Musical Blockchain

World's first Creative approach to blockchain

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00. Abstract

This document proposes the world's first Creative approach to Blockchain as a solution for melodic sequence composition and sound generation, based on a provided source of inspiration, and new fundamentals for computer-based improvisation, with implementation of public blockchain-powered ledger for generated digital assets and then-legal issues management on a second layer.

Having future appliances in music, art, education, medicine and other areas, this solution induces Creativity and is expected to have a profound impact on the real world at many levels.

01. Introduction

Most use cases, demonstrating blockchain's potential for the Creative Industry are usually just different new examples of intellectual property management, fundraising and direct sales/different micropayments, done in a modern way which in fact has little or nothing to do with what this industry is built on - Creativity.

Taking in account that the overall Creative Industry is relatively-huge, this document mainly focuses on the sound-related segments of the Creative Industry.

When it comes to computer-generated works, resulting in computer-generated sequences powered by pre-trained neural networks or similar machine learning algorithms, it is proximate to the result of the work of a real human being. However, while generation is highly automated and algorithmised, the result usually uses previously predefined patterns to replicate style, movement, and technique.
Our essential principle is to avoid pre-trained models and propose natural-like inspiration, improvisation, and jamming processes on a technological level with the aid of a blockchain.

02. Structural basics
We define musical composition as a chain of linked blocks.

Blocks represent variable-sized multitrack sections of a composition, from a single tone to a complete musical phrase.
Block building begins from zero-block. Zero-block contains an expandable list of main rules and characteristics for composition, including crucial info on section size, key, track count, form, composition length, rhythm, intervals, pitch variation, tempo flow.
Starting from zero-block, the main composition is being built by the network of nodes, adding blocks, relevant to the initially provided characteristics.
Each newly generated block contains information about the previous section, progression, and progression details.
Every block, broadcasted to all nodes, being timestamped by the entity, carrying responsibilities of an orchestral conductor.
Conductor is able to react in real time. When required, raised privileges could be applied to the conductor, controlling block creation.
When the conductor has raised privileges, next-block building leadership (similar to the jazz world' soloing) could be set based on the improvisation intensity of the progression, section rules and progression details.
Forks are possible when most nodes are not agreeing on a currently broadcasted progression.
Forks are resolved by selecting the longest chain, first completed the block building, relevant to the characteristics - or - with the intervention of privileged conductor. Orphaned forks are dropped.
Not to be caught in the infinitive forking, block building time is limited to 13 minutes; fork, which will have closest characteristics, derived from conductor's analysis, will be added on the timeout and following blocks will be built out of it.
Resulted blockchain contains multitrack composition, that can be exported in human-audible format.

03. Process
The whole generation process utilises three main methods: Inspire, Improvise, Jam.
Before the beginning of sequence generation we need to set basic characteristics for the composition.
This is done by the analysis of the provided static data via the Inspire method.
When we have set of characteristics, we initiate melodic sequence generation with Improvise method.
When we interact with real time input, data is being feed to the Jam method.

=> Inspire
This method is used to prepare the initial set of characteristics of the future melodic sequence, based on the user provided data.
For an in-depth analysis of different types of user-provided data source (image, text, audio, binary data), this method is utilising different reversible (allowing to process data in both ways) in-house developed modules which we have created, based on the works in the

synesthesia field, with such references as Newton's (1704); Seeman's (1881); Rimsky-Korsakov's (1908); Scriabin's (1911); Appeli's (1940) color-to-key tables; works in physics, mathematics and frequency analysis field, referring highly acclaimed Chladni's experiments (1787); various works in the medicine (works and publications on psycho-acoustics, hearing and sound/human body studies), psychology (mentioned before synesthesia, as well as works and publications on the emotional states, color psychology and conscious/unconscious perception) and esotherics (works and publications on chakras and colors).
Additionally, we utilise machine-learning algorithms for object recognition, emotion spectrum analysis, and data-patterning algorithms.
As a result of user data analysis this method generates a set of rules and characteristics, forming zero-block.

