



УДК 004.738.5:004.75:001.892

# CLASSIFICATION MECHANISMS FOR DIGITALIZED INFORMATION IN WEB APPLICATION DEVELOPMENT, TAKING INTO ACCOUNT CLOUD SERVER DEPLOYMENT TRENDS

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DOI: 10.15673/atbp.v14i1.2274

**Abstract.** With the transition from natural to virtual communication, there are new technologies for presenting information, the perception of which depends on its presentation by modern multimedia. Visual perception plays an important role in everyday life, helping in learning and communicating with other people. Behind the most effective perception is a complex process of understanding the information obtained. Visual perception of information includes the processes of seeing and reading. Building assumptions on what we see, we rely on expectations, beliefs, past knowledge and previous experience. Reading is a complex activity that involves both the process of perception and thought. At the very beginning of the formation of reading, understanding is not common, but only after perception, as the development and automation of reading skills, understanding begins to outpace the process of perception, manifested in the emergence of semantic assumptions, guessing meaning within words. Perception of visual image is accompanied by the actualization of its auditory-motor image, without which it is impossible to recognize. Reading is accompanied by inner speech. The same information can be understood by different people with different degrees of depth, which entails the existence of factors that affect the process of perception and understanding of texts. Such factors can be divided into the following groups: characteristics of the individual who acts as a subject of perception and understanding; parameters of the text and the reality that is reflected in this text; features of the situation in which the process of perception and understanding takes place. Text in a virtual environment, ie media information - is more accurately and quickly perceived by a person and it depends on various factors influencing perception, as well as the type and method of presenting information.

The purpose of the study is to analyze the perception of digitalized information, the formation of recommendations for professionals with UI / UX, which will be further formed into a prototype of a possible web directory. The aim is also to develop a possible tool model that can be used not only by the above specialists, but also by SMM-managers, business analysts and others. The methods of research were chosen analysis - the study of individual parts of the objects of study, comparing different approaches or their individual components to obtain a holistic picture of the subject area.

**Анотація.** З переходом від природної комунікації до віртуальної, з'явилися нові технології подання інформації, сприйняття якої залежить від подачі її сучасними мультимедійними засобами. Візуальне сприйняття грає важливу роль в повсякденному житті, допомагаючи в навчанні та спілкуванні з іншими людьми. За максимально ефективним сприйняттям стоїть складний процес осмислення отриманої інформації. До візуального сприйняття інформації можна віднести процеси бачення і читання. Будуючи припущення побаченого, ми впираємося на очікування, переконання, колишні знання і попередній досвід. Читання - це складний вид діяльності, який залучає до себе як процес сприйняття, так і думка. На самому початку формування читання, розуміння йде не спільно, а лише слідом за сприйняттям, у міру розвитку та автоматизації навичок читання, розуміння починає випереджати процес сприйняття, що проявляється у виникненні смислових здогадок, вгадування сенсу в межах окремих слів. Сприйняття зорового образу супроводжується актуалізацією його слухомоторного образу, без чого неможливо його впізнання. Читання супроводжується внутрішнім промовлянням. Одна і та ж інформація може бути зрозуміла різними людьми з різною мірою глибини, що тягне за собою існування факторів, що впливають на процес сприйняття і розуміння текстів. Такі фактори можна поділити на такі групи: характеристики особистості, яка виступає в якості суб'єкта сприйняття і розуміння; параметри тексту і тієї реальності, яка в цьому тексті відбивається;



особливості ситуації, в якій протікає процес сприйняття і розуміння. Текст у віртуальній середовищі, тобто медіа-інформація - більш точно і швидко сприймається людиною і це залежить від різних факторів впливання на сприйняття, а також від виду та способу подачі інформації.

Метою дослідження є проведення аналізу сприйняття діджиталізованої інформації, формування рекомендацій для фахівців з UI/UX, які будуть надалі сформовані у прототип можливого веб-довідника. Також метою є розробка можливої інструментальної моделі, яка може використовуватись не лише вищезазначеними фахівцями, а й SMM-менеджерами, бізнес-аналітиками та ін. Методами дослідження було обрано аналіз – вивчення окремих частин об'єктів дослідження, порівняння різноманітних підходів або їх окремих складових для отримання цілісної картини предметної області.

**Key words:** digitalization, UI / UX, web, instrumental model, analysis, visualization

**Ключові слова:** діджиталізація, UI/UX, web, інструментальна модель, аналіз, візуалізація

## Introduction

With the transition from natural to virtual communication, there are new technologies for presenting information, the perception of which depends on its presentation by modern multimedia. Visual perception plays an important role in everyday life, helping in learning and communicating with other people. Behind the most effective perception is a complex process of understanding the information obtained. One of the technologies used today to control the flow of information is the use of associative features of human perception and memory.

