Prospects for using artificial intelligence for book layout

Perspectivas del uso de inteligencia artificial para el diseño de libros

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Abstract

The purpose of the article is to explore the possibilities of using artificial intelligence for the layout of book publications. The materials of the article focus on methods of automating the work of a specialist in the field of printing production during work on the layout of a book publication. In the course of the study, modern available technologies for working on textual and visual information were considered, ways of their use were given on the example of the stages of book layout. The article also raises questions of the ethics of using neural networks for full content generation and the problem of the lack of a mechanism for assigning copyright to created images and text. In addition, the prospects for the further use of artificial intelligence in the printing business as a whole and how it can affect the production process were considered. The article contains examples of already existing technologies and patents, which confirm the possibility of their implementation in the printing process.

Keywords: Artificial Intelligence, book, layout, design, printing industry.

Introduction

Artificial intelligence (AI) is a method that allows computers or software to «think» and «acting» almost exactly like the human brain. This is achieved by studying the laws of the human brain and analyzing its cognitive processes. Today, artificial intelligence is one of the most popular terms in the world. It is able to create a huge amount of digital content, namely: provide the user with information, images, video, audio content, and write text of any level of complexity and direction independently. In the hands of an experienced specialist, artificial intelligence can become a powerful tool for creating content for any purpose, as well as greatly simplify work, sometimes even speeding it up several times. The areas of AI use are expanding every day, and this phenomenon has not escaped the printing industry. In this article, we will consider possible ways of using artificial intelligence by employees of the printing industry, namely, how this tool can be applied to the layout of book products.

The main purpose and objectives of the work

Purpose. To explore the possibilities of introducing artificial intelligence in the printing industry using the example of all stages of the layout of a book publication.

Objectives: exploration of the possibilities of artificial intelligence in working with textual and graphic information on the example of the stages of book layout; determine at which stages of the layout of a book publication it is most appropriate to involve the use of artificial intelligence; analyze the ethics of using artificial intelligence to directly create content for a book publication; determine exactly how artificial intelligence can affect the printing industry in the future.

1. Using AI for book layout.

Main stages of book layout.

Before getting on the book shelves of bookstores, the book goes through three stages: pre-printing, printing and post-printing. In this work, the main attention will be paid to the pre-press preparation of the book edition.

Prepress is the process of creating electronic layouts of printed products using desktop publishing systems (Rozum, O.F., Velychko, O.M., & Melnikov, O.V., 2012). In order to put the layout together and prepare it for printing, the following is also necessary Prepare all textual information (obtain the author's original, edit and proofread the author's original, select the future font design according to the layout option and the purpose of the book), prepare illustrative information (develop from scratch or edit the provided raster and vector illustrations, format them according to the book format, convert them to the required color model), develop page design (formulate specific requirements for page layout, select the size of the margins and text size, specify all spacing and indents, formulate a general color scheme and specify all additional decorative elements), develop the design of the cover, flyleaves, spine according to the material on which these elements will be printed.

After the layout designer has all the necessary electronic materials, he begins the layout process. Book layout is the process of forming pages. The essence of the process is the placement of text and illustrative material on the pages of a printed or electronic publication that meets certain technical and aesthetic requirements and criteria. The layout designer, relying on his knowledge, skills, and layout rules, creates a visual image and design, determining how the text and pictures will look together.

Prepress plays an important role in ensuring the high quality of a book. It allows to: eliminate errors and inaccuracies from the text, create a visually appealing and easy-to-read book layout, develop a design that matches the overall concept of the book and attracts readers' attention, make sure that the book meets all the technical requirements of printing.

Working with text using AI.

Artificial intelligence in layout is a set of technologies and methods that allow computers to independently analyze and process data to create aesthetic and functional designs, as well as the use of technologies such as machine learning algorithms and neural networks to enable computers to understand and reproduce design solutions (Huss, 2023).

Artificial intelligence is actively used to select optimal color schemes, fonts, and compositions in design. By analyzing the preferences of the target audience, artificial intelligence offers combinations that maximize visual perception. This helps to create a design that not only attracts attention but also creates a comfortable and memorable experience.

