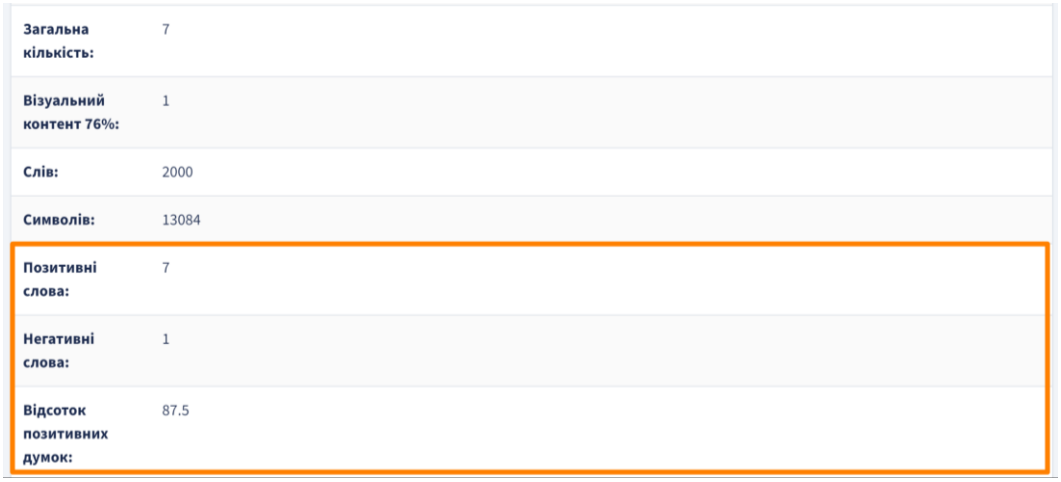


Fig. 9. Result of the calculation of the positive percent of opinions

However, this index, in general, shows either positive or negative review, that does not completely characterize the «opinion» about the motor vehicle.

That is why, the aim of the index *Emotion AI* is to determine the «opinion» of the owner of the motor vehicle and transform it into the index by means of the machine learning algorithm.

Emotion AI – is the index, connected with the manifestation of the emotions with the help of artificial intelligence (AI), also known as the affective computations. Computations are referred to the analysis of the text tonality on the base of the machine learning algorithms. They are the class of the methods of the content-analysis in computer linguistics, intended for the automated detection in the text the emotionally colored words and emotional assessment of the authors of the objects, spoken about in the text.

Main aim of the tonality analysis is searching of the thoughts in the text and detection of their properties. What properties will be studied depends on the set task. Aim of the analysis is the motor vehicle, the review of which has been written by the owner, who the «opinion » belongs to. The opinions are divided into two types – direct opinion and comparative opinion.

Direct opinion contains the utterance of the author about one object – motor vehicle. Formal definition of the direct opinion looks as a set of five elements (*e, f, op, h, t*), where:

- (***e**ntity*, ***f**eature*) – is the object of the tonality **e** (entity, regarding which the author expresses) or its properties **f** (attributes parts of the object);
- ***o**rientation* or ***p**olarity* – is tonal assessment (emotional position of the author, regarding the mentioned subject);
- ***h**older* – subject of the tonality (author, i. e., who this thought belongs to);
- moment of time ***t**ime*, when the opinion was left.

Examples of the tonal assessments:

- positive;
- negative;
- neutral.

«Neutral» means that the text does not contain emotional coloring. Other tonal assessments may exist.

By means of the algorithms of the machine learning SVM (*support vector machine*) and LDA (*Latent Dirichlet allocation*) we determine if the review really refers to the motor vehicle (Fig. 10) and further we determine to what extent the opinion is negative or positive by the scale from -1 to 1.

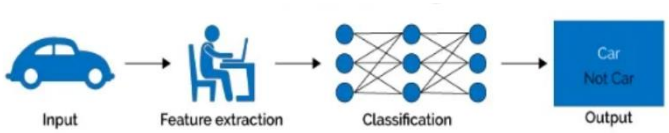


Fig. 10. Determination of the motor vehicle review features by means of machine learning

f_n – is the index of Zipfs law («rank-frequency»). This empiric regularity of the distribution of the words frequency of the natural language if all the words of the language (or simply rather long text) are arranged in accordance with the decrease of their frequency of usage, then the frequency of the n^{th} word in such list turns out to be approximately reverse proportional to its ordinal number *n*, that is, the rank of this word. The example for the typical review is shown in Fig. 11.