=> Improvise
Machine-learning models, pre-trained on existing tracks are **NOT USED** for any data generation.
Melodic sequence being built block-by-block by the network of nodes, working simultaneously, with a small coordination by the conductor.
Nodes are building blocks in the same way as musicians in a studio creating a melody.
Each node in a network represents a different instrument, building its own part of a block.
Conductor is responsible for block timestamping and presence check.
Additionally, the conductor can correct improvisation process during the procedural checks, including:
- Rhythmical check
- Style-wise check
- Melody form-wise check
- Melody diversification check
- Expressiveness check

We utilise machine learning algorithms only for the analysis and corrections (as one of the references we use the works of Nicolas Slonimsky).
An additional feature provided by the method - is an instrument/synth suggestion for generated multitrack data, according to the initial set of characteristics.

=> Jam
While taking over the realtime input of user data, this method sets additional privileges and correction sets for the conductor, which controls block generation.
Re-initialised the Inspire method generates a new sequence, broadcasting blocks to the real-time human-audible output, handled as well by this method.

04. Non-sequential data generation
While default output for the Improvise method is a melodic sequence, it is possible to generate non-sequential data accompanying the provided user data, using reversible-design of Inspire method's modules.

By controlling initial characteristics of zero-block and adding privileges to the conductor (or removing conductor from the list of participating nodes), it is possible to initiate an additional instance of Inspire method on the newly generated block and reverse-process it, broadcasting conversion output as a newly generated block.
Thus, resulting blockchain may contain audio, graphical, text or binary data, which is possible to convert into a human-perceptible format.

05. Nodes interaction over the network

Normal interaction of the nodes over the network looks like this:
1) New generated block is broadcast to all nodes.
2) Each node collects broadcasted data as a new block basis.
3) Each node works on new block generation, according to the new block basis, using initial set of characteristics and progression data for calculations.
4) When a node builds a successful progression, it broadcasts the resulting block to all nodes.
5) Nodes accept the block if the progression is relevant and finishing own parts of the block generation with provided details.
6) Conductor is called to resolve unaccepted issue or to handle occurred timeout.
7) Conductor can select a new leader, whose progression and progression data will be dominant for the next block.
8) When all nodes have expressed their acceptance, dominant progression is selected according to initial set of characteristics and progression data of the nodes.
9) Nodes express their acceptance of the block by working on creating the next block in the chain, using the data of the accepted block as a new block basis.

06. Output

Resulting digital asset is stored in blockchain in the internal format, fingerprinted and secured.
Data export into human-perceptible format is possible thru the exporting modules.
For sequence export MIDI and waveform formats are used.
For pure audio data waveform and binary data dump formats are used.
Text data are exported in plain text with line breaks.
Graphic data are exported as a data tables for following analysis and re-use.
Realtime audio stream is used for realtime Jam method.

07. Additional aspects

When solution is used for a full composition generation, implementing acoustic fingerprinting into the process for audio identification, will prevent creation of similar musical compositions.
Unique audio fingerprints may be stored in the existing public blockchain-powered ledger, creating international public database of generated digital assets, with appropriate copyright data and licensing information.
Some generated full-length digital assets will be used for inspiration and boosting artistry of the creative community free of charge.

Artists, using full-length digital assets for commercial production, are by default agreeing to split royalties in 50/50 percentage, unless specified otherwise in advance by mutual agreement between the parties.

08. Essential references

Bitcoin: A Peer-to-Peer Electronic Cash System, Satoshi Nakamoto, 2008.
Traité d'acoustique, Ernst Florens Friedrich Chladni, 1809.
Thesaurus of scales and melodic patterns, Nicolas Slonimsky, 1947.
Practical Manual of Harmony, Nikolay Rimsky-Korsakov, 1937.
The physics of vibrations and waves, H. J. Pain, 2005.

09. Conclusion

Most whitepapers nowadays end with some sort of summarising paragraph, telling of the high points and wow factors, and how bad the industry was before the product came along.

We would like to revisit our abstract and talk briefly about the future.

With this document we described our Creative approach to the Blockchain as a solution for melodic sequence composition/sound generation, and proposed new fundamentals for computer-based improvisation without CPU-power/energy-wasting PoW-systems and pointless calculations, which also makes this solution kind of 'Green'.

As for the future.
We believe that the tools for inspiration and boosting creativity will be your next best friend in the studio, on-stage, and at home.
We believe that man-machine collaborations, and unique data-driven soundscapes will create a beautiful sonic experience.
We believe that technology can spawn a new generation of young musicians, utilising tools as tools, and not as a replacement for talent.
We believe that new technologies will change the concept of art, as photography changed it almost 180 years ago.

We believe, that making solutions for a real world is the only way forward.

The world has changed yesterday.

Are you ready for a future?