The use of artificial intelligence in design automation can be a very promising trend that will bring noticeable results. An automated layout process optimized with AI can reduce time and financial costs while improving the quality and efficiency of the final product (book). This opens up new opportunities for designers to create attractive printed publications.

Speaking about the textual information of a book, there are opportunities for AI implementation in this case as well. Artificial intelligence algorithms learn to understand the context and tone of the written text quite quickly. For example, the updated editor in Microsoft Word with «The Ideas» feature uses an AI algorithm for editing and understands the nuances in prose text better than tools based on code and logic.

«The Ideas» feature will tell the user how to replace a poorly worded sentence, help them find synonyms and alternative phrases. This way, editors and proofreaders don't have to spend time on third-party resources to find a good substitute and edit the text artistically. For example, the algorithm recognizes when the word "really" is used to emphasize a certain point and when it denotes a question. The algorithm also gives eloquent arguments in favor of its corrections, recommending other wording options for the text it considers incorrect. For example, if the program doesn't like a sentence with a passive voice, it will suggest a variant with a rewritten verb in the active voice. «The Ideas» can independently explain abbreviations and highlight certain parts of the text to make it easier to read. The program will also help authors take into account the gender aspects of texts. Of course, this tool is still far from perfect, but even at this stage, it can simplify the work of an editor working on a book's text (Dickson, B., 2017). Microsoft notes that artificial intelligence is not capable of creating and writing a unique text instead of a human, but it can help make the text better and simplify the work of everyone who is involved in working with textual information (BBC, 2019).

Working with images using AI.

Today, artificial intelligence is very actively used to generate and edit images. Machines can interpret images just like the human brain and analyze them even more thoroughly. There are two areas of image processing, namely analog and digital image processing.

Analog image processing is a traditional approach to manipulating photographs, prints, and other physical media of visual information. In contrast to digital processing, which uses computer algorithms, the analog method is based on physical changes in the characteristics of an image. This includes techniques such as retouching, color correction, contrast and brightness manipulation. This method is characterized by simplicity (many analog processing methods do not require special equipment and can be performed manually), flexible control (the artist has full control over the processing process and can get unique results), unique aesthetics (analog processing can give images a certain warmth, vintage, authenticity that is unattainable with digital methods). Among the disadvantages are the complexity of the work, the considerable time spent on editing one image copy, and the need for special skills.

It is important to note that with the development of digital technologies, analog image processing is gradually being replaced by digital methods. Nevertheless, it still retains its relevance in many areas where its unique capabilities and aesthetic component are valued.

Even though, as mentioned above, retouching is mostly done manually by humans, image editor developers have found a place for artificial intelligence to speed up and improve the retoucher's work. Thus, modern photo auto-correction services greatly facilitate and simplify the retouching process for all users. AI-powered photo editors do everything that a retoucher would do manually, and at the same time allow you to fully control the process. Automatic retouching helps in the following aspects: to give photos taken with a simple camera a professional look and improve image quality; to save time by letting the program do all the work instead of manual editing; to print and publishing companies - to improve the process of image correction for printed products and more (Evergreen, 2020).

Thus, even in painstaking work that requires everything to be done manually and requires certain knowledge from the person doing the retouching, artificial intelligence has confidently taken its place, making it easier to work on images.

In turn, digital image processing is a dynamically developing industry that uses computer algorithms to manipulate digital images. Unlike analog processing, which is based on physical changes in an image, digital processing offers endless possibilities for improving, analyzing, and creating visual information. It is in this variant of image processing that artificial intelligence tools are actively involved.

A prime example is a tool from Adobe for their Photoshop software, namely «Firefly». An AI-based art generator, «Firefly» is a technology that can create digital images using generative artificial intelligence. «Firefly» uses textual queries to create an illustration or composition, which can then be customized in different styles. Like other types of artificial intelligence, the generative type uses large data sets to generate content, such as a digital illustration, creating something completely new - all with a single text query. «Firefly's» current generative AI model has been trained on datasets from Adobe Stock, available licensed content, and expired public domain content. AI-based artistic generators allow you to experiment with images and styles and find new ways to realize your creative ideas.

