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Modern trends of technology of auditing of audio information

Здійснено патентне дослідження сучасних тенденцій технології опрацювання аудіоінформації з ретроспективою десять років за роками, напрямками патентування та країнами-власниками патентів. Систематизовано фактори, які впливають на якість обробки аудіоінформації

It's not possible to imagine a modern person without a mobile phone, tablet or laptop. Information innovations fill our lives in all spheres, and education is no exception. In the time of various devices, society prefers audio-visual information than ordinary printed books, manuals, etc. Students and schoolchildren increasingly choose their education through the Internet to improve their skills or learn new material, which is what is available and interesting to young people. Therefore, distance learning courses or electronic editions become more relevant every year.

One of the main components of distance learning courses is audio information, which can be presented as a separate audio collection or audio book, or be part of a video presentation. This form of information representation helps the user to more deeply perceive and understand the material. When listening to audio, the student concentrates on key moments of the information presented, transmitted by the correct intonations, accents and accents, easier to learn the material, becomes more interested in the subject. Therefore, qualitative processing of audio information is a topical issue.

The purpose of the work is to study modern trends in the technology of processing audio information and systematization of factors that affect the process of processing.

To determine trends in the development of audio information processing, over 150 patents were reviewed and 70 were classified and published in 2008 through 2018, according to the following classes: G10L19, H03G, H04S, H04R, G06N. Retrospective search is taken just ten years, because earlier development may already be outdated and not relevant. The subject of the search were: methods of audio processing; encoding and decoding audio; software and hardware for audio processing. The search for patent documentation was carried out using Internet resources in official patent libraries: Espacenet Patent search (er.espacenet.com), Google Patents Ukrpatent (https://library.uipv.org) and Rospatent (http://www1.fips.ru/wps/portal).

The presented results of the research (Fig. 1) indicate an annual increase in the number of patent developments. In particular, in recent years, various methods of audio and inventions related to hardware have been actively patented.

When processing an audio signal is the application of technologies for changing the frequency or phase characteristics of the sound, narrowing or extending the dynamic range, the use of amplitude, frequency or phase modulation, the removal of noise, as well as the creation of time-delayed fading copies of this signal. The purpose of processing can be as purely technical tasks, such as harmonization of signal parameters with the characteristics of the electroacoustic path, and artistic, which are determined by the sound engineer, in particular, it may be different sound effects [1-5].

The most common sound effects were found in [3-5], which are used in sound processing technologies: echo, reciprocal echo, flanger, phaser, chorus, overdrive, horns displacement, time stretching, resonance effect, robotic voice effect, modulation, compression of sound, three-dimensional audio effects , sound filtering, equalizer and Wah-wah. All these effects are used to correct and improve audio recordings. Directly, such methods as mounting, amplitude transformations, frequency (spectral) transformations, phase transformations, time transformations and formant transformations are used for sound processing.
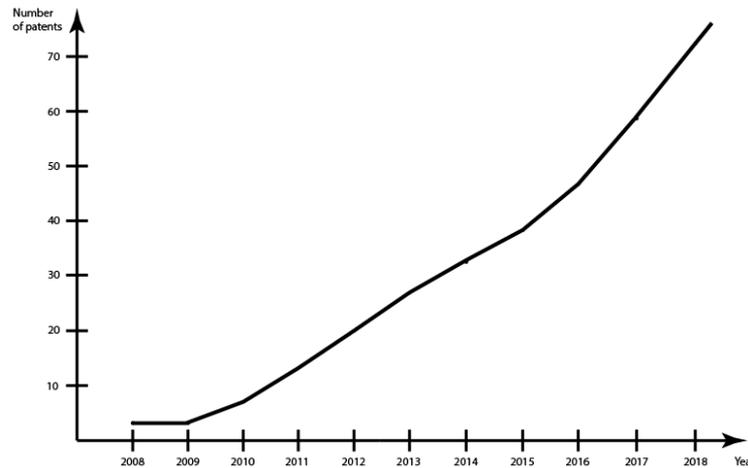
Fig. 1. Diagram of patents developed by technology for processing audio information

