



AI×MUSIC

Workshop

**Recommenders and Intelligent Tools in
Music Creation: Why, Why Not, and How?**

Speakers

**Christine
Bauer**

Johannes Kepler
University Linz



**Peter
Knees**

TU Wien

**Richard
Vogl**

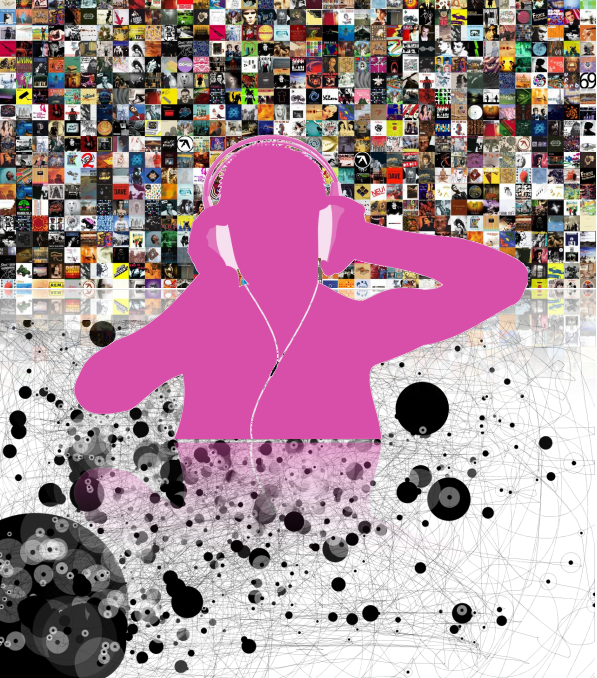
TU Wien



**Hansi
Raber**

Hansi Raber

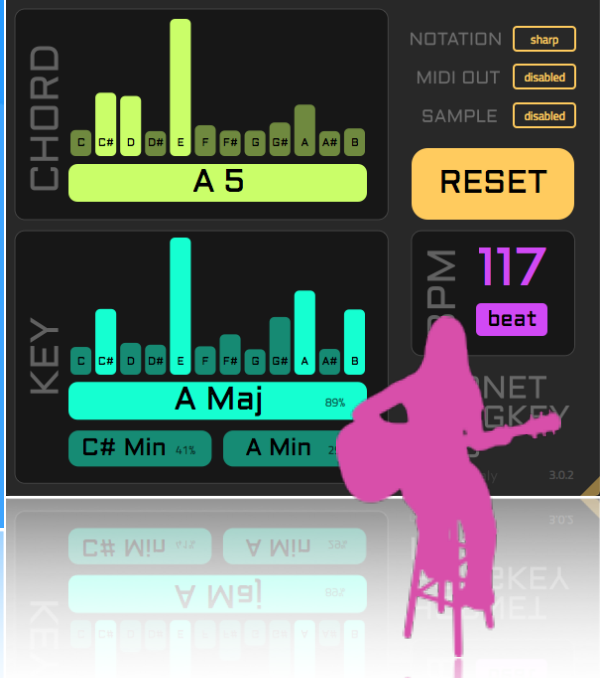
Artificial Intelligence and Music



Recommendations for listeners

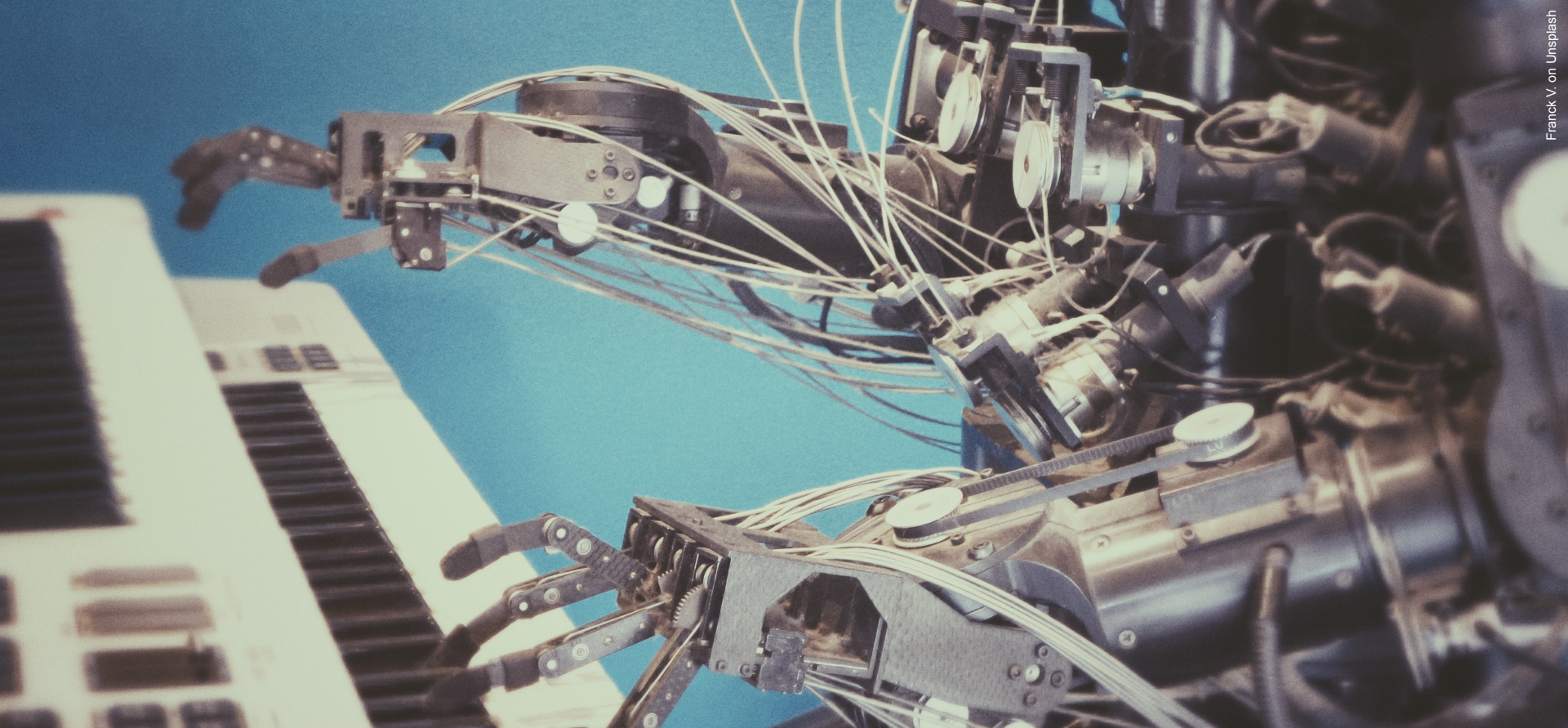


Song identification



Chord and key identification

Typical associations

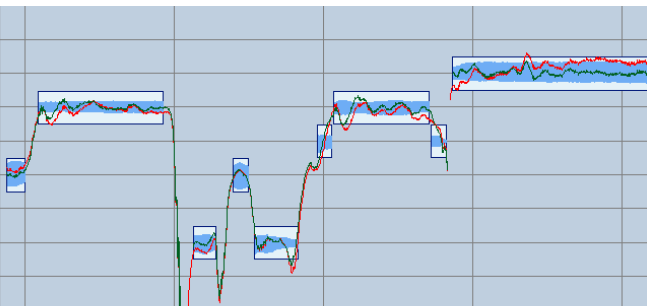


AI as music creator – the future?

Quantization & Slicing

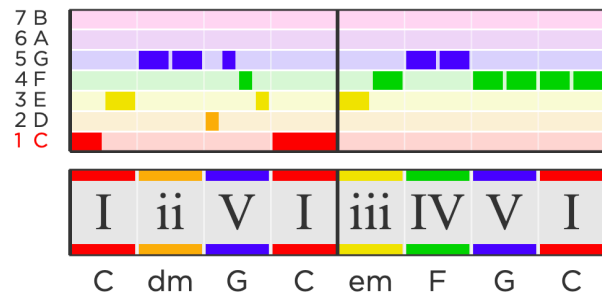
Melody assistant

Automatic drumming



Autotune

Automatic mixing



Chord suggestions

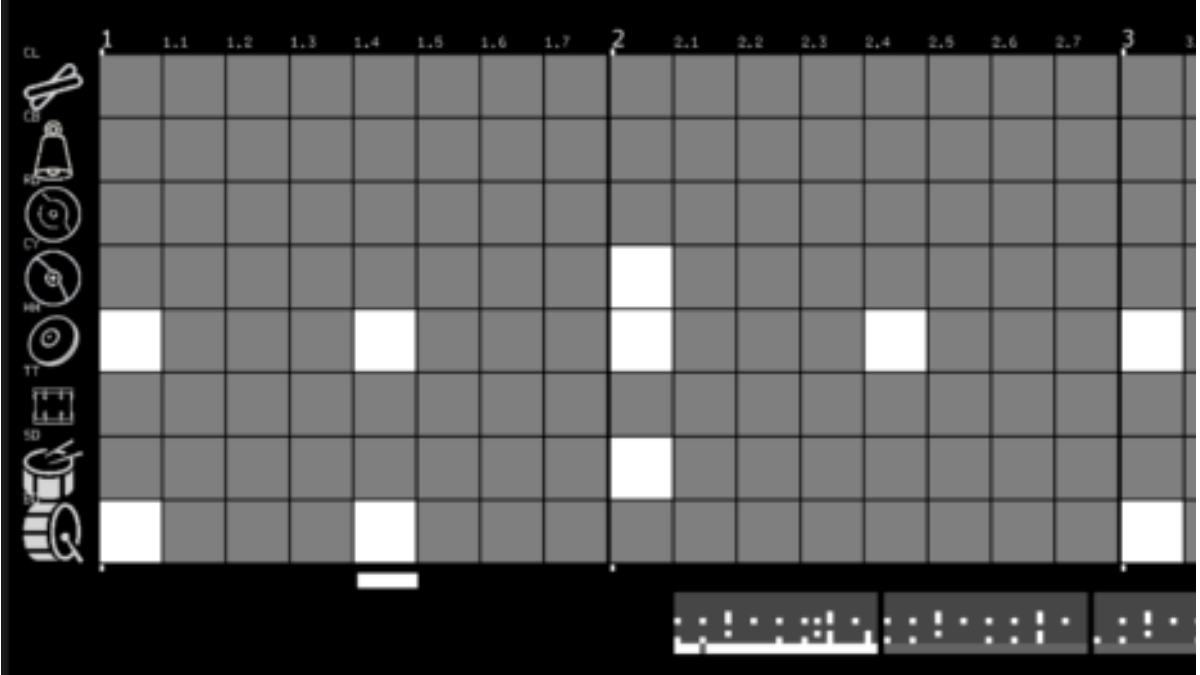
Intelligent tools in music creation



**Peter
Knees**



Recommenders and intelligent tools for creative music making



Richard Vogl **Hansi Raber**



Technology demos



**Christine
Bauer**



Reflection and open questions

Recommenders for Music Makers

LIB	DISK	FX
BANK	TYPE	SUBTYPE
