



**Published:**

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## 5        **GENERATING MUSIC OUT OF A DATABASE OF SETS OF NOTES**

The subject of the invention is a method of generating music contents, based on algorithms of sequential processes performed on input data sets.

10        Algorithms should be understood in this disclosure as a sequence of actions performed on data in the form of a music contents set, formed according to compositional rules created on the basis of user preferences, business and legal rules standardising organisation of the process of generating music contents and their recordings.

15        Business rules should be understood as a statement, which defines the business aspect aimed at controlling or influencing business behaviour by informing that there are specific requirements related to behaviour, actions and practices or procedures executed within the given user activity. For the purpose of this disclosure of the solution, business rules have been merged with music  
20        composing rules.

Business rules with music composing rules should be understood as any set of rules of music compositions, taking into account sales estimation of musical forms and standards of music composition.

25        The term of atomic sound repository should be understood as a set of single note recordings.

During the process of generating music contents, algorithms perform a series of processes, aimed at creation of a generator in the first step, with said generator generating a digital musical score of a model provided with parameters and composition characteristics in the generator, according to user preferences. Music  
30        contents are generated in this area of generator operation, on the level of a technical composition.

Music contents on technical level should be understood as a developed model resulting from a range of executed processes, aimed at generator creation. The generator creation process is divided into two stages, wherein in the first sub-stage of the first stage, contents are created on an abstraction level as an  
5 element of the form, in the second sub-stage, the abstract contents are converted into a digital musical score of each part of the given instrument separately, containing the form, layers of harmony and melody, shaped by setting composition parameters and characteristics in the generator, according to user preferences.

10 In the second stage of the music contents generation process, the digital score is processed such that it is transformed into a recording in the specified sound form, using sampling synthesis and samples as recordings of single sounds. Sampling synthesis should be understood as the process of music contents creation using a part of a previously prepared music recording, known as  
15 a sound sample, as an element of a newly created composition.

During the rendering stage, music contents in the form of a model are replaced by a sequencer and a sampler, using sound samples, into the form of a recording of individual instruments, separately. Such created contents are subjected to applying sound effects through digital signal processing (DSP), and  
20 mixing of separate parts into a multi-instrument recording in the next stage. The final recording is obtained and verified by a critic module based on artificial intelligence algorithms of neural networks. During this stage, a composition of artistic nature is obtained, with compositional advantages conforming to business standards and compositional rules. Next, the composition is exported to the  
25 distribution module of the platform.

A range of solutions generating music compositions is known. A known solution is presented in the patent publication KR 20190100543. It discloses an electronic device, including: a display, a processor connected electrically to the  
30 display, a memory connected to the processor, wherein when the processing takes place, the processor checks the specified input parameters and output

sound tracks and identifies sound parameters on the basis of an artificial intelligence algorithm. The electronic device stores instructions for verification of appropriate information about the composition and displaying auxiliary information related to input correction of the sound track on the display according to the confirmed information about the composition. The defined parameters include precise information, in particular about the musical style, about the musical instrument, rhythm, tempo and the music genre.

Another known solution is disclosed in the patent document CN 110211556. It discloses a method and a device for music file processing, a terminal and a memory medium. The processing method includes the following stages: first data of human voice is collected, intended to introduce target sounds, obtaining reverb parameters accepted by data of the target human voice, corresponding to target music. First data of human voice is processed according to reverb parameters, and second data of human voice is obtained. Data of human voice and of the accompanying music corresponding to the target music are then processed, synthesised and the target music file is obtained.

Another known solution is presented in the patent disclosure KR 20190105254. It discloses a solution intended to provide a fully digital sound processing device, which directly receives digital signal of a sound source. The processing takes place on the basis of a file containing a digital sound source, audio signal processing takes place fully digitally, in connection with the input signal of the digital sound source. The audio signal is then sent to a loudspeaker. After direct introduction of the digital signal from a digital sound source file, the entire signal processing may be subsequently performed digitally, and the audio signal may be processed adaptatively, on the basis of artificial intelligence.