As can be seen from fig. 2, Russia and the United States have the largest patents for audio information processing technology, which can be explained by the fact that a large proportion of innovative developments are currently being patented and patented in the United States. A significant number of registered patents in Russia (over 40%) belong to foreign scientists who patent their inventions in Russia.
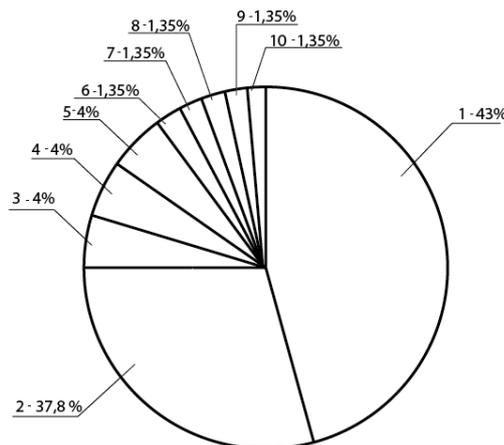

Fig. 2. Diagram of patenting technologies for the processing of audio information by the countries holding the patents: 1 - Russia, 2 - USA, 3 - China, 4 - Japan, 5 - France, 6 - Ukraine, 7 - Korea, 8 - Sweden, 9 - Germany, 10 – Finland

The distribution of the patent design gap by directions (fig. 3) has shown that audio information processing and hardware for this purpose are most often represented in patents over the past ten years. This is due to the fact that workstations for sound processing are improving every year, which, in turn, allows us to upgrade and enhance the audio information processing methods.

The causal diagram of factors influencing the quality of audio information processing is developed. It has been found that important factors in the processing of audio information are played by factors such as hardware and software, since all technological operations are performed with them. For high-quality audio information processing, a workstation with a powerful sound card is required as it affects the number of input and output channels, the sampling rate and the ADC and DAC bit rates, on the frequency and dynamic range [6].

Modern software allows you to make complex sound signal transformations and create the most incredible sound effects. Yes, there are several types of specialized software analyzers [7 to 9]: digital audio sequencer editors; specialized audio restorers; trackers - this is a separate category of sound programs designed to create music; analyzers - designed to perform measurement analyzes of audio data, and help to present audio data more convenient than ordinary editors.
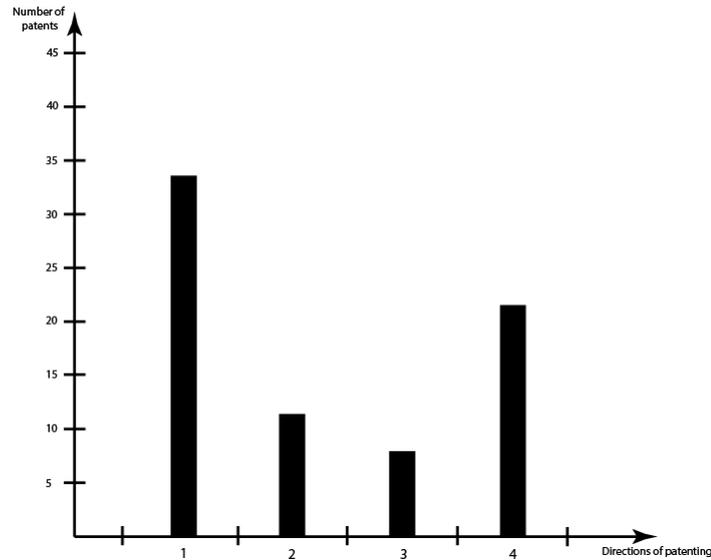
Fig. 3. Dynamics of patenting technologies for the processing of audio information in the areas of development: 1 – methods of audio processing; 2 – audio coding and decoding, 3 – software, 4 – hardware

When processing audio information an important parameter is the format of files, which may vary: formats without compression, compression formats without loss of quality, formats with loss of quality. For high-quality sound, you should choose formats without compression or compressed formats without losing quality, as they will not impair the sound quality.

No less important is the factor of the work of the operator, since the processing of audio information is not an automated process, therefore the created conditions for the work of staff will directly affect the speed and quality of the tasks.

Also, the quality control of audio information processing and interim control of not only technological operations, but also control of equipment adjustment, control over the organization of workplaces and compliance with standards are also influential. It is this factor that allows you to identify shortcomings and quickly eliminate them at intermediate stages.

The developed cause-effect diagram systematizes the factors that influence the quality of the processing of audio information, makes it possible to analyze them to improve productivity and improve the quality of the final product.

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