Factory	Kick	Rim Shot
Favorites	Snare	Side Stick
Samples	Clap	Roll
User	Hihat	Brush
NEW ...	Cymbal	Analog
	Tom	Digital
	Shaker	Acoustic
	Metallic	Distorted
	Wooden	Noisy
	Hand Drum	Dry
	Mallet Drum	Wet

Type here to filter...

- SAMPLE NAME
- Snare-RnBB.wav
 - Snare-Runaround.wav
 - Snare-SoulOne.wav
 - Snare-StudioA.wav
 - Snare-StudioB.wav
 - Snare-StudioC.wav
 - Snare-StudioD.wav
 - Snare-SweetItOut.wav
 - SnareRim-Dakeat.wav
 - SnareRim-DraculaEast.wav
 - SnareRim-Dragon.wav
 - SnareRim-Dub.wav
 - Snare-SoulOne

BANK	TYPE	SUBTYPE
Factory	Kick	Rim Shot
Favorites	Snare	Side Stick
JWH	Clap	Roll
Samples	Hihat	Brush
Fills	Cymbal	Analog
User 1	Tom	Digital
NEW ...	Shaker	Acoustic
	Metallic	Distorted
	Wooden	Noisy
	Hand Drum	Dry

Sojourner Truth		Intro	Drop	Section 1	Section 2	Outro
SYNC: Scene	RETRIG					
A	DeeJay Kit	1 Intro	2 Drop	3 Section 1		
B	Deez Kit			1 Section 1	3 Section 2	4 Outro
C	Synths	1 Intro	2 Drop	3 Section 1	4 Section 2	5 Outro
D	Rhodes	4		1 Section 1		
E	Guitars			1 Section 1	2 Section 2	
F	Strings					1 Outro
G	Bass					9 Outro
H	Group H					