The perception of information by a person or a group of people is most effective when the appropriate environment is formed, which contributes to this process. Favorable for the absorption of information environment can be formed using a certain color scheme. It is important to form the pace of presentation and perception of information, which should correspond to the capacity of the visual and auditory organs. Today, a huge number of multimedia technologies are used in various fields: organizational systems, distance learning, media, Internet, etc. They implement new principles of information presentation that allow a person to perceive it as comfortably as possible.

### 1. Theoretical component of the project

At the end of the twentieth century, cinema and television were in serious competition with books and newspapers in terms of information transmission. At the beginning of the 21st century, there was a whole debate about the benefits of television and the degradation of the modern generation that has stopped reading books. Eventually, the video flooded the entire information space, and it is no longer possible to ignore this fact (calling everyone who does not read books offensive words). Let's take a closer look at a problem that has arisen recently, but has already gained momentum. "Watch and listen or read?" [1].

In the early 2010s, a gradual transition from traditional, ie paper books, to electronic ones began. Producing a vector e-book from paper books that extend computer recognition (OCR) involves a tremendous amount of effort, especially if the book contains many illustrations, graphs, charts, tables or formulas. The current state of recognizable programs allows you to simply formalize all of the above, and sometimes even correct errors in recognizable texts. Raster graphics will give a quality image and many shades, if the developer does not regret the pixels. It is indispensable when printing photos, complex images, where color and liveliness are important. Vector graphics will help to create diagrams and drawings without losing image quality at any scale. However, the difference between vector and raster graphics does not prevent them from interacting with each other. So vector files can contain bitmap images, which is extremely convenient for layout and advantageous for printing. Therefore, for such books it is much easier to make raster, rather than vector electronic versions.

Even in full-text books - without illustrations, tables or formulas - automatic recognition can be performed with errors. It will be much faster to prepare a raster e-book, especially since modern technology allows you to do it quickly enough. For example, the average size of raster books, including text - 13 KB per page. This means that a raster book containing 400 pages averages about 5 MB (figures for DJVU format). About 900 such books can be accommodated on a standard DVD (4.3 GB).

Uncoordinated programs allow you to create files in PDF format, in which all the flat material is placed in scanned images, and the text is vector. Such PDF files greatly benefit from purely raster books, their appearance (non-aligned vector fonts and fragments of page images), as well as file size [6].

In biology and in the field of PR technologies, the theory is actively used, according to which a person perceives pictures much more effectively than textual information. In the process of forming "homo sapiens" the human brain went through several stages, and the ability to perceive by ear and read, was formed in him much later. That is why watching videos is much more convenient and understandable, because here the visual perception comes to the fore [1].

Book printing does not lose its popularity, despite the large number of media and IT products. People still visit bookstores, and stalls with fresh newspapers and magazines never run out of customers. Expensive volumes, serials, books in PDF or FB2 format are very popular, which indicates that people are interested in reading [1].

The text is a certain structure, where everything is laid out on the shelves and connected by cause and effect. If the video contains extraneous noise effects and author's comments, the printed edition is subject to the laws of the genre, and does not lead the reader away from the topic [1].

While reading the book, a person imagines the main character's clothes, the situation in the room where the event takes place, or what intonations are used by the main characters. While watching the video, viewers are deprived of such a privilege, because there is a scenario where every detail is taken into account. When watching a movie or program, you do not need to



connect the imagination - the director and screenwriter have already presented and invented everything, but we only have to "swallow" and evaluate [1].

The current generation of Z is focused on visual perception, it is much easier for young people to watch an informative video available online than to find and read long text instructions. Middle-aged people out of habit prefer to deal with structured text, where interpretation options are possible [1].

Visualization and text are alternative ways of transmitting information, the question is that some are more comfortable to watch and listen, and others - to read. In today's world, professionals with a high level of professionalism are valued, so you should not ignore books or videos, because both can teach you the necessary and useful things [1].

When a designer works with text, whether it is creating a website design or layout for a magazine, his assumptions are reduced to the fact that the works created by him are read and viewed exactly as he sees it. And he sees his work as a model of printing solutions [2].

You might think that graphic work will be noticed and read correctly, but the perception of the text depends on many nuances and experiences.

The brain reads the sum of positive and negative spaces around and inside letters and words. Man does not hold his attention to these details, instead, the brain does the hard work, disassembling the picture of what we read [2].

Competent work with the text will help to immerse yourself in the process, and untidy text can spoil the impression of the materials read.

Reading is not a linear process. Instead, our eyes perform a series of forced movements called saccades. These are a kind of lightning leaps through lines of text. Sometimes it's a big leap, sometimes a small one. Saccades help the eyes to register a certain amount of information in a short period of time. The length of the saccades depends on the skill of both the reader and the familiarity with the subject of the text. Between saccades, the eyes stop for a split second. This moment is called fixation. During this tiny pause, the person sees a couple of characters clearly, and the rest of the text is blurred. Our brain collects these fixations and deciphers information in a flash. All this happens reflexively [2].