According to the invention, the method of generating music contents is based on a series of sequential processes, the operation and course of which are based on artificial intelligence algorithms. The process of music contents generation takes place using a controller corresponding to the MIDI standards. Business rules enabling automatic creation of music tracks according to user preferences

were created. Automatic generation of music contents is possible by solutions operating within the platform, such as a user preference database, repository resources, business rules, models used in generation of music compositions of the given type and a melody generator, where parameters and characteristics for models of instrument form and lines are specified. Models are created on the technical level and further processed according to music input file modification algorithms, such that the final recording is generated, and after its verification the composition containing the intended compositional and artistic load is obtained.

The method of generating music contents according to the invention is characterised in that the input sound samples are processed according to input music file modification algorithms, related, in particular, to characteristics such as tempo, mood of the song, the music genre, duration and the scope of contents modulation. This results in a composition with the intended artistic expression. The first stage of the generation process includes construction of music contents on the technical level, in the form of models. Technical contents are obtained as a result of a range of processes focused on generator creation. Execution of the series of processes includes analysis of the input music contents in terms of the existence of patterns once the input contents are provided. Next, the patterns are saved in the database of business rules and music composition rules used to develop the music composition generation models of the given type. Thus, a melody generator is created, used to generate a digital score of the parts of the given instrument. A database of atomic sounds is prepared in general and then sent to the generator, where parameters are set using a controlling device conforming to MIDI standards. Thus created models are subjected to automatic generation of a digital score and parts for individual instruments are created and subsequently rendered to music tracks for each instrument. A record on an artistic level is obtained. Next, the record is polished and mixed. The final version of the record is recorded and next the composition and its record is verified by the critic module. After verification, the record is exported to a distribution module of a dedicated platform.

In the preferred embodiment of the invention, the final music record is created using artificial intelligence algorithms during the stage of analysis in terms of the presence of existing patterns, preparation of composition generation models, creation of a melody generator and sound preparation.

5 In another preferred embodiment of the invention, sound samples are created simultaneously with contents saving in the repository.

In another preferred embodiment of the solution, the developed models are sent to be read and a digital note record of the composition with the desired characteristics is generated automatically.

10 In another preferred embodiment of the invention, sound tracks of the instruments are rendered using repository resources.

In another preferred embodiment of the invention, the composition and its record are verified using artificial intelligence and the process of generating music contents is repeated from the beginning if the record does not pass verification.

15 Using ready patterns of diagrams and samples, a user without special instrumental and hardware resources and with substantial knowledge on the level of a programmer or of a sound engineer, using a controller in order to specify the characteristics of sound contents shall be able to create fully fledged music contents with artistic value, prepared according to individually specified composition preferences.

20 Artificial intelligence algorithms are used during the process of music contents creation, resulting in an effect of work of an entire team of specialists responsible for generation of such music contents using traditional tools. The operation of the generator is supported and controlled by a controller based on the MIDI standard. The fully digital generation of musical contents using a controller gives the user the opportunity to specify instructions for the generator, by specifying base parameters, in particular for the genre, tempo, mood, duration and content modulation parameters imparting individual contents. The work of the user is

25 additionally supported by the functional repository of sounds containing sounds in the form of single notes. Music tracks for individual instruments are rendered to a

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form next subjected to mixing and specified to the level according to the intended, artistic composition. The algorithm, based on operation of multilayer feedforward neural networks, verifies the composition and its record in terms of conformity with composition assumptions, in particular for conformity with preferences and business standards effective during composition. The music contents may be generated without limitations. The generator creation process takes place one time. The generated music contents may be distributed.

The subject of the invention is presented in an example embodiment in the attached drawing, which illustrates an example block diagram of music contents generation.

The block diagram presents the course of individual operations executing the subject of the invention, and indicates the sets and databases used during generation of new music contents using the method according to the invention. The terms music contents, composition, composition and its record are used in this disclosure in order to designate the result of the method according to the invention. A controller conforming to the MIDI standard is an element required to execute the method according to the invention.

In the block diagram presented in the figure, each "+" symbol should be understood as a conjunction of a series of processes following in a sequence during a single period of time.

The arrows denoted with a dotted line along their length, should be understood as an indication of the sequence of actions occurring in the past compared to the sequence of activities indicated with arrows denoted with a continuous line along their length.

