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## **ARTIFICIAL INTELLIGENCE AND SOUND GENERATION**

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### **ШТУЧНИЙ ІНТЕЛЕКТ І ГЕНЕРАЦІЯ ЗВУКУ**

New technologies, and in particular artificial intelligence (AI), are extremely changing the nature of creative processes. Computers are playing very significant roles in creative activities such as architecture, fine arts, and science. The music industry has also witnessed tremendous transformations done by AI over the past couple of years – not only in terms of listening to music but also in terms of how music is made. Nowadays, AI has reached such a great level that there is a whole industry built around AI services for creating music. Whether it is sounds of distortion or electronic beats, AI has opened the doors of new possibilities for sound generation.

Hiller and Isaacson's (1958) work, on the ILLIAC computer, is the best-known pioneering work in computer music. Their chief result is the Illiac Suite, a string quartet composed following the “generate and test” problem-solving approach. The program generated notes pseudo-randomly by means of Markov chains. The generated notes were next tested by means of heuristic compositional rules of classical harmony and counterpoint. Only the notes satisfying the rules were kept. If none of the generated notes satisfied the rules, a simple backtracking procedure was used to erase the entire composition up to that point, and a new cycle was started again [1].

Recent examples include: Taryn Southern's 2017 album, “I AM AI”, which features music generated by a commercially developed music AI system; the 2018 album “Hello World”, billed as “the first music album composed by AI + artists”; Holly Herndon's 2019 album, “Proto”; and dozens of albums created by the “first-ever algorithm to sign major label deal”. Several companies have also been founded recently to capitalize on advancements of AI applied to music content creation, particularly for production music, i.e., music to accompany film, radio and other media. Examples of these companies include Aiva and Amper for creating soundtracks for advertisements; and Melodrive for automatically creating music in video games. Some companies are also devoting resources to creating software for artists exploiting AI technology. Examples include LANDR for mastering music, IBM and Sony for music composition, and Google's Project Magenta for sound and music synthesis [2].

Amper is a simple example of evolving imitation into collaboration. This online app allows the user to select instruments, rhythms, styles and tempos to “collaboratively” generate new music.

NSynth Super is another example of how AI can generate new music and sounds for the musician to work with [3]. The NSynth algorithm, using deep neural network, learns the core aspects of what makes a sound, sound like it does. And then the system combines the characteristics of different sounds and comes up with new sound or tracks which is not the blending of different sounds; it's completely new. Also, It has the ability to generate more than 100,000 sounds.

Despite all the amazing things NSynth can do, the major benefit is that it is open source, NSynth Super is built using open source libraries to welcome a greater and wider community of artists, coders, and researchers to experiment with machine learning [4].

### Секція 3. Науково-технічний прогрес: проблеми та перспективи

Services like LANDR embody time and cost saving alternatives to traditional workflows that usually include numerous manual tasks and expenses for professional services [5].

LANDR recently rolled out multiple mastering styles, volume matching for playback, and other quality of life improvements, and the company revealed that it now releases thousands of tracks weekly on platforms like Spotify, Apple Music, and Amazon Music. Given that 2.5 million artists in 160 countries around the world have mastered and promoted over 12 million tracks with its tools, it's perhaps unsurprising that Landr has attracted backing from big-name producers and artists like Hans Zimmer, Nas, Richie Hawtin, Pete Tong, and Tiga [6].

Concerning human approaches and solutions, Joshua Reiss, professor for Audio Engineering at the Centre for Digital Music at the Queen Mary University of London and initial co-founder of Landr states: "It is very difficult to understand the solutions and where they come from, so we may call them "creative" when more accurately they are "complex" [5].

The challenge of understanding creative and artistic decisions has been another limitation of AI for musical tasks. Artificial intelligence can offer solutions for complicated problems by exploring the acquired data, using pattern recognition and building neural pathways. But these are still merely a subset of the creative human touch. Reiss explains: "There are too many unknowns, too many subtle aspects, and the human element is far more adaptive" [5].

Of course we are still very far from systems that can replace man in sound generation, also because it is something that strongly involves the emotional component, something that a machine will hardly be able to understand. At the same time, possibilities for products with AI are growing rapidly. Moreover, the trend of economic investments in these technologies reveals glimpses, especially in the user/software relationship. The professional audio-video market is very dynamic, growing 12% a year and is expected to reach over \$ 180 billion in revenue in 2020 [5], in such a dynamic environment it is no wonder that the technology of machine learning will find fertile ground. AI musical potential is immense and it is likely that some creators and musicians will have the inclination and the aptitude to be much more inventive in their interaction with the system and produce truly unique results through it.

#### References

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