The shapes of the letters and the shapes that these letters form when combined into words can significantly affect the ability to decipher the text. If you look at the middle line of the text covering the upper halves of the letters, it becomes extremely difficult to perceive [2].

To perceive means to interpret information about the environment obtained through the senses. This interpretation depends on our cognitive processes and available knowledge. Visual or visual perception can be defined as the ability to interpret information that reaches the eye through the light of the visible region of the spectrum. The result of our brain's interpretation of this information is what is known as visual perception or vision. Thus, visual perception is a process that begins in our eyes [3]. However, perception is not a unitary process. There are specific damages that can disrupt each of the above processes. Disorders of this type are characterized by damage to areas of the brain responsible for certain processes. These disorders are known as visual agnosia. Visual agnosia is defined as the inability to recognize known objects despite the preservation of visual acuity [3].

The last few years, 3D images are among the trends, so you can safely expect 3D graphics. The popularity of this style is possible in different types of graphic design: drawings, printed images, web design, advertising and more. The depth of the image creates a sense of reality of the drawn object. Therefore, you can realize anything, which is used by futuristic and science fiction designers.

Three-dimensional typography changes the perception of design and gives the work character. 3D text will be popular for at least a few more years. It allows the designer to improvise, to give the text a personal style [4].

Designers promise to please with a wide variety of serif fonts. Reinforced fonts make the text more convincing, convey sophistication and splendor. Already, this trend is distinguished by its popularity due to the serifs of different lengths, shapes and types. Motivational posters have many examples of this font in their captions [4].

Digitization, according to J.-P. de Clercom, is to use digital technologies and data (digitized (digitalized) and existing in digital form) to make a profit, improve business, change / transform business processes (other than purely digitalized latter) and create an appropriate environment for their implementation, based on the use of digital information. For business purposes, digitalisation is seen primarily as enabling, improving and / or transforming business operations and / or business functions and / or business models / processes, and / or the business as a whole through the use of digital technologies and wider use of 183 converted digital knowledge in order to obtain certain benefits. If digitalization is mainly about data systems, then the process of digitalization focuses on information and interaction systems, enhanced by digitized data and processes [5].

## **2. Experimental component of the project**

There are few reference books for UI / UX development, usually just collections of design articles, whether on development platforms or on the Internet. But most programs and development platforms do not have a built-in directory that has up-to-date information. An analysis of existing counterparts helps emphasize the importance of creating an accessible web directory that can be used by both UI / UX design professionals and SMM managers, business analysts and others.

The development and active implementation of paperless standards leads to the fact that much of the information is converted into digital, ie digitalized.

Most of the content that is perceived by the immediate user is part of the activities of web developers, experts in UI / UX.

In order to perform a study on the perception of digitalized information, the following sources were developed [1-6].



A person's perception of information is carried out with the help of his senses. In this regard, they all play a significant role, but sight and hearing are particularly important in this regard, because with their help a person receives most of the information [7].

The best results are obtained by the combined effect of visual and audio information, as the organs of sight and hearing increase the coefficients of stimuli, affect long-term memory. Studies have shown that a person remembers 15% of the information he receives in verbal form and 25% - in visual; if both of these methods of information transmission are used simultaneously, it can accept up to 65% of the content of this information [7].

Perception of visual information depends on the ease of reading the text, on its location on the page. For example, text printed in a narrow column reads slower than the same text printed in a wider plan. The vertical line of the text is read longer than the horizontal, although they can be equal in size. Lines that do not have breaks with smooth rounding are read 1/3 longer than a line with pronounced angles. Thus, printed text will be read a third faster than written [7].

Of particular importance in the perception of the text is the color of the print and the color background. Studies have shown that the easiest to read is a black font on a white background, followed by a black set on all colored backgrounds. Unreadable yellow font on a white background and vice versa [7].

When choosing a color in computer programs for a display with a color screen, it is important to know how color affects the psyche, and hence the perception of information. According to experts, the complementary are three pairs of colors: red with green, yellow with purple and blue with orange [7].

With this combination of colors there are no new shades, and there is only a mutual increase in saturation and brightness of the image. Color contrast is enhanced if the letters are highlighted with a black outline, but weakened if they are outlined with a white outline [7].

Highlighting the font in a different color when reading the text helps to consolidate the material in long-term memory. The shorter, more compact and expressive the text, the better the chances that it will be read and memorized. In addition, it has been experimentally proven that students better understand the text in a deductive way of presenting ideas, characteristic, above all, for scientific and technical texts [7].