It is also worth mentioning the possibility of using neural networks for digital image restoration. This function is quite relevant for the layout of historical or autobiographical publications, which often use portraits or photographs taken in the last century. Such photographic materials often get damaged and deteriorate over time, often fade, and lose their color completely or partially. Artificial intelligence tools were also used to solve this problem.

Tencent specialists have created a tool called GFP-GAN (Generative Facial Prior-Generative Adversarial Network) that can restore damaged low-resolution portraits. The technology combines data from two artificial intelligence models (generative and discriminative networks) to fill in the worn-out and faded details of a photo with realistic missing details in a few seconds, while maintaining high accuracy and quality. The generative network is trained on a large dataset of face images. It uses this information to create a new face image that matches the facial features in the input photo. The discriminative network learns to distinguish between real and fake face images. It uses this information to improve the generative network. The new approach is aimed at preserving the "identity" of people in the photo, with a special focus on facial features such as the mouth and eyes (Brovinska, M., 2022).

Overall, GFP-GAN is a powerful tool that can be used to restore, enhance, and create facial images. It has many potential applications, such as photo restoration and the creation of 3D models that can be used in printing activities as well.

2. Expediency of using artificial intelligence at certain stages of book layout.

AI at the stage of text information processing.

Having considered the possibilities of artificial intelligence for working with text, we can say that its involvement is a reasonable solution. Integrating AI at this stage opens up new horizons of possibilities, making word processing more efficient, flexible, and intelligent. AI can automate routine tasks such as proofreading, proofreading, and formatting, freeing up time for more creative and analytical work. In addition, AI can help detect and correct grammatical errors, stylistic inaccuracies, and logical inconsistencies, making the text clearer, more concise, and easier to understand.

It is important to note that AI does not replace human work with text, but complements it. It can automate routine tasks, analyze data, and generate content, but the final decision on how to use the text remains with the human.

AI at the stage of processing illustrative information.

Currently, the use of artificial intelligence in image processing is a progressive and rapidly developing trend. As mentioned above, neural networks can complement almost all stages of image editing: analog processing (retouching), digital processing, as well as increase the resolution and improve the quality of photo illustrative material. Since the layout stage usually involves processing a large amount of illustrative information of varying complexity, the introduction of AI can automate the image processing process in a single style that is determined by the concept of a book publication. Artificial intelligence can also ensure the high quality of source images, which is very important for a high-quality second illustration. We shouldn't forget about the possibility of generating images using AI. Sometimes the generated images can serve as a source of inspiration for the visual information editor, and sometimes these images can be used in the layout process itself and appear on the pages of a future publication.

AI at the stage of book layout creation.

When creating page and spread layouts, it is also advisable to introduce AI-based automation tools. Currently, such tools are able to create aesthetic and functional designs based on pre-analyzed design solutions. Such tools can not only select the overall color scheme of the future publication, but also choose the optimal layout for images that will be completed among the textual information. Therefore, this function will be useful at the stage of developing the concept of pages and spreads, which can reduce the time spent on finding the perfect solution for the design of the book block according to the topic of the publication and the target audience. Later, this toolkit can be expanded to automate the arrangement of text and images according to the layout design.

AI at the stage of checking technical requirements for a book layout.

Given the ability of artificial intelligence to learn from a large amount of identical information, it is quite possible to implement this tool at the final stage of book layout design - to check the layout for compliance with technical requirements. The technical specifications for the layout contain information about indents, margins, marginals, fonts, requirements for lineation and specific image layout, and so on. All of this is now done by a human, sometimes checking very large volumes of pages of the future publication. Given the large volume of work, sometimes certain violations of technical requirements remain uncorrected. Therefore, the use of AI at this stage will reduce the time for checking layouts and prevent defects during printing.

3. Ethical issues in creating AI content for a book.

Using AI-generated images.

Currently, the most discussed and controversial topic among designers and people related to art is the use of artificial intelligence to create images with their further commercial use. We are talking about a software product, a neural network that can generate images based on text queries (for example, Midjourney, Dall-e, Stable Diffusion, etc.). Such neural networks are created through machine learning, which is the process of giving computers the ability to improve their performance in a task by using information from a specific database (in this case, a set of images).

