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Сосуществование машинного интеллекта, цифрового искусства и диагностики: возможно ли оно?

А.В. Власов[1, 2]

[1] Научно-практический клинический центр диагностики и телемедицинских технологий, Москва, Российская Федерация
[2] Научно-исследовательский институт медицины труда имени академика Н. Ф. Измерова, Москва, Российская Федерация

АННОТАЦИЯ

Развитие машинного интеллекта и применение генеративных изображений, созданных с его помощью, является перспективным направлением коммуникационного дизайна и человеко-машинного взаимодействия. Письмо в редакцию представляет собой авторское видение применения генеративных изображений в области диагностики состояний человека.

Использование машинного интеллекта как интерактивного и интеллектуального инструмента диагностики позволит психологу и врачу эффективно дополнить терапевтические процессы контролируемого взаимодействия их участников.

Сейчас уже существуют библиотеки моделей и наборы приложений с text-to-image алгоритмами, которые могут быть задействованы инженерами и дизайнерами в процессе создания объектов современного цифрового искусства, и также могут быть использованы в исследованиях новых парадигм с помощью визуальных коммуникаций, их прикладного применения в экспериментальной диагностике.

Ключевые слова: генеративные изображения; text2image; визуальное восприятие; диагностика.

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Coexistence of machine intelligence, cyber art, and diagnostics: is it possible?

Andrey V. Vlasov[1, 2]

[1] Research and Practical Clinical Center for Diagnostics and Telemedicine Technologies, Moscow, Russian Federation
[2] Izmerov Research Institute of Occupational Health, Moscow, Russian Federation

ABSTRACT

The development of machine intelligence and the application of generative images created using it is a promising area of communication design and human–machine interaction. This letter to the editor represents the author's vision of the use of generative images for diagnosing human conditions.

The use of machine intelligence as an interactive and intelligent diagnostic tool will allow a psychologist and a physician to effectively complement the therapeutic processes of controlled interactions of their users.

Libraries of models and sets of applications with text-to-image algorithms are already available that can be used by engineers and designers in the process of creating objects of modern digital art. They can also be applied in the investigation of new paradigms using visual communications and their application in experimental diagnostics.

Keywords: generative images; text2image; visual perception; diagnostics.

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机器智能、数字艺术和诊断的共存：有可能吗？

Andrey V. Vlasov[1, 2]

[1] Research and Practical Clinical Center for Diagnostics and Telemedicine Technologies, Moscow, Russian Federation
[2] Izmerov Research Institute of Occupational Health, Moscow, Russian Federation

简评

机器智能的发展和在其帮助下创建的生成图像的使用是通信设计和人机交互的一个有前途的方向。致编辑的信提出了作者对生成图像（图1）应用于人类状况诊断的设想。

使用机器智能作为交互式和智能诊断工具将允许心理学家和医生有效地补充其参与者受控交互的治疗过程。

现在已经有了带有文本生成图像算法的模型库和应用程序集，可供工程师和设计师在创建当代数字艺术对象的过程中使用，也可以用于研究使用视觉的新范式通信，其在实验诊断中的应用。

关键词： 生成图像； 文本生成图像； 视觉感知； 诊断。

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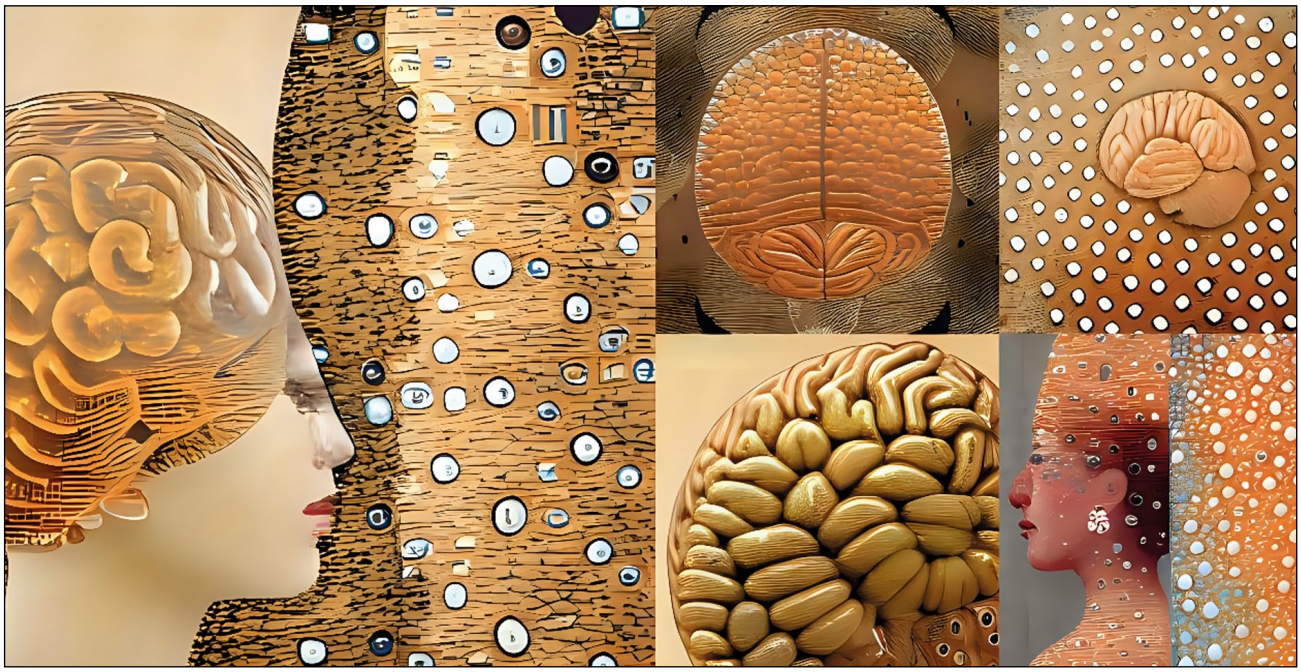