The type of mental activity is important for the perception of information. According to neuropsychology, 48% of people think logically and 52% - figuratively. Thus 24% of logically thinking people pass to figurative thinking and 26% are developed by figurative thinking, pass to logical thinking. It is easier for one to remember telephone numbers, for another - a theorem, for the third - a chronology of historical events. Most psychologists believe that the preservation of a material in human memory is closely related to the nature of perception of the world, with the type of thinking [7].

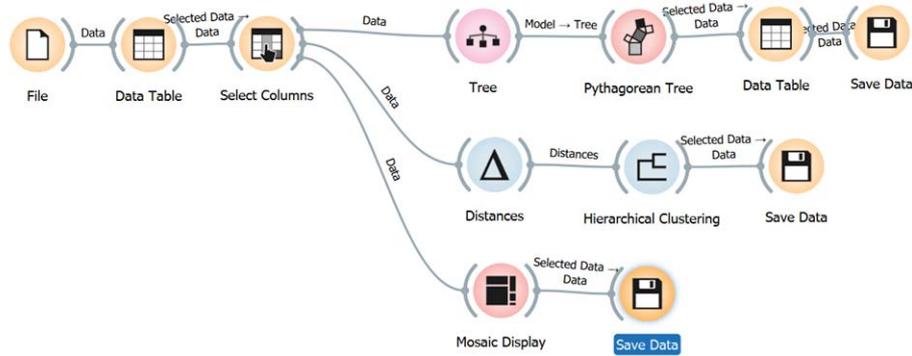
When a designer works with text, whether it is creating a website design or layout for a magazine, his assumptions are reduced to the fact that the works created by him are read and viewed exactly as he sees it. He sees his work as a model of printing solutions, which in turn builds. Verified headlines, literate gaps and adhered to the typographical rhythm. Our brain reads the sum of positive and negative spaces around and inside letters and words. Man does not hold his attention to these details, instead, the brain does the hard work, disassembling the picture of what he reads [5].

The typography on the screen is different from the printed one. The reader is dealing with two physical environments: physical space (where lighting plays a key role) and the device [5].

The above information became the basis of the survey form of respondents on the subject of this project. 167 respondents of different gender, age and profession took part in the survey. All respondents were asked to take a survey on the following questions:

1. Your education (level of education)?
2. What is your vision?
3. How much time do you spend on a computer / smartphone per day?
4. What type of books do you prefer?
5. Imagine you received a letter asking you to edit the text of a large document, what will you do?
6. If you are asked to make a plan, what will you do?
7. Read the passages of the text №1-6 and evaluate your impressions about the perception of the style of the given text, evaluation by such criteria as intelligibility of the text, ease of reading, perception of clarity of the presented text, speed of reading, ability to read "diagonally".
8. Specify the most convenient font size / size that you normally use.
9. Specify the font you use most often.
10. Choose the fragment (s) of the above texts, the format of which would be convenient for you to work on web resources.

The research was performed not only to form recommendations for UI / UX professionals, which will be further developed into a prototype of a possible web directory, but also to develop a possible tool model that can be used not only by the above specialists, but also SMM managers, business -analysts, etc.



**Fig. 1 – Instrumental model**

Orange was chosen as the application for the analysis of this data type. Orange is an open source component software written in Python that works best for machine learning and data mining, namely visualization. These components are called widgets, and they range from visualization to pre-processing, evaluation, and predictive modeling. Orange allows you to display a data table and select functions, read data, compare learning algorithms and train predictors and visualize data elements.

Taking into account the above information, an instrumental model was built, presented in Fig. 1.

Given that the amount of initial data was over 1000. The following outfits were chosen to build the model:

*File*, the widget reads attribute values from the input file. The *File* widget reads the input file (data table with data instances) and sends the data set to its output channel. The history of recently opened files is stored in the widget. The widget also contains a directory with sample datasets that come with a pre-installed version of Orange [8]. The widget reads data from Excel (.xlsx), simple tab delimiters (.txt), comma-separated files (.csv) or URLs.

*Data Table*, displays data about the values of attributes in the spreadsheet. The *Data Table* widget receives one or more datasets in its input and presents them as a spreadsheet. Data instances can be sorted by attribute values. The widget also supports manual selection of data instances [9].

*Select Columns*, selects data attributes and data area composition manually. The *Select Columns* widget is used to create a data domain manually. The user can decide which attributes will be used and how. Orange distinguishes between regular attributes, (optional) class attributes, and meta attributes. For example, to build a classification model, a domain will consist of a set of attributes and a discrete class attribute. Meta-attributes are not used in modeling, but several widgets can use them as instance tags [10]. Orange attributes are of type and are discrete, continuous, or character string. The attribute type is indicated by a symbol before the attribute name (D, C, S, respectively).