MASTER GROUP SOUND 1 SAMPLER 2 COMPRESSOR 3 BEAT DELAY 4

FX Compressor

No Preset

SRC GRV MCR OUT

Depth Time Output

Threshold Amount Knee Attack Release Gain

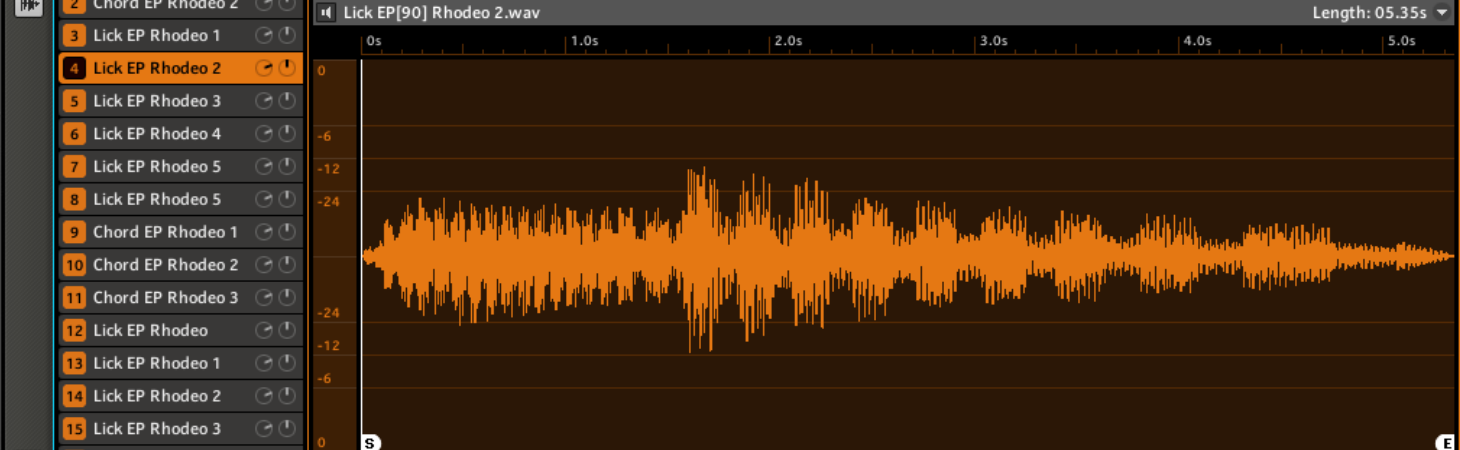
Rhodes

RECORD EDIT SLICE MAP

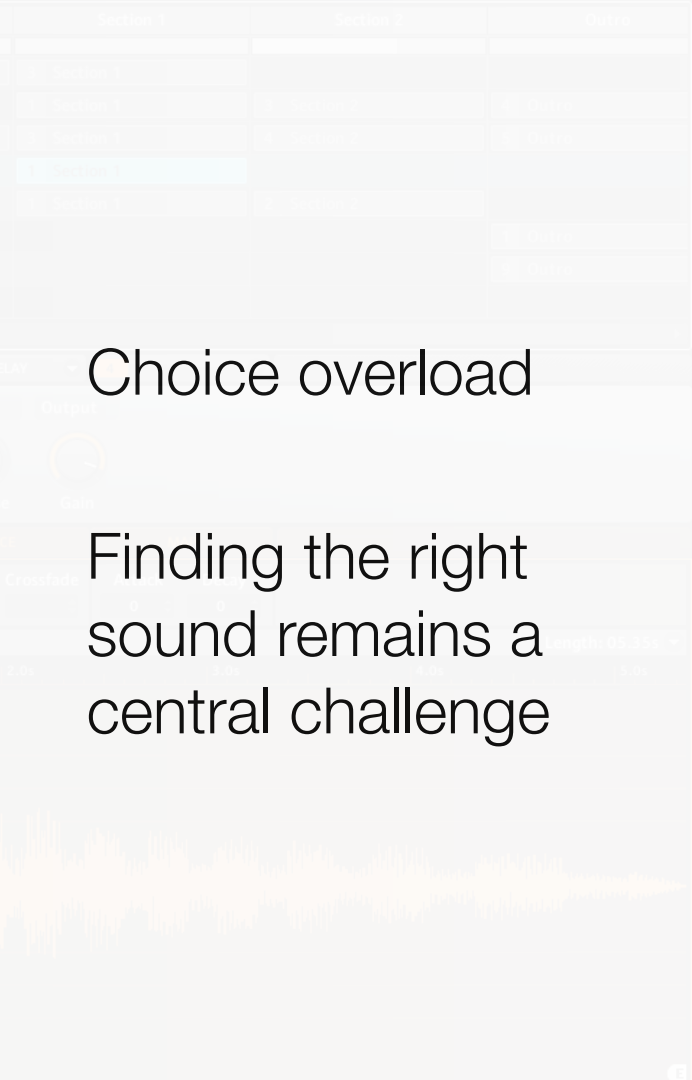
Start End LOOP Start End Crossfade Attack Decay

0 236030

Lick EP [90] Rhodeo 2.wav Length: 05.35s



- 1 Chord EP Rhodeo 1
- 2 Chord EP Rhodeo 2
- 3 Lick EP Rhodeo 1
- 4 Lick EP Rhodeo 2
- 5 Lick EP Rhodeo 3
- 6 Lick EP Rhodeo 4
- 7 Lick EP Rhodeo 5
- 8 Lick EP Rhodeo 5
- 9 Chord EP Rhodeo 1
- 10 Chord EP Rhodeo 2
- 11 Chord EP Rhodeo 3
- 12 Lick EP Rhodeo
- 13 Lick EP Rhodeo 1
- 14 Lick EP Rhodeo 2
- 15 Lick EP Rhodeo 3



Choice overload

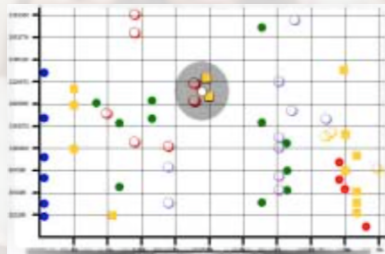
Finding the right sound remains a central challenge