Fig. 1. Images generated by a neural network.

VISUAL PERCEPTION OF IMAGES

Machine learning (ML) is widely used in diagnostic settings to address concerns with pathology classification, search, and visualization, including the diagnostics of Alzheimer's disease, one of the most studied issues in terms of the standpoint of publication activity [1, 2]. Artificial neural networks and generative models for creating visual content, text2image, are currently being developed along with the use of ML algorithms (in particular, the support vector machine) and the expansion of the diagnostician's tools. The text2image model is an algorithm that enables to generate an image based on a text query.

In contemporary culture, the perception of visual images, such as artistic images, is directly related to emotional and cognitive processes, personal characteristics of their perception, and interpretation by each person individually. In fact, how we perceive things, like abstraction (Fig. 1) can tell us a lot about ourselves. In their work [3], M.F. Koich and F. Pessotto showed that the distortion of the emotional perception of images is associated with individual personality traits. According to the authors' study, the feeling of joy when presented with certain images correlated with sociability, and the feeling of fear correlated with the ability to resist aggression and defend personal boundaries.

A promising technology for broadcasting artistic content is virtual reality technology, where the user (patient) creates his own reality, "transitional" between the inner world and external reality, which can be explored in cooperation with a psychologist or doctor [4]. Due to the technology of virtual reality, researchers have acquired new tools with unique capabilities. For example, F. Paladines-Jaramillo et al. [5] adapted the Rosenzweig Picture-Frustration test, for which the stimulus material with pictures of various situations was transferred to a virtual environment.

Technologies, such as general-purpose artificial intelligence, will eventually be able to become a naturalistic part of the therapeutic processes into which they are integrated. Definitely, research and development of special therapeutic applications and systems are required for adaptation and mass introduction into practice.

MACHINE INTELLIGENCE

The possibilities of machine intelligence are expanding rapidly, keeping up with advances in virtual reality technology. Over the past year, we have seen stunning creations of generative digital art objects[1], design objects, photorealistic paintings, pictorial images using generative adversarial networks (GANs) and diffusion models (DM), such as DALL-E 2, Imagen, ruDALL-E, VQGAN, Stable Diffusion, Latent Diffusion, Disco Diffusion, and so forth. These models operate on a principle of converting the input text into an image.

The result of the joint interaction of a person developing an algorithm and entering a text query, and GAN (or DM) is already an additional creative effect [6]. Here, the computational result of the text2image model is a digital object, a two-dimensional image.

[1] For example, DALL-E 2 OpenAI (access mode: https://openai.com/dall-e-2); ruDALL-E (Dalle) Sber, SberDevices (access mode: https://rudalle.ru).

An interesting fact is that GAN-like models are used to analyze neuroimaging data (computed tomography or magnetic resonance imaging[2]) [7, 8].

Machine intelligence has a perfect command of the text; with the current state-of-the-art of artificial intelligence technologies, the ability to predict the next element of the text is important for understanding its meaning and creating new meaningful texts. It is true that the algorithms for creating visual images also use the "prediction of the next pixel". However, unlike text models (GTP-3, etc.) and the text phrases generated by them, during dialog interaction, synchronization between people occurs at the level of neuropsychological functions [9], for example, it increases with the involvement of the general emotional field [10]. The positive effects of this neural synchronization are applied in communication experiments [11, 12].

VISUAL PERCEPTION AND EMOTIONS

Developers are constantly striving to improve the functionality and performance of neural networks (applications DALL-E 2, ruDALL-E, Stable Diffusion, Midjourney, etc.), and their appearance inspires scientists to analyze the visual perception of the meanings inherent in artistic objects using generative art[3] [6, 13]. In this regard, a logical question arises whether the perception of digital art objects is related to the personal characteristics of the beholder. In particular, P. Achlioptas et al. [14] conducted a study of the emotions that accompany the visual perception of pieces of art and the explanations of their own emotions associated with them. Visual art were used in this experiment as stimulus material to evoke a strong emotional response. As the authors of [14] emphasized, the affective component is often underestimated when developing artificial intelligence systems.