*Tree*, this is an algorithm of a tree with pruning forward. *Tree* is a simple algorithm that divides data into nodes according to the purity of the class (increment of information for categories and MSE for numerical target variable). This is the precursor of the random forest. Orange's *Tree* is self-designed and can handle both categorical and numerical datasets [11]. It can also be used for both classification and regression problems.

*Distances*, calculates the distances between rows / columns in a dataset. The *Distances* widget calculates the distances between rows or columns in a dataset. By default, the data will be normalized to ensure equal treatment of individual functions. Normalization is always performed in columns. The sparse data can only be used with the Euclidean, Manhattan and Cosine metrics [12].

The resulting distance matrix can be further submitted to *Hierarchical Clustering* to identify groups in the data, to *Distance Map* or *Distance Matrix* to visualize distances (*Distance Matrix* can be quite slow for large data sets), to MDS to display data instances using *Distance Matrix* and, finally saved with *Save Distance Matrix*. The *Distance file* can be downloaded using the *Distance File*. *Distances* also work well with Orange supplements. The *Distance Matrix* can be fed to a network add-on to convert the matrix to a graph and to a text add-on to search for duplicate documents in the body.

By choosing *Distance Metric* you can get the following models

- Euclidean ("straight line", the distance between two points)
- Manhattan (sum of absolute differences on all grounds)
- Cosine (cosine of the angle between two vectors of the internal space of the product). Orange calculates the cosine distance, which is a 1-likeness.
- Jaccard (cross-sectional size divided by the size of the sample set association)
- Spearman (linear correlation between ranks of values, transformed as distance in the interval [0, 1])
- Spearman absolute (linear correlation between the rank of absolute values, reassigned as the distance in the interval [0,

1])



- Pearson (linear correlation between values, converted as a distance in the interval [0, 1])
- Pearson absolute (linear correlation between absolute values, converted as a distance in the interval [0, 1])
- Hamming (number of signs by which the corresponding values differ)
- Bhattacharyya distance (similarity between two probability distributions, not real distance, because it does not obey the inequality of the triangle)

*Mosaic Display* - display data in a mosaic chart. *Mosaic plot* is a graphical representation of a two-way frequency table or contingency table. It is used to visualize data from two or more qualitative variables and was introduced in 1981 by Hartigan and Kleiner and expanded and refined by Friendly in 1994. It provides the user with the means to more effectively recognize the relationships between different variables [13].

The *Pythagorean Tree* is a visualization of the *Pythagorean tree* for classification or regression trees. *Pythagorean Trees* are flat fractals that can be used to represent the general tree hierarchies presented in the article by Fabian Beck and co-authors. In our case, they are used to visualize and study tree models such as *Tree* [14].

- Information about the input tree model.
- Visualization parameters:
  - *Depth*: set the depth of the displayed trees.
  - *Target class* (for classification trees): the color intensity for the tree nodes will correspond to the probability of the target class. If None is selected, the node color will indicate the most likely class.
  - *Node color* (for regression trees): Node colors can correspond to the mean or standard deviation of the value of the training instance class in the node.
  - *Size*: determines the method of calculating the size of the square representing the node. Normal node sizes will match the size of the subset of training data in the node. Square root and Logarithmic are the corresponding node size transformations.
  - *Log scale factor* is enabled only when logarithmic transformation is selected. You can set the log ratio between 1 and 10.

*Pythagorean Tree* can visualize classification and regression trees. The following is an example of a regression tree. The only difference between them is that the regression tree does not allow you to paint by class, but can paint by middle class or standard deviation.

*Hierarchical Clustering*, the widget groups elements using a hierarchical clustering algorithm. The widget supports four ways to measure cluster distances:

- *Single linkage* calculates the distance between the nearest elements of two clusters
- *Average linkage* calculates the average distance between the elements of two clusters
- *Weighted linkage* uses the WPGMA method
- *Complete linkage* calculates the distance between the most distant elements of clusters

If the objects to be clustered are instances, you can add them to the *Append cluster IDs*. The ID can look like a regular Attribute, Class attribute, or Meta attribute. In the second case, if the data already has a class attribute, the source class is placed among the meta-attributes.

*Save Data*. The widget does not save data every time it receives a new input signal, as this will constantly (and mostly unintentionally) overwrite the file. Instead, the data is saved only after a new file name is set or the user clicks the Save button [15].

If the file is stored in the same directory as the workflow, or in a subtree of that directory, the widget remembers the relative path. Otherwise, it will keep the absolute path, but turn off automatic saving for security reasons.

Classification was chosen as the basic model of data analysis. Classification - a system of distribution of objects into groups according to predefined characteristics. In some cases, the term categorization is used to mean the division of objects into categories.