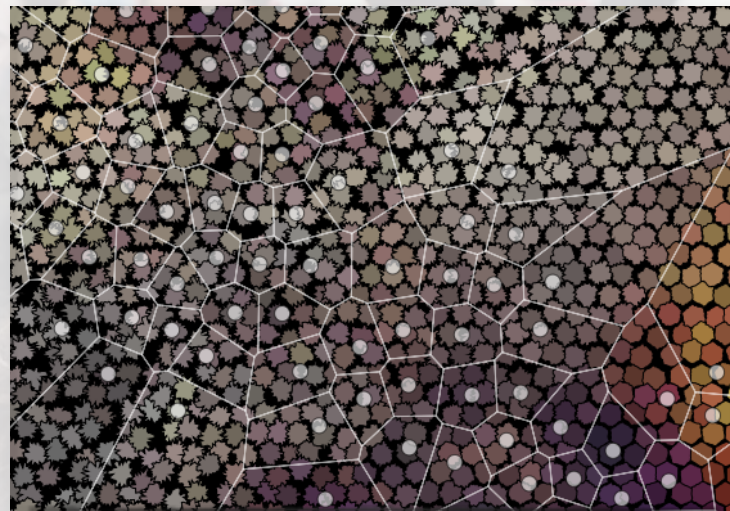
“We usually have to browse really huge libraries [...] that most of the time are not really well organized.” (TOK003)

“[I have] like, two hundred gigabytes of [samples]. I try to keep some kind of organization.” (TOK006)



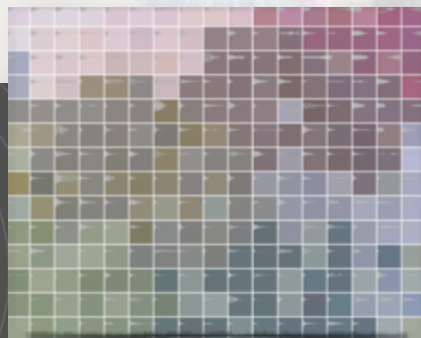
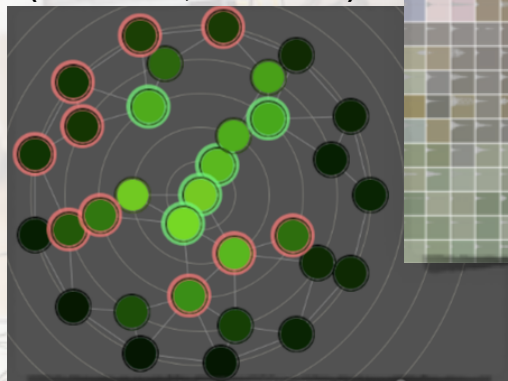


Sonic browser
(Fernström and
Brazil, ICAD 2001)

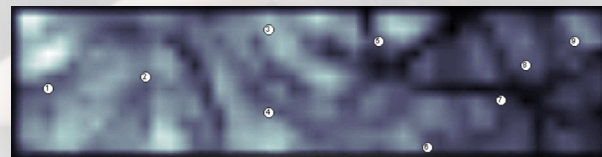


Texture browser
(Grill and Flexer, ICMC 2012)

Audio Quilt: snare, synth
(Fried et al., NIME 2014)



Drum sample browser
(Pampalk et al., DAFx 2004)



Sample Browsing Interfaces

User-centric approach

- ▶ participatory workshops, semi-structured interviews
- ▶ conversations with international up-and-coming musicians






Recommenders are seen critical in creative work

***“I am happy for it to make suggestions,
especially if I can ignore them” (TOK007)***





Who is in charge?

***“as long as it is not saying
do this and do that.” (TOK009)***





Artistic originality in jeopardy

“as soon as I feel, this is something you would suggest to this other guy as well, and then he might come up with the same melody, that feels not good to me.” (NIB4)

“then it’s really like, you know, who is the composer of this?” (NIB3)




Users open to **personalization**

“You could imagine that your computer gets used to you, it learns what you mean by grainy, because it could be different from what that guy means by grainy” (PA008)



Imitation is not the goal, **opposition** is the challenge

“I’d like it to do the opposite actually, because the point is to get a possibility, I mean I can already make it sound like me, it’s easy.” (TOK001)



“Make it complex in a way that I appreciate, like I would be more interested in something that made me sound like the opposite of me, but within the boundaries of what I like, because that’s useful. Cause I can’t do that on my own, it’s like having a bandmate basically.” (TOK007)



Theme 1: Virtual band mate (controlled “collaborator”)

“I like to be completely in charge myself. I don’t like other humans sitting the chair, but I would like the machine to sit in the chair, as long as I get to decide when it gets out.” (TOK014)

Theme 2: Exploring non-similarity (“the other/strange”)

“So if I set it to 100% precise I want it to find exactly what I am searching for and probably I will not find anything, but maybe if I instruct him for 15% and I input a beat or a musical phrase and it searches my samples for that. That could be interesting.” (TOK003)



The “Other” in Creative Work

- ▶ no interest in imitating existing ideas and “filter bubbles”
- ▶ challenge and question expectations and past behavior