Each first arrow leading to the tile of the database 25 should be understood as a "saved in" arrow, while each arrow leading from the tile of the database 25 should be understood as "read in".

Existing compositions should be understood as existing sound compositions or sound samples.



The term "composition and its record" during the stage of exporting to the distribution module of the platform 23 should be understood such that not only the record itself is verified, but also i.e. some of the information regarding parameters set by the user and characteristics of the composition 12, including the  
5 composition concept, e.g. its genre.

The term of contents on the technical level 26 should be understood as the MIDI file and additional data sent to the generator in the form of a technical algorithm and of the source code.

Sequencer 28a should be understood as an electronic device or a computer  
10 program storing not the sequence of sounds, but a sequence of instructions controlling the synthesiser, including parameters and enabling its multiple playback.

Sampler 28b is understood as an electronic music instrument or a computer program enabling digital recording of any sound, and its subsequent use as any  
15 traditional music sound.

The area of operation of the sampler and of the sequencer should be understood as tandem operation of modules: 28a and 28b on MIDI files and data related to music contents, comprising instructions for the rendering process 16.

Verification by the AI critic module 19 should be understood as verification of  
20 the record and of its composition by a module based on operation of artificial intelligence algorithms based on artificial neural networks. These are learning algorithms comprising of networks of artificial neurons, first and foremost able to generalise the observed data. The network learning term should be understood as forcing the network to react to the selected input parameter in a specific manner.

25 As shown in Fig. 1, the process of generating music contents begins with generator formation, wherein input music contents 1 from existing compositions are analysed first. The two track nature of the process lies in the fact that existing compositions are analysed in terms of the existence of patterns 3 of existing compositions simultaneously with music composition generation models 5 are  
30 developed, the melody generator 10 is created and sounds 6 are prepared. Thus generated models on the technical level 27 in the form of source code are

introduced into the generator 14, for which parameters and characteristics are set. Setting characteristics and parameters for the generator is preferably performed using a controller 26 conforming to the MIDI standards.

Contents from the generator as models on the technical level 27 are sent to  
5 the generation process, where a digital score of the composition with the required characteristics 15 is generated automatically on the basis of artificial intelligence algorithms and parts for individual instruments 17 are next obtained. The created parts 17 are sent as information analysed in the field of sequencer and sampler 28 operation and rendered 16 for each instrument separately, such that using the  
10 the sequencer and the sampler, with samples, digital score of each part of the given instrument are changed to a sound form and the record form is created separately for individual instruments. Next, the record is polished and mixed 18. Thus, the final music record 20 is obtained and sent to verification. The composition 27 and its record 20 are verified using the critic module 19 base on specialist neural  
15 network algorithms. The final music contents are exported 23 and sent to distribution 24. If the composition and its record are verified negatively in the critic module 19, the process is stopped at this stage an the automatic generator 16 generates new contents according to the set parameters and characteristics, preferably using user preference databases 13.

20 In this embodiment of the invention, the prepared music contents are saved in the sound repository 8 during the sound preparation stage 6.

In this embodiment of the invention, the generator has composition characteristics and parameters set using user preference databases 13.

25 In another embodiment of the invention, generation models for music composition of the given type are developed and saved in a database 11 of prepared models, from which these models are read during the stage of automatic generation of the digital score of the composition with the desired parameters 15.

List of figure references:

- 5        1. Introduction of the input music contents  
         2. Process conjunction  
         3. Analysis of existing compositions for pattern presence  
         4. Business rules, including music composition rules  
         5. Development of generation models for music compositions of the given type  
10       6. Sound preparation  
         7. Data saving in the selected database  
         8. Atomic sound repository  
         9. Data reading from the selected database  
         10. Melody generator creation  
15       11. Developed models stored in a database  
         12. Setting composition parameters and characteristics in the generator  
         13. User preference database  
         14. Music generator  
         15. Automatic generation of a digital score of the composition with the desired  
20       parameters  
         16. Rendering the sound from sound samples according to the digital score  
         17. Instrument parts  
         18. Record mixing and polishing  
         19. Verification of the composition and of its record by the critic module based on  
25       artificial intelligence (AI)  
         20. The final music record  
         21. Positive evaluation of the composition and of its record  
         22. Negative evaluation of the composition and of its record  
         23. Export to the distribution module of a dedicated platform  
30       24. Music distribution  
         25. Database tile  
         26. Controller conforming to the MIDI standard  
         27. Creation area of the content on the technical level  
         28. Sequencer and sampler operation area  
35       28a. Sequencer  
         28b. Sampler  
         29. The area of final music contents on the artistic level
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## Claims