Due to the fact that the classification forms at least one non-empty group (class), the classification of grouping is defined as the process of forming classes.

These classes will help to form the necessary recommendations for groups of use by groups of respondents with the same characteristics.

That is why we will pay special attention to the *Pythagorean Tree* widget. *The Pythagorean Tree*, or *Pythagorean Tree*, can visualize classification and regression trees. The only difference between them is that the regression tree does not allow you to paint by class, but can paint by middle class or standard deviation.

One of the properties of the *Pythagorean tree* is that if the area of the first square is equal to one, then at each level the sum of the areas of the squares will also be equal to one.

If the angle in the classical *Pythagorean tree* is 45 degrees, then you can also build a generalized *Pythagorean tree* using other angles. Such a tree is often called the wind-blown *Pythagorean tree*. If you draw only the segments that connect in any way the selected "centers" of the triangles, you get a naked *Pythagorean tree*.



Construction algorithm:

- 1) Construct a vertical segment
- 2) From the upper end of this segment recursively build 2 more segments at certain angles.
- 3) Call the function of constructing the next two segments for each branch of the tree.

We describe a recursive function that will build a Pythagorean tree. The function accepts the following parameters: the residual number of steps to build a tree, the coordinates of the points of the base of the square (A, B), the coordinates of the vector

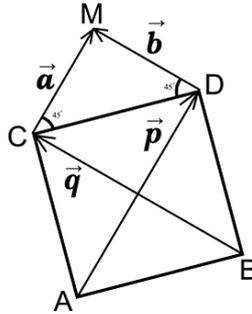


Fig. 2. – Pythagorean tree

It is on the basis of such an algorithm that it is possible to build analytical models shown in Fig. 3-5

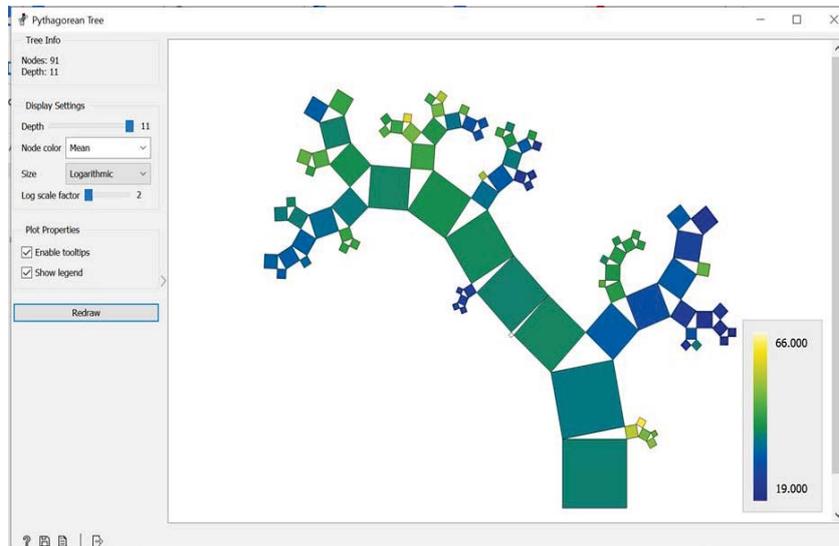


Fig. 3. – General view

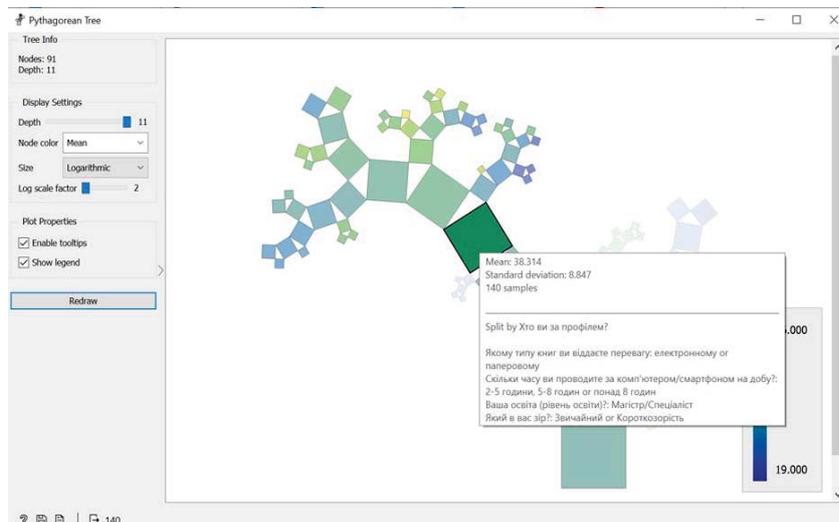
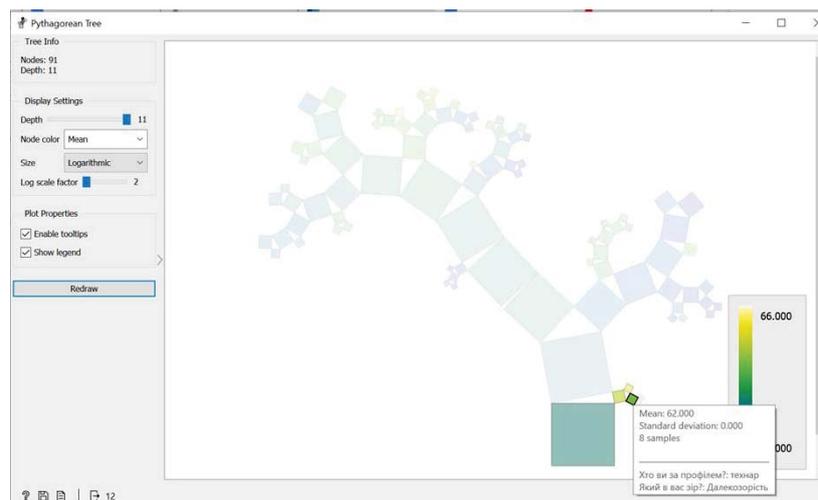