The main reason for dissatisfaction is the use of artists' works for AI training without their consent. At present, all the most famous AIs (Midjourney, Stable Diffusion, Dall-e, Lensa) work on databases filled with copyrighted content. Therefore, all content generated by such AIs is essentially a hidden collage of works by different authors. Since the works used for generation belong to specific people, the use of their work without their consent is a gross violation of copyright (Kit, L., 2023).

What is the solution to this situation, given that there is still no specific mechanism for regulating content and establishing its authorship? One option is to use similar generated images only as references and as a source of inspiration. For example, a layout designer is working on the cover of a book reprint and has a task to design something new, but specific images of its general appearance have not yet been formed. In this case, it makes sense to make a text query to the AI that generates the images, see the results of the neural network, and build on this in your work.

Norms and laws regulating content created by AI intelligence are still being developed, and it is not known when they will come into force and whether they will satisfy people in creative professions. In the current realities, one should work with such neural networks based only on one's own conscience and integrity.

Using AI-generated texts.

The other side of the AI-generated content coin is the use of AI to create text. At its core, text generation works in the same way as illustrations: a neural network "learns" from a certain database of books, articles, and web pages, which it then begins to "distinguish" and produce content depending on a human request. Thus, textual AI can be used both for information search and article writing. The use of artificial intelligence for such purposes is not in doubt or controversy, but everything changes when it comes to full-fledged book writing with the help of text neural networks.

Sudowrite is an example of such a neural network. Its developers collected plot twists from short stories and novel summaries and presented them to GPT-3 as examples. For the descriptions, they wrote sentences about smells, sounds, and other senses so that GPT-3 knows what it is being asked when the author clicks "describe." Thus, the result that the AI produces depends on the author's request: the neural network can produce simple synonyms of words or other variants of comparisons, or it can fully describe the event that was briefly explained to it. In the second case, the author may start abusing this tool and "write" his or her stories or novels solely with the help of such generation, followed by a little editing of the text. Indeed, such cases already exist. At some point, "books" appeared on Amazon's online platforms that at first glance are indistinguishable from a typical detective novel. They were sold, commented on, and rated for some time, until one of the users checked the text of the book for machine-generated content. As it turned out, the entire book was generated by artificial intelligence. Despite numerous complaints after this information was made public, the book was not removed from the platform.

Therefore, when using text neural networks, you should keep in mind that it is only a tool that can improve and speed up your work, push you to new ideas and concepts, but you should not rely on the generated text unconditionally.

4. Artificial intelligence and printing in the future.

Fully automated layout.

The improvement of existing tools and their continuous improvement at some point may potentially lead to the emergence of computer layout programs that will require minimal human intervention in the process. The layout designer will only upload the necessary textual information and illustrations, specifying the required format, number of pages, and technical requirements, describing the result of the work to be achieved as much as possible. In this case, AI will be able to analyze both textual and graphical information, correcting and editing them in terms of the task at hand.

Another option for using AI is to make corrections and give advice on the layout being created in real time. The neural network will be able to provide the layout designer with information on color schemes, font solutions, and options for finishing illustrations based on previously analyzed layouts. This will speed up the search for the perfect design solution and the emergence of new creative solutions in the course of layout design for book publications.

Involving AI at the printing stage.

The printing industry is in the early stages of using the huge amount of machine data it generates to improve the efficiency, quality, and autonomy of the printing process. Potentially, AI can control the supply of ink and paper, thereby speeding up the setup process. During the printing process, it is possible to control print quality and correct color reproduction with the ability to immediately remove defective materials. After printing, an automated distribution system can be used to redirect all printed elements to the next stages of book assembly. AI can also manage logistics and resource planning, and keep a constant check on the available materials in the warehouse.

So far, various companies have already started integrating artificial intelligence into the printing process. HP and Ricoh, for example, use visual inspection and machine learning systems to detect, classify, and correct print problems. In these cases, algorithms and, in some cases, user feedback are used to improve the accuracy and speed of detecting print defects. Depending on the problem, AI is used to take corrective action, such as compensating for printhead clogging or, if necessary, reprinting the order that is placed in the job queue. Thanks to AI, less skilled operators are required to maintain printing machines, and even then, quality is guaranteed.