- 5 1. A method of generating music contents according to the invention, wherein input sound samples are processed according to modification algorithms music input files, related, in particular, to characteristics such as tempo, mood of the composition, music genre, duration and the scope of content modulation is selected, with the effect being a composition with the intended artistic
- 10 expression, **characterised in that** music contents are created on the technical level (27) and on the artistic level (20), wherein on the level of contents creation on the technical level (20), the input music contents (1) for the presence of patterns (3), the patterns are saved in a database of business rules and music composing rules (4) used to develop generation models of
- 15 music compositions of the given type (5), next a melody generator is created, in which a digital score of the part of the given instrument (10) is created, wherein a database of atomic sounds (6) is created simultaneously, and next the music contents are sent to the generator (14), in which parameters (12) are set using a controller (26) conforming to the MIDI standard and subjected
- 20 to automatic generation of a digital score of the composition (15) and parts for individual instruments (17) are created and then rendered (16) to music tracks for each of the instruments, followed by mixing of individual tracks into a record (18) and the final version of the record (20) is obtained, with the composition (27) and its record (20) then verified by an AI critic module (19).
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2. Method of generating music contents according to Claim 1, **characterised in that** the final music record (20) is created using artificial intelligence algorithms at the stage of analysis for the presence of existing patterns (3), composition generation models (5) are developed and the generator (6)
- 30 preparing sound (10) is created.