Let us conduct a small experiment by answering the following question: "Which of the two images presented in Fig. 2 (*a*, *b*), was created by a neural network, in your opinion?"

The answer is simple. These two images (Fig. 2) were created using artificial intelligence [15].

Due to the development of text2image generative models, it seems possible to quickly create a thematic series of unique digital images using a neural network. Even now, almost any researcher can use such tools, generate new contextual images, and plan their own design of the experiment.

It is ecologically valid to use visual arts as a stimulus for organizing research. A person in his reactions has many experiences, including emotions and self-reflection. This experience is highly individual, and the reactions of people looking at the same object vary significantly. These individual differences are confirmed by the patterns of neuronal activity in different subnetworks of the brain [16].

CONCLUSION

In order to positively answering the question posed in the letter, "Is it possible to use machine intelligence to create generative images and apply it in experimental diagnostics?",

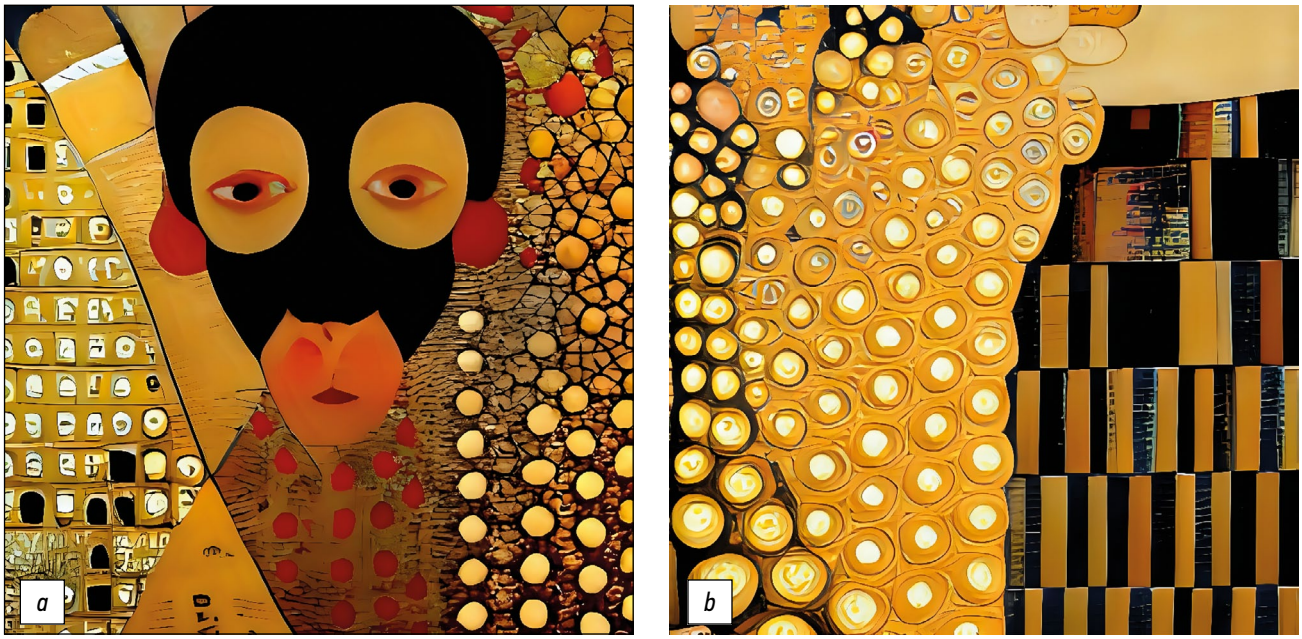

Fig. 2. Images (*a*, *b*) generated by a neural network.

[2] For more details, see reviews about the role of generative adversarial neural networks in the analysis of medical images [6, 13].

[3] Generative art refers to art objects created using information technology, in particular GAN or DM.

it is necessary to focus on the fact that the development of research at the intersection of psychology and generative art, where machine intelligence creates full-fledged artworks, contributes to the emergence of intelligent systems that support the emotional human-machine interaction. Such systems will then be integrated into robots that, in the role of a social partner, will help a person manage adaptively and regulate his own emotions, and, in the role of a medical assistant, will organize therapeutic activities.

Such an approach will be implemented not only as an interactive and intelligent tool of a psychologist and a doctor, for example, for the purposes of experimental diagnostics of affective processes in patients, but as a more complex system[4] that provides a controlled interaction between the doctor-machine intelligence and the patient for the purposes of practical medicine.

ADDITIONAL INFORMATION

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AUTHOR'S INFO

*** Andrey V. Vlasov;**
address: 24-1 Petrovka street, 127051 Moscow, Russia;
ORCID: https://orcid.org/0000-0001-9227-1892;
eLibrary SPIN: 3378-8650; e-mail: a.vlasov@npcmr.ru

ОБ АВТОРЕ

*** Власов Андрей Васильевич;**
адрес: Россия, 127051, Москва, ул. Петровка, д. 24, стр. 1;
ORCID: https://orcid.org/0000-0001-9227-1892;
eLibrary SPIN: 3378-8650; e-mail: a.vlasov@npcmr.ru