Xerox PredictPrint Media Manager uses artificial intelligence to match and share the most relevant settings for different media when users scan barcodes from paper media. The solution automates the setting of size, type, color, coating, and weight through barcode scanning (Printus, 2021).

Also, worth noting is the recently patented technology that uses artificial intelligence systems to process PDF files, created by Global Graphics Software. Algorithms based on the patent "Methods and systems for improving the processing of raster images using artificial intelligence" have already been implemented in the digital front-end for high-speed industrial inkjet printing machines SmartDFE. Real-time rasterization of variable data for high-speed digital printing presses is a major challenge because it requires a very high constant rate of bitmap data transfer to the printing press. Unfortunately, the diversity of PDF files and computing hardware means that complex tasks can be processed too slowly for stream rasterization.

This problem is aggravated by the presence of a huge number of PDF creators on the market, who prefer rich design without thinking about rasterization and printing. Press operators were forced to process jobs in advance (while their press was idle) or process jobs in-stream and hope that the DFE could provide data at the speed of the press.

The SmartDFE system uses artificial intelligence and machine learning to create an intelligent raster processor model adapted to each press manufacturer's computing hardware (covering over 1,000 PDF operations performed in the Harlequin RIP). This model can analyze any PDF print job and predict the minimum constant bitrate, and therefore the print speed, that can be achieved, enabling press operators to make informed decisions and efficiently plan production processes (Printus, 2023).

AI and book market analysis.

Artificial intelligence can rapidly change the landscape of the book market, opening new horizons for publishers, booksellers and readers. This tool enables the collection, processing and analysis of large volumes of data on readership preferences, sales trends and market dynamics, leading to better market understanding and informed decision-making.

The use of AI in the marketing segment of book publishing can lead to improved advertising that will be targeted precisely to its audience. The neural network can analyze purchase history, reading behavior and other data to offer readers personalized recommendations of books they might like. This leads to a more engaged audience and a better conversion rate. AI can also segment audiences based on various characteristics, such as demographics, interests, and readership, allowing publishers and booksellers to target and effectively promote their books.

In addition, understanding their audience, namely analyzing data on sales, seasonal trends and other factors, can lead to accurate forecasting of demand for new books, helping publishers to optimally plan circulations and avoid excesses or shortages. Also, by following the readership trends, it will be possible to predict for which period it is better to plan the release of a particular publication in order to maximize sales.

Conclusion

Changes in the printing industry were constantly accompanied by peaks of innovation, followed by years of continuous improvement. The integration of modern technologies into printing provides breakthroughs that were not possible before, and these breakthroughs are happening surprisingly quickly. The appearance of artificial intelligence tools is another impetus for the development and modernization of the printing industry.

The latest technologies significantly speed up and make the book production process less complex and difficult. Currently, the processing of illustrations and their preparation for printing at the typesetting stage is significantly accelerated, and the proofreading and editing of textual information requires less specialist qualifications in the printing industry, but more in the IT field. Artificial intelligence tools also help to create more diverse and interesting layouts of future printed editions by analyzing existing design solutions on the bookshelves of bookstores.

But the potential of using neural networks does not end there. The appearance of new automatic typesetting services is only a matter of time. Research in this field will help make the printing of printed products more automated and personalized. The ability to control the printing process through artificial intelligence will make it possible to reduce the number of defects during the production of printed editions and reduce the time to prepare the printing of any edition.

The only controversial issue at the moment is the ethicality of using fully generated images and texts, which may later be used in books, magazines, brochures, catalogs. Copyright regulation and specific rules for the use of generated images are among the most important issues that must be resolved by society.

The main thing to remember is that the tandem of man and machine is the most effective way of cooperation. No matter how advanced and innovative the neural network is, all the content that will be created with its help is primarily aimed at human consumption, and only another person can know what exactly needs to be used in this or that field, and what needs to be weeded out.

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