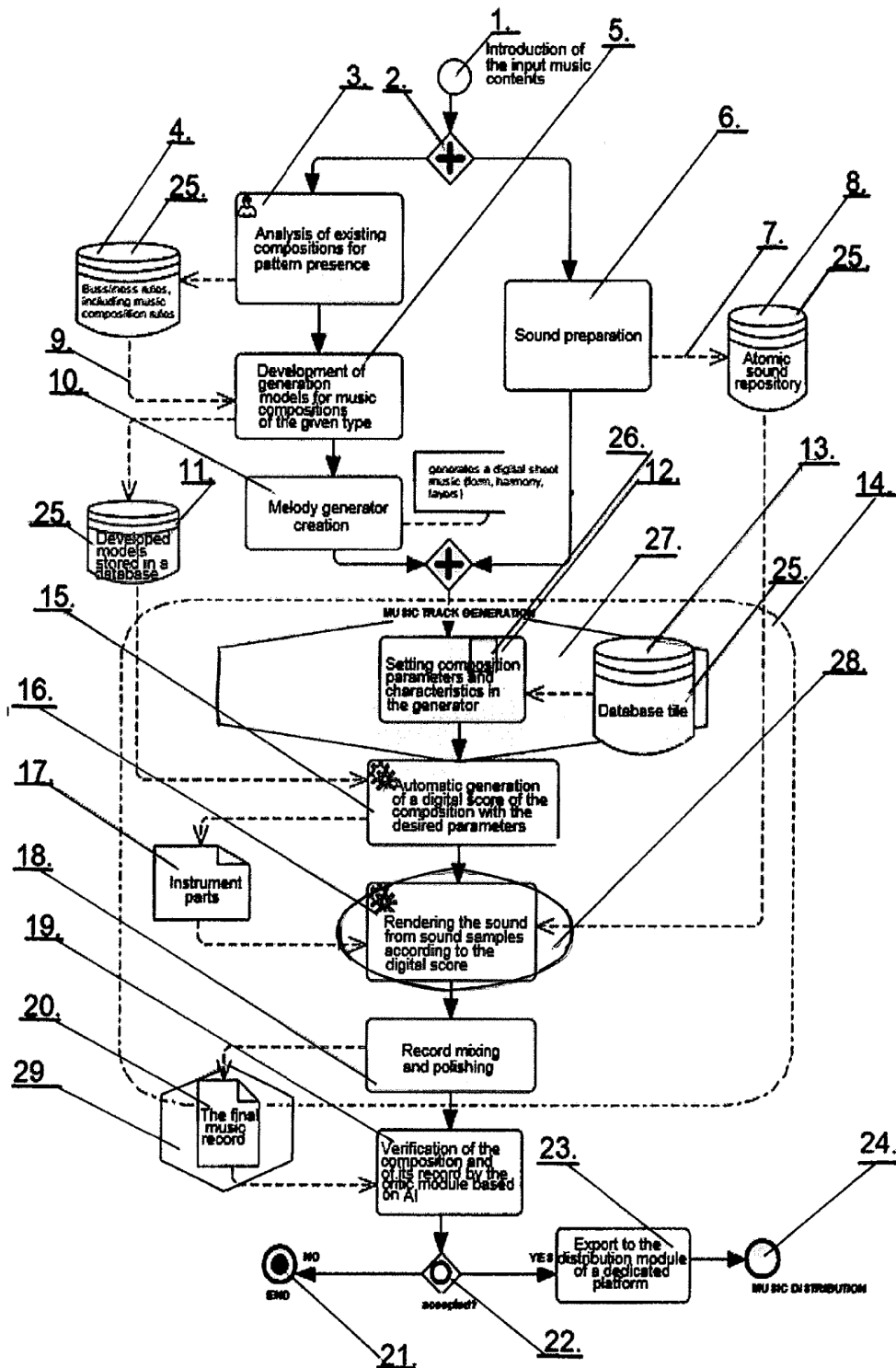
3. Method of generating music contents according to Claim 1 and 2,  
**characterised in that** sound samples (6) are created and contents are saved  
in parallel in the repository (8).
- 5 4. Method of generating music contents according to Claim 1, **characterised in  
that** the developed (5) models (11) are sent to be read and a digital score of  
the composition with the desired parameters (15) is generated automatically.
- 10 5. Method of generating music contents according to Claim 1, **characterised in  
that** sound tracks of instruments (17) are rendered (16) using resources from  
the repository (8).
- 15 6. Method of generating music contents according to Claim 1, **characterised in  
that** the composition and its record are verified (19) using artificial intelligence  
algorithms and the process of generating music contents is repeated from the  
beginning if the record does not pass verification.

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# INTERNATIONAL SEARCH REPORT

International application No  
PCT/PL2021/000039

## A. CLASSIFICATION OF SUBJECT MATTER

INV. G10H1/00  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G10H G06F G06Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2009/064851 A1 (MORRIS DAN [US] ET AL) 12 March 2009 (2009-03-12) paragraphs [0002], [0030], [0047] - [0086], [0102], [0112], [0123]; claims 1, 18, 23; figures 2,7 ----- -/--	1-6

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

28 October 2021

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04/11/2021

Name and mailing address of the ISA/

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# INTERNATIONAL SEARCH REPORT

International application No  
PCT/PL2021/000039

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	<p>PLUTA MAREK ET AL: "An Automatic Synthesis of musical phrases from Multi-Pitch samples", ARCHIVES OF ACOUSTICS, vol. 42, no. 2, 27 June 2017 (2017-06-27), pages 235-247, XP055854301, DOI: 10.1515/aoa-2017-0026 internet Retrieved from the Internet: URL:https://journals.pan.pl/Content/101287/PDF/aoa-2017-0026.pdf&gt; [retrieved on 2021-10-22] abstract paragraphs [0001], [02.3], [03.6], [03.7], [0006]; figures 2,3,4; example Reference [11]; table 1</p>	1-6
Y	<p>US 2020/090632 A1 (REIN DIETER [DE] ET AL) 19 March 2020 (2020-03-19) paragraphs [0011], [0046]; claims 1,2, 5,6; figures 1-5</p>	1-6
A	<p>KR 2019 0100543 A (SAMSUNG ELECTRONICS CO LTD [KR]) 29 August 2019 (2019-08-29) cited in the application claim 10</p>	1-6
A	<p>CN 110 211 556 A (BEIJING BYTEDANCE NETWORK TECH CO LTD) 6 September 2019 (2019-09-06) cited in the application figures 2,3</p>	1-6
A	<p>KR 2019 0105254 A (JD SOUND CO LTD [KR]) 17 September 2019 (2019-09-17) cited in the application abstract</p>	1-6