Fig. 4. – Selection of cluster squares option 1



**Fig. 5. – Selection of cluster squares option 2**

Using the Pythagorean tree allows you to build virtually active classification groups, ie by clicking on each fractal, the user receives a direct sample of data that characterizes it.

That is, to form the recommendations and methodologies obtained from the study, you can choose clustered squares of groups or parameters that can be used by UX / UI developers. This will not only save time for development, but also in the future to solve the problem of user-friendly interface usability of projects.

### **3. Description of research results**

The development and active implementation of paperless standards leads to the fact that much of the information is converted into digital, ie digitalized. Most of the content that is perceived by the immediate user is part of the activities of web developers, experts in UI / UX.

UX design and UI design are processes for creating digital and physical products that focus on improving the consumer properties of a product or service, such as usability, satisfaction, and aesthetics. After the research phase, the designer sketches the first draft of the layout, demonstrates it to the client, collects feedback, discusses solutions and next design steps. After one, two or three iterations, this layout becomes the final design. Doing UX development alone or just UI development is wrong: these are inextricably linked things. You can not just paint the drawn prototype and satisfy the solution to the client's problem or take into account user behavior when interacting with the interface. In any interface, the emphasis shifts when the designer begins to use attention management tools: color, font, size, footnotes, factoids and others. With this, it shows what is important on the screen and where to look at the user.

The most important stage of UX design and analytics, which affects the end result. The business audience and needs are analyzed to understand who will use the product and the interests of users are taken into account. The context of interaction, conditions, technical and business constraints are fixed. Users are constantly raising rates with rising expectations. These expectations are not determined by direct competitors. They are formed by the latest best user interface encountered by the audience. Even if this interface belonged to a major Silicon Valley brand, it could invest millions in interface design. And now users expect to see other resources at a level no lower than that, and they don't care that only a few can invest millions in design. The only way organizations can cope with these increased demands is to create large teams of many professionals.

Not surprisingly, the old models of website creation are collapsing. It was not enough just to pour content into templates. It's not enough for designers to dump user interface sketches through the wall to developers. Creating a modern site - the painstaking and interconnected work of different professionals. But abandoning this model of web resource development has become a cultural challenge for many organizations. There are significant failures. Companies that tried to carry out large-scale redesigns eventually went overboard and suffered huge delays. In the midst of all this growing complexity, it is from the design of the user interface that new approaches are evolving. Project thinking, which introduces a more iterative approach to the process of developing and designing the user interface in particular. There is no proper way to create a user interface. No template is suitable for all solutions. But there is a shift from a linear to an iterative approach, where collaboration is key and ideas are constantly aligned. This is an approach that often begins with what has become known as the discovery phase.

Taking into account this information, a study of different categories of users on their perception of digitalized content, developed an experimental methodology and a prototype was performed. The time spent by developers on the deployment of the UX / UI model and its further refinement is crucial in project development.

The structure of the UX / UI model should simplify the implementation of targeted user actions as much as possible. What the user does (downloads files, makes a purchase, answers a poll, goes to another page, opens a tab) should also resonate with the business goals of the product. Based on the analysis of real or expected responses, the UX concept is created in the early stages of development. The whole way and sequence of actions of the target client is investigated. It is the presence of a professional guide based on research that has recommendations and algorithms will solve these problems.



To address the general approach to the formation of mechanisms for the classification of digital information in the development of web applications, taking into account trends in the deployment of cloud services and the formation of UX / UI models, it is also necessary to focus on cloud computing.