Opposite goals when recommending for creative work

Defamiliarization

Predictability & Explainability

Change of Context

Context Preservation

Opposition

Imitation

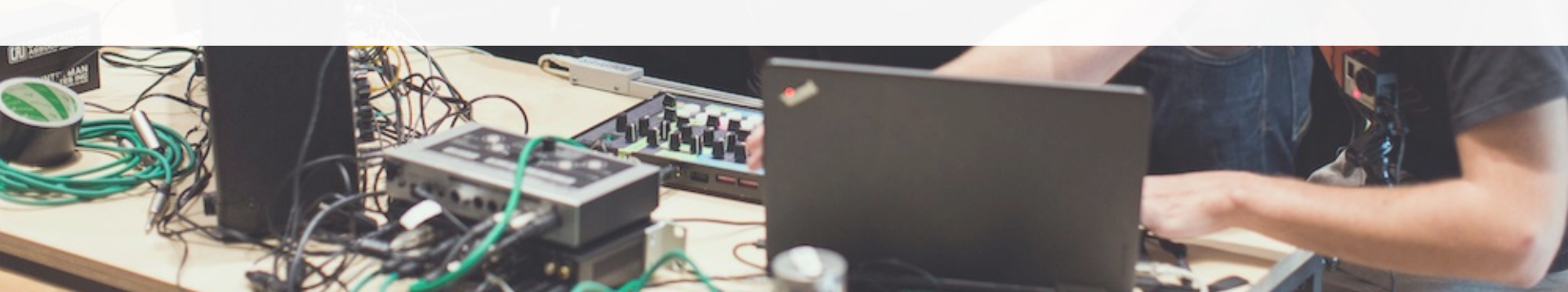
Obstruction

Automation



Takeaways

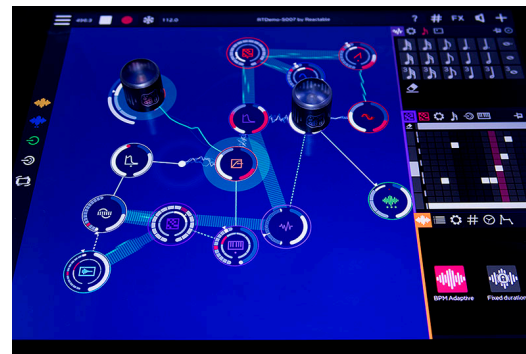
- ▶ experts need recommenders mostly for **inspiration**
- ▶ a useful recommender needs to be a **collaborator**



Technology Demo: AI Drummers

Why AI Drummers

- As an **inspirational tool**
- Increase **productivity**
- **Use cases:**
 - Music production
 - Live performances
- **Challenges:**
 - Many degrees of freedom
 - Genre dependent
 - No well defined measure of quality
 - Original, meaningful, but not random patterns!



Reactable ROTOR



NI Maschine

Examples for AI Drummers

- Drum Pattern Variation
Generate variations of a seed pattern
- Parametric Drum Pattern Generation
Control properties of drum pattern which should be created

Drum Pattern Variation

	1	1.1	1.2	1.3	2	2.1	2.2	2.3	3	3.1	3.2	3.3	4	4.1	4.2	4.3
Snare	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray
Tom	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray
Hi-hat	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray
Kick	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray

↑
This is a step-sequencer...

Drum Pattern Variation

	1	1.1	1.2	1.3	2	2.1	2.2	2.3	3	3.1	3.2	3.3	4	4.1	4.2	4.3
Snare	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray
Tom	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray
Hi-Hat	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray
Kick	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray

- Create modifications of a given seed pattern
- Maintain characteristic of the drum pattern (the beat)

This is a step-sequencer...

Drum Pattern Variation

	1	1.1	1.2	1.3	2	2.1	2.2	2.3	3	3.1	3.2	3.3	4	4.1	4.2	4.3
Snare	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray
Tom	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray
Hi-Hat	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray
Kick	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray

- Create modifications of a given seed pattern
- Maintain characteristic of the drum pattern (the beat)

This is a step-sequencer...

Drum Pattern Variation

	1	1.1	1.2	1.3	2	2.1	2.2	2.3	3	3.1	3.2	3.3	4	4.1	4.2	4.3
Snare	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Green	Gray
Hi-Hat	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray
Tom	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Green
Kick	White	Gray	Gray	Gray	Green	Gray	Gray	Gray	White	Gray	Gray	Gray	Green	Gray	Gray	Gray

- Create modifications of a given seed pattern
- Maintain characteristic of the drum pattern (the beat)
- **Add details** to increase intensity

This is a step-sequencer...

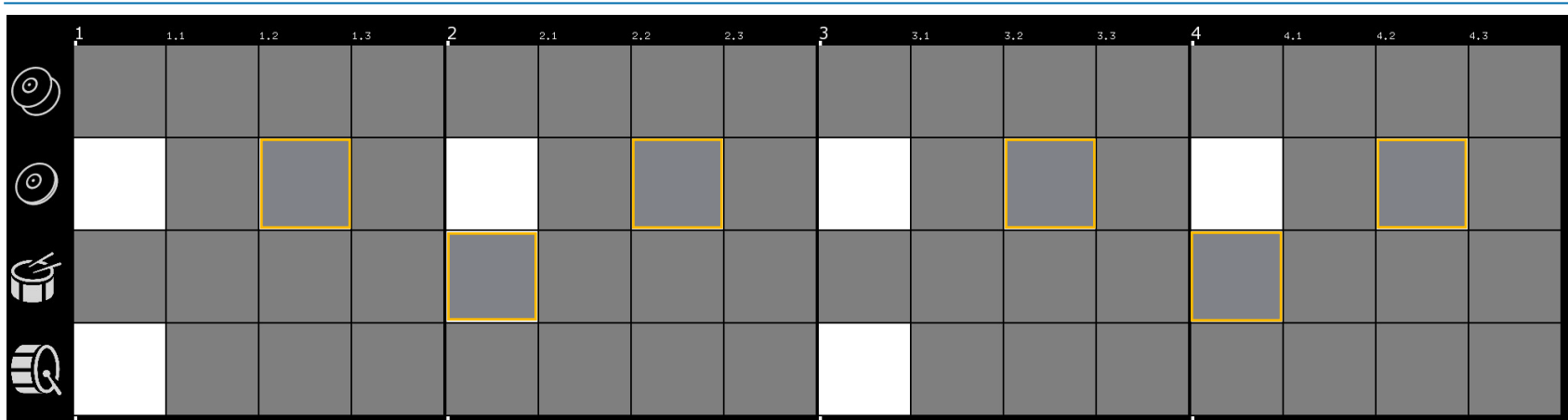
Drum Pattern Variation

	1	1.1	1.2	1.3	2	2.1	2.2	2.3	3	3.1	3.2	3.3	4	4.1	4.2	4.3
Snare	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Green	Gray
Hi-Hat	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray	White	Gray
Tom	Gray	Gray	Gray	Gray	White	Gray	Gray	Gray	Gray	Gray	Gray	Gray	White	Gray	Gray	Green
Kick	White	Gray	Gray	Gray	Green	Gray	Gray	Gray	White	Gray	Gray	Gray	Green	Gray	Gray	Gray

- Create modifications of a given seed pattern
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- **Add details** to increase intensity

This is a step-sequencer...