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/PL2021/000039

### Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:  
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 1-6(partially)  
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:  
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:  
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

### Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

#### Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

Continuation of Box II.2

Claims Nos.: 1-6(partially)

Doubts arise as to whether the present application fulfills the requirements of Article 5 PCT for the following reasons (and for additional reasons detailed in the WOISA):

Manually / automatically

Claim 1 does not clearly define which steps of the method are performed automatically by a processor and which steps are processed manually by a human. However it is also unclear from the description whether the actions of sending, developing, creating, preparing are performed by a human or by the claimed algorithm.

Generalisation

In figure 1, a music generation method is depicted only in a form where all steps of an algorithm are present to obtain the effect of music generation according to specific rules.

With the scope of claim 1 as filed, a selection has been made from a broad range of possible sub-routines from the complete algorithm of figure 1, so that this selection shows only a broad case different from the specific disclosure defined by figure 1 and by the corresponding pages of the description.

Speculative features

Feature

F19-: Line 24 of page 10, claim 1 makes use of the expression "with the composition and its record then verified by an AI critic module". However the description nowhere defines in technical terms how this verification step is to be carried out, nor precisely defines the features of "critic module" and how it is to be implemented.

Reviewing

the description, following comments are made:

- The description page 2

lines 23, 24 defines "compositional advantages conforming to business standards and compositional rules", a mere result to be achieved;

- The

description page 4 lines 28-30 provides literal support as it defines "The final version of the record is recorded and next the composition and its record is verified by the critic module. After verification, the record is exported to a distribution module of a dedicated platform", but it does not enable the skilled person to carry out feature F19-.

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The description page 4 lines 7, 8 defines "the final recording is generated, and after its verification the composition containing the intended compositional and artistic load is obtained",

here again not

enabling the person skilled in the art to carry out the invention.

- The

description page 5 lines 28-30 defines: "In another preferred embodiment of the invention, the composition and its record are verified using artificial intelligence and the process of generating music contents is repeated from the beginning if the record does not pass verification", leaving the reader in doubt as to whether the same invention is defined

**FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210**

in figure 1 and in claim 1.

- The description page 6 lines 2-5 defines:

" The algorithm, based on operation of multilayer feedforward neural networks, verifies the composition and its record in terms of conformity with composition assumptions, in particular for conformity with preferences and business standards effective during composition";

- The

state of the art document KR20190100543, cited on page 2 line 28 of the present description, mentions a verification step in dependent claim 10:

" ... instructions that allow the processor to verify setting information and to automatically correct ... ", which however provides no information either as to a potentially known scope of the feature F19-, since the expression " the composition and its record then verified by an AI critic module" of claim 1 does not carry the same meaning as:

" to verify

setting information" of KR20190100543, nor as: " conformity with preferences and business standards" of the description.

Feature

F19-critic module 19: - The description page 7 line 19-24 defines that " the AI critic module 19" is using AI but does not define how this feature is to be implemented. However, the description page 2 lines 21, 22 and page 8 lines 13, 14 do not provide a remedy to this speculative feature "critic module".

Conclusion

The features of claim 1, in particular on lines 6, 7, 14, 15, 16, 17, 18, 24 of page 10, are so broadly formulated that their scope is speculative.

A meaningful search can only be performed on the basis of the narrower, disclosed invention, on the basis of that part of the claim which is supported.

The search was

consequently restricted to the features shown in the drawing and in corresponding passages of the description.

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) PCT declaration be overcome.

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/PL2021/000039

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2009064851 A1	12-03-2009	CN 101796587 A	04-08-2010
		JP 2010538335 A	09-12-2010
		TW 200921637 A	16-05-2009
		US 2009064851 A1	12-03-2009
		US 2010192755 A1	05-08-2010
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CN 110211556 A	06-09-2019	NONE	
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KR 20190105254 A	17-09-2019	NONE	
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