Cloud computing is becoming an integral part of today's business. But to successfully use this technology, you need to clearly understand the main characteristics of the cloud, its types and what services you can use to optimize cloud performance.

Cloud computing is the model by which a company accesses shared computing resources such as servers, storage, networks, applications, and other cloud services. All resources can be used and managed by the user without additional help from the cloud service provider.

Cloud computing has the following key features: on-demand self-service, free Internet access, pooling of resources, fast scalability, and measurement service.

Software as a Service (SaaS) - software as a service. Such a cloud model should mean the use of software providers that operate in the cloud infrastructure. You may use similar software through a client or software interface. It is important to understand that if you use a SaaS service, you will not be able to manage such a cloud infrastructure as OS, network, storage, server. Among the striking examples: Microsoft 365.

Platform as a Service (PaaS) is a platform as a service. You are provided with a cloud computing platform, which has all the necessary cloud languages, services, tools, libraries from the cloud provider. You also cannot manage the underlying cloud infrastructure, servers, network, OS, and repositories. But instead, you can manage applications and some application environment configuration settings. Prominent examples include Microsoft Azure.

Infrastructure as a Service (IaaS) - infrastructure as a service. You have computing power, storage, network, and other important computing resources at your disposal to deploy and manage arbitrarily selected software. These may include applications and operating systems. You also do not manage the cloud infrastructure, but you can configure the OS, deploy applications, storage, and partially manage some components, such as host firewalls. Well-known service providers include Google, IBM, Amazon and others.

### General conclusions

According to the results of the study, it was concluded that to solve these problems, you need to use software and all the possibilities of information technology. Based on this conclusion, similar systems that could potentially solve these problems were analyzed and the advantages and disadvantages of these systems were analyzed.

Based on the results of the analysis of analogues, it was concluded that these analogues can not fully perform the tasks and do not have the necessary functions, so it was decided to develop a software product with the desired functionality.

On the basis of the conducted researches and adhering to certain stages of realization, the prototype of a research software product was made. This system allows you to perform tasks and can increase the efficiency of UX / UI developers.

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Отримана в редакції 28.01.2022. Прийнята до друку 22.02.2022. Received 28 January 2022. Approved 22 February 2022. Available in Internet 15 March 2022.

УДК 681.5.033.3

## ТЕСТУВАННЯ ПРОГРАМИ PID TUNER MATLAB

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DOI: 10.15673/atbp.v14i1.2275

**Анотація.** Актуальність. Налаштування ефективних параметрів регулятора як при моделюванні САР, так і на реальному об'єкті, залишається актуальною задачею при побудові систем регулювання, зважаючи на суперечливі вимоги у забезпеченні високої динамічної точності стабілізації регульованої змінної і стійкості системи. Ця задача потребує крім знань теорії автоматичного керування, також і навиків застосування сучасних пакетів програм MATLAB, що забезпечують аналіз і синтез систем керування.

**Мета.** Провести тестування програми PID Tuner у визначенні параметрів регулятора нелінійної САР при різних значеннях запізнення в каналі регулювання.

**Метод.** В якості методу дослідження обрано моделювання САР в середовищі Simulink.

**Результати.** Наведено експериментальні дані, які характеризують роботоспроможність програми PID Tuner в умовах зміни часу запізнення в об'єкті керування.

**Висновки.** Програма PID Tuner може бути рекомендована для підготовки спеціалістів з автоматизації виробничих процесів в отриманні навичок з налаштування параметрів регулятора САР.

**Abstract.** Topicality. Adjusting effective controller parameters both during ACS (automatic control system) simulation and with real control object, remains topical task during control systems design, because of the contradicting requirements: to ensure high dynamic accuracy of the controlled variable stabilization and system stability. This task requires not only knowledge of the Automatic Control Theory but also skills of using modern MATLAB programs which provide functionality of control systems analysis and synthesis.

**Goal.** To carry out testing of PID Tuner program when tuning controller parameters of the non-linear ACS with different time delay values in the control channel.

**Means.** ACS modelling in Simulink environment was chosen as means of research.

**Results.** Experimental data, which describe performance efficiency of the PID Tuner program in the conditions of control object time delay change, is shown.

**Conclusions.** PID Tuner Program can be recommended for training of specialists in automatic control to obtain skills in ACS controller parameters tuning.

**Ключові слова:** програма PID Tuner MATLAB, налаштування параметрів регулятора САР.

**Key words:** MATLAB PID Tuner program, ACS controller parameters tuning.

### 1. Вступ

Налаштування ефективних параметрів регулятора як при моделюванні системи автоматичного регулювання (САР), так і на реальному об'єкті керування (ОК), залишається актуальною задачею при побудові систем регулювання, зважаючи на суперечливі вимоги у забезпеченні високої динамічної точності стабілізації регульованої змінної і