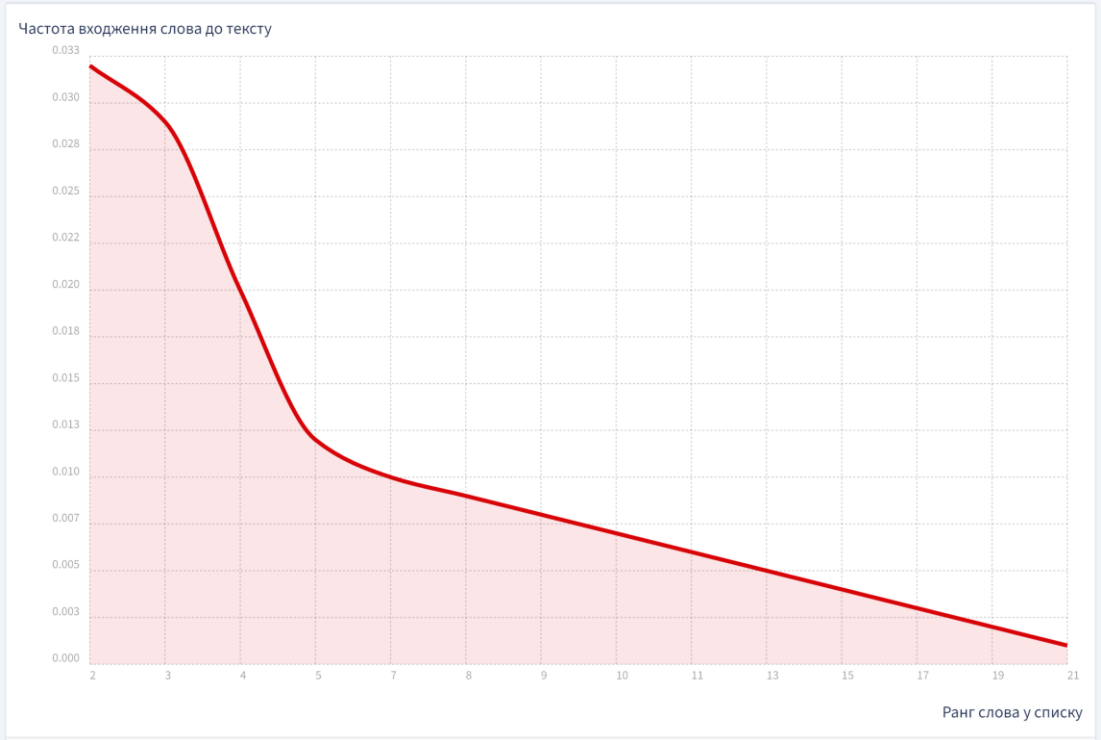


Fig. 11. Graph for the frequency of the words from the review according to Zipf's law

For instance, the second by the usage word comes across almost two times less frequently than the first word, third word – three times less than the first word and so on. Let us assume formally:

N – number of the elements;

k – their rank;

s – value of the index that characterizes the distribution of the values.

Zipf's law provides that from the set of N-elements the normalized frequency of the rank element *k*, *f* (*k;s,N*), is:

$$f(k;s,N)=\frac{1/k^2}{\sum_{n=1}^{N}(1/n^2)}; \quad (4)$$

Also, while calculating the index it is worth taking into account the list of stop-words. Calculation of the

index according to Zipf's law is shown in Fig. 12 and the ratio of the number of words to the frequency is shown in Fig. 13.