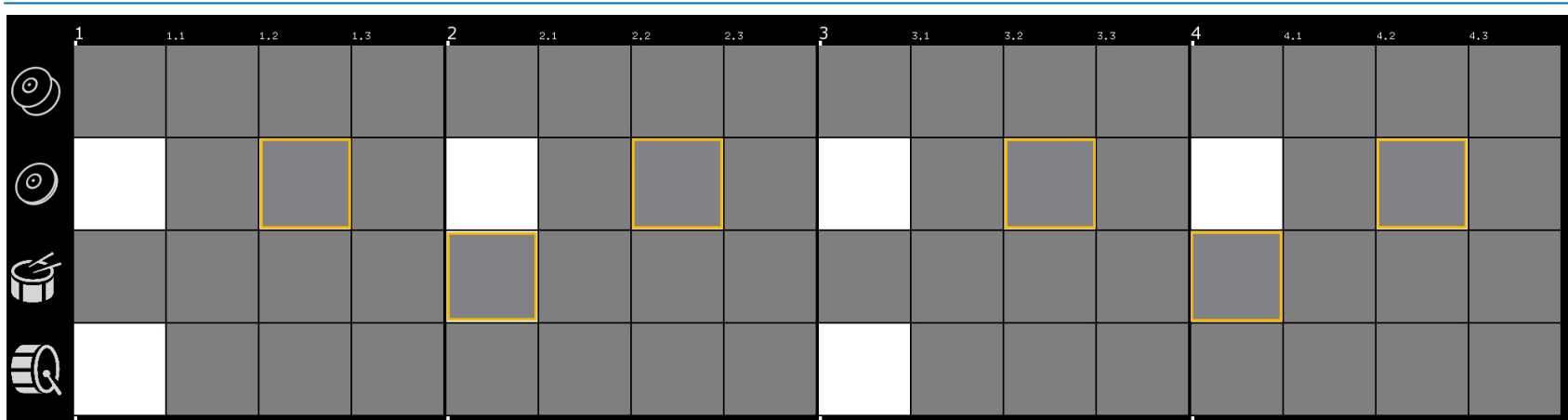
Drum Pattern Variation



- Create modifications of a given seed pattern
- Maintain characteristic of the drum pattern (the beat)
- **Add details** to increase intensity
- **Remove notes** to make it more simple

This is a step-sequencer...

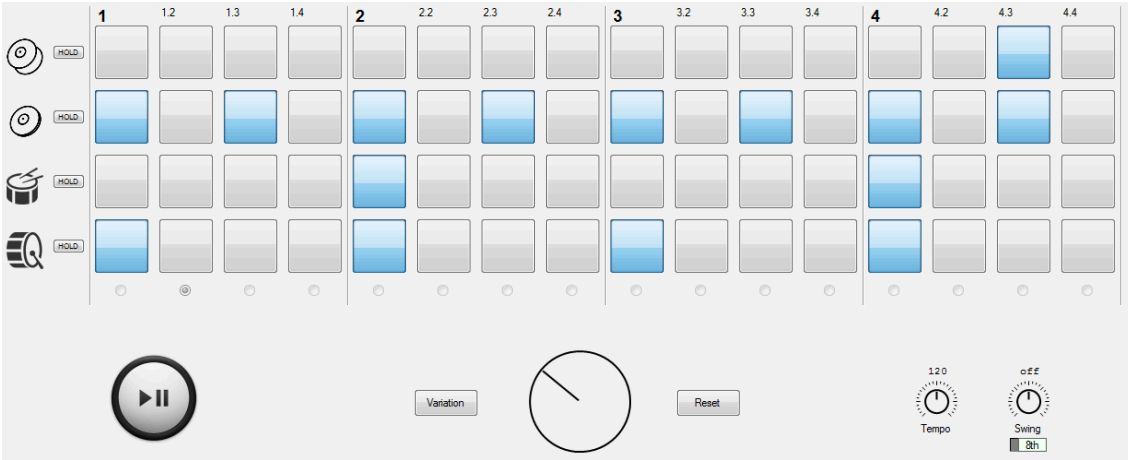
Drum Pattern Variation



- Create modifications of a given seed pattern
- Maintain characteristic of the drum pattern (the beat)
- **Add details** to increase intensity
- **Remove notes** to make it more simple

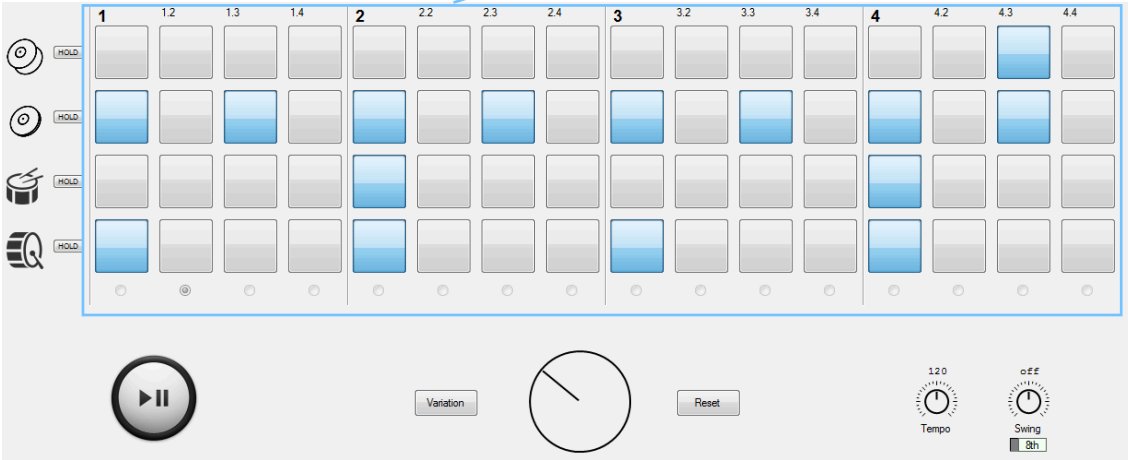
This is a step-sequencer...

User Interface



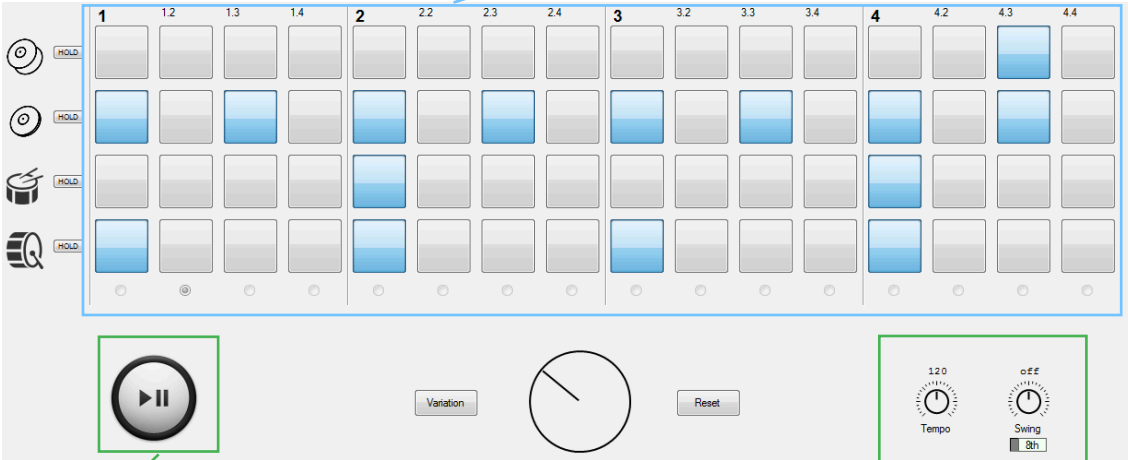
User Interface

step sequencer grid:
pattern editor and visualization



User Interface

step sequencer grid:
pattern editor and visualization



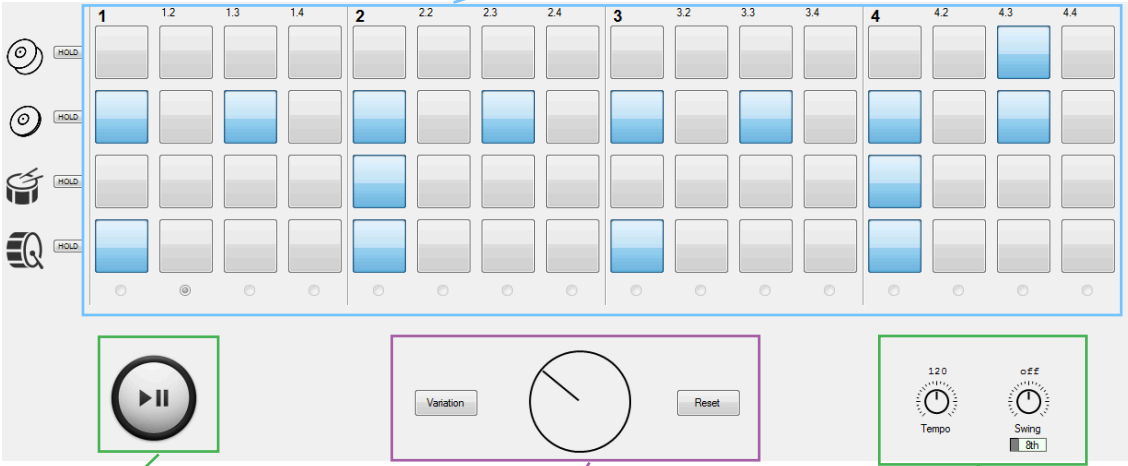
playback
controls

tempo and swing
controls (playback)



User Interface

step sequencer grid:
pattern editor and visualization



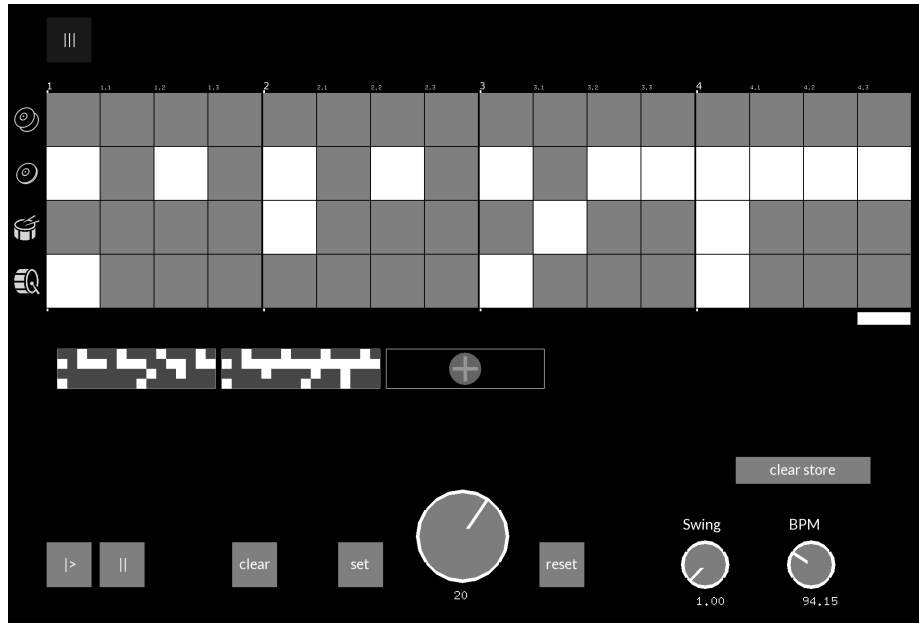
playback controls

generator controls:
pattern browsing dial

tempo and swing controls (playback)

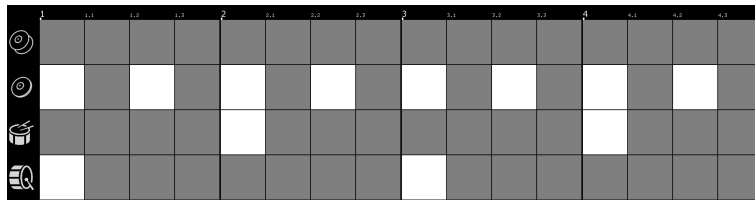


Touch UI



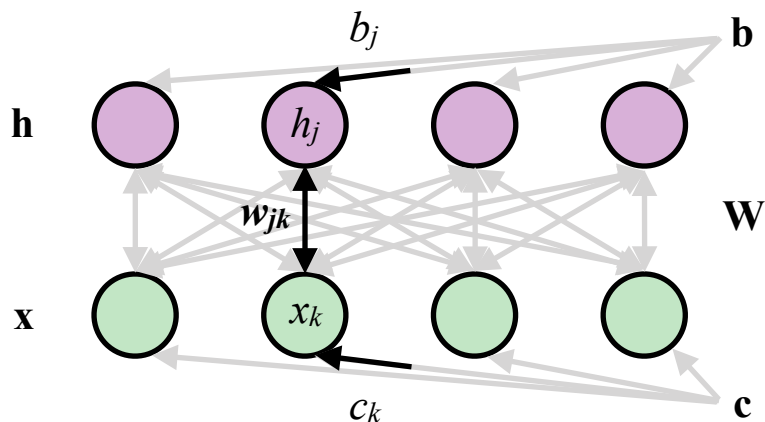
Pattern Variation Method

- Focus on **electronic dance music** (EDM)
- **Step sequencer interface**
 - 4/4 time signature
 - 16th note resolution, 4 instruments
 - Fixed pattern grid size