Fig. 12. Example of the calculation of Zipf's index for the review

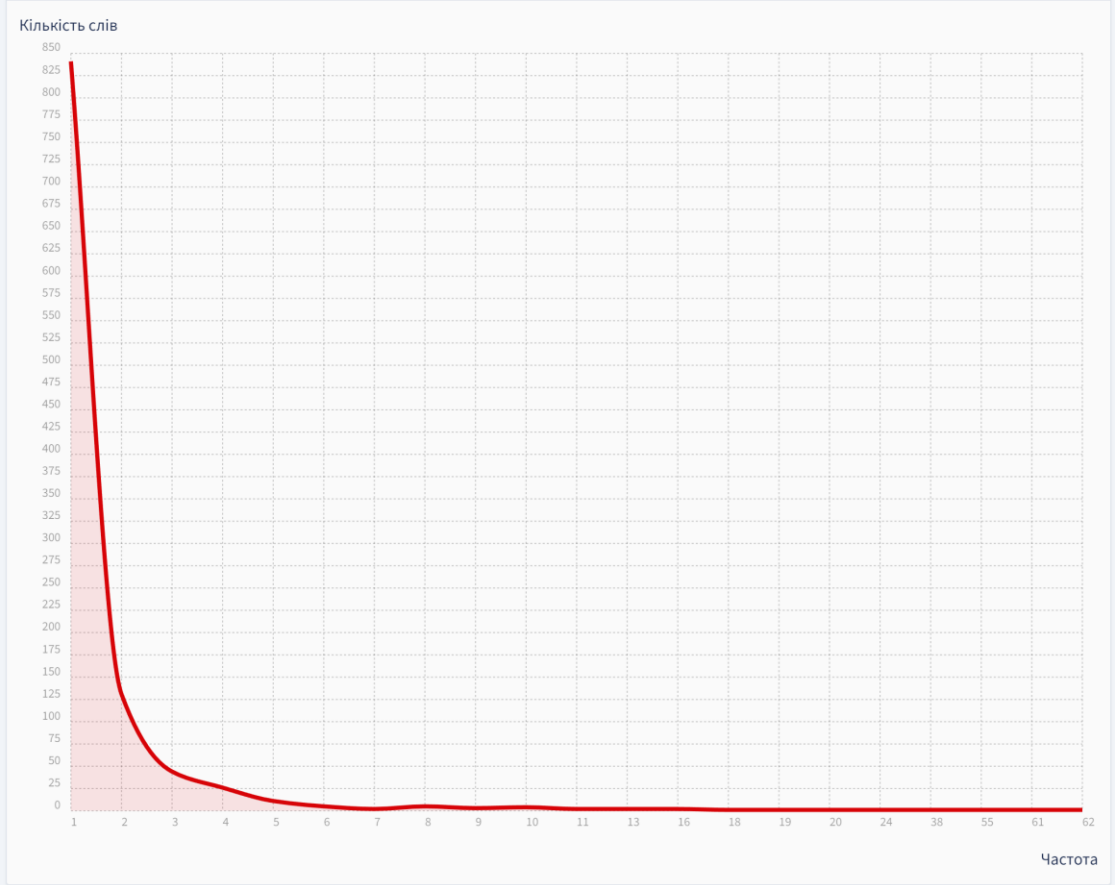


Fig. 13. Ratio of the number of words to the frequency

Δ_{Date} – is the index that equals the delta between the date of the publication of the review and the current date. The greater is the distance between the dates, the less is the value of such review. It is measured from 0 to 1.

The example of the visualization of the quality cyclogram of two reviews "The Value of Opinion"» is shown in Fig. 14, where the green color is the example of the quality review and red color – is the example of the less quality review.

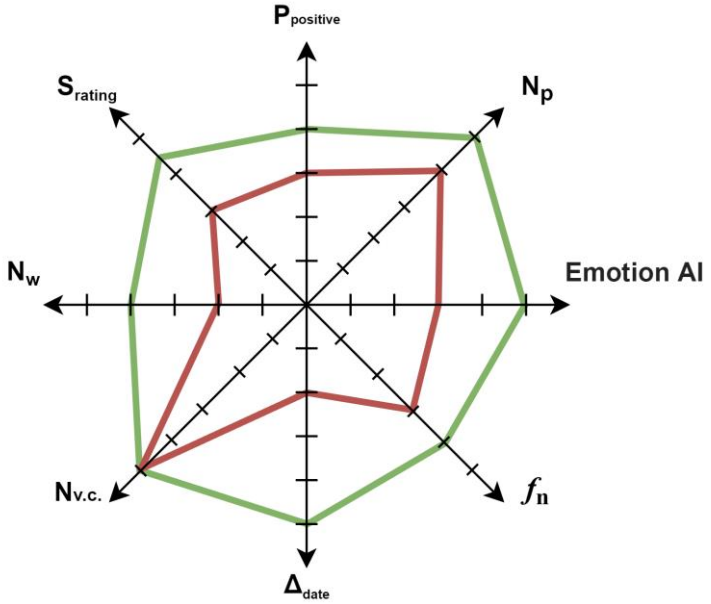


Fig. 14. Quality cyclograms of two reviews “The Value of Opinion”»

Quantitively the value of the summary index, i. e., quality level Y_k, can be calculated as the determination of the arithmetic mean of all the matrices, with the accounted indices (Y_i), which will be compared with basic matrices of the review quality (review is considered to be neutral with weighted average indices).

$$Y_k = \frac{1}{n}\sum_{i-1}^{n} Y_i \tag{5}$$

Conclusions

It was established that there is no single systematization and principles of reviews quality determination which can be used for the improvement of the recommendations within the frame of the assessments, based on qualimetric methods.

Thus, availability of the reviews in the Internet-resources is mainly used as a tool of the marketing and confidence, as it is proved by the analysis of the open data about the companies and recommendation systems.

Principles of the reviews quality determination were formulated, namely the set of matrices, which are qualimetric base of quality: N_w, S_{rating}, $P_{positive}$, N_p, *Emotion AI*, f_n, Δ_{Date}, $N_{v.c.}$ All these eight matrices form «Cyclogram of reviews quality “The Value of Opinion”», calculation examples of which are shown in the paper. Besides the suggested qualimetric approach to measuring, cyclogram includes the index – «*Emotion AI*», it is based on the algorithms of machine learning SVM and LDA for the analysis of the texts tonality and it enables to analyze the emotions of the motor vehicle owner and determine his «opinion» with numerical index.

The example of more qualitative and less qualitative review of the motor vehicle on the base of the studies, carried out, is visualized.

«Cyclogram of reviews quality “The Value of Opinion”» can be used for the analysis of any reviews of the items and products in the Internet for the improvement of the quality of recommendation systems and marketing research, it is universal for the application.

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