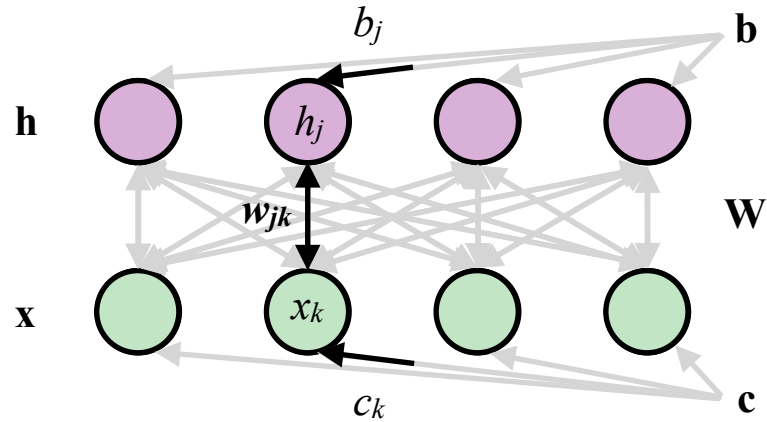


Pattern Variation Method

- Focus on **electronic dance music** (EDM)
- **Step sequencer interface**
 - 4/4 time signature
 - 16th note resolution, 4 instruments
 - Fixed pattern grid size
- **Stochastic generative model**
 - Sampling of **restricted Boltzmann machine** (RBM)
 - Trained on EDM **drum loop library** (NI Maschine)

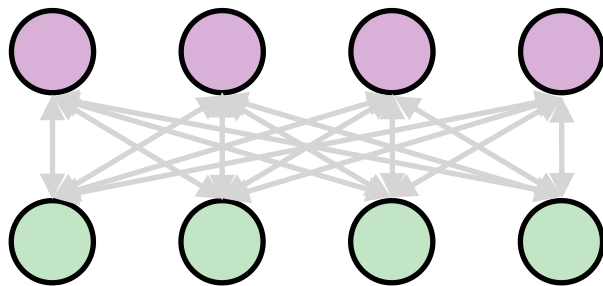


Pattern Variation Method



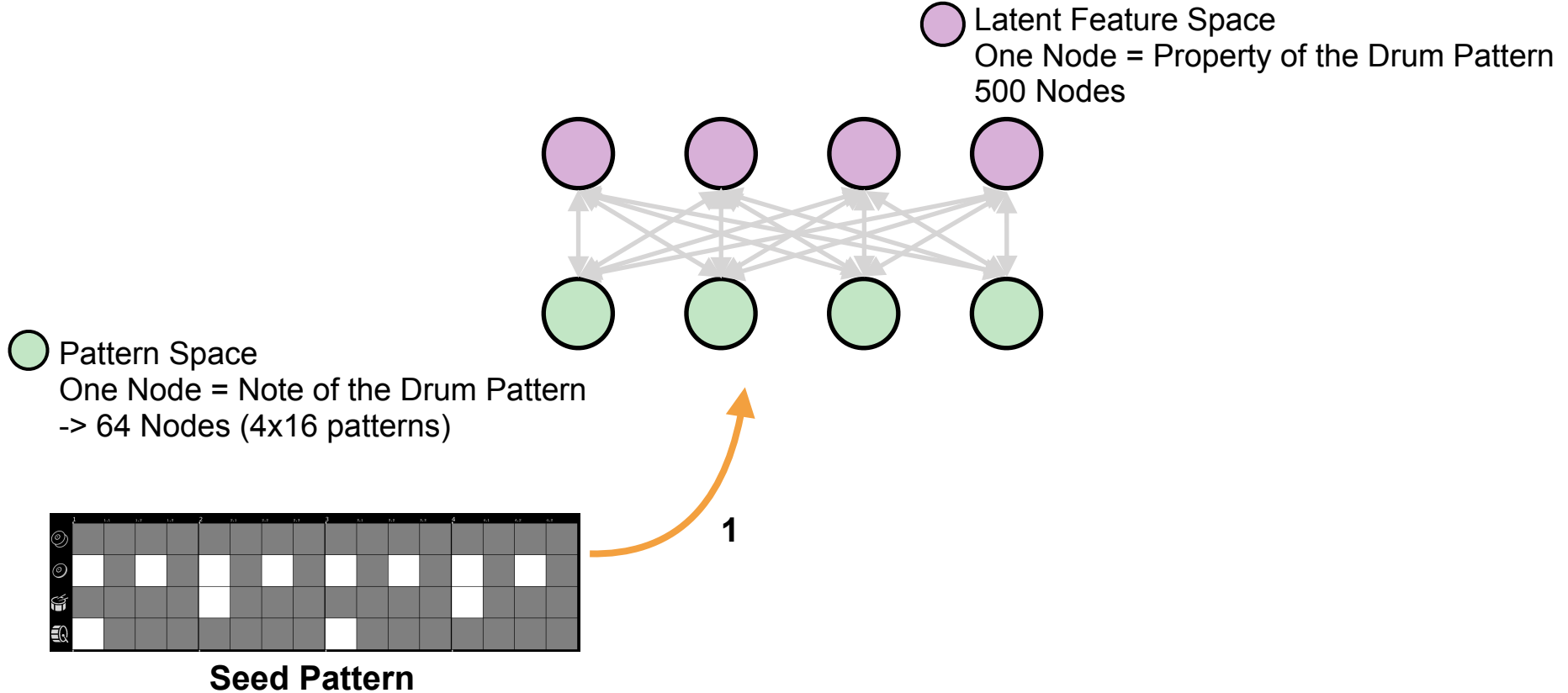
Pattern Variation Method

● Latent Feature Space
One Node = Property of the Drum Pattern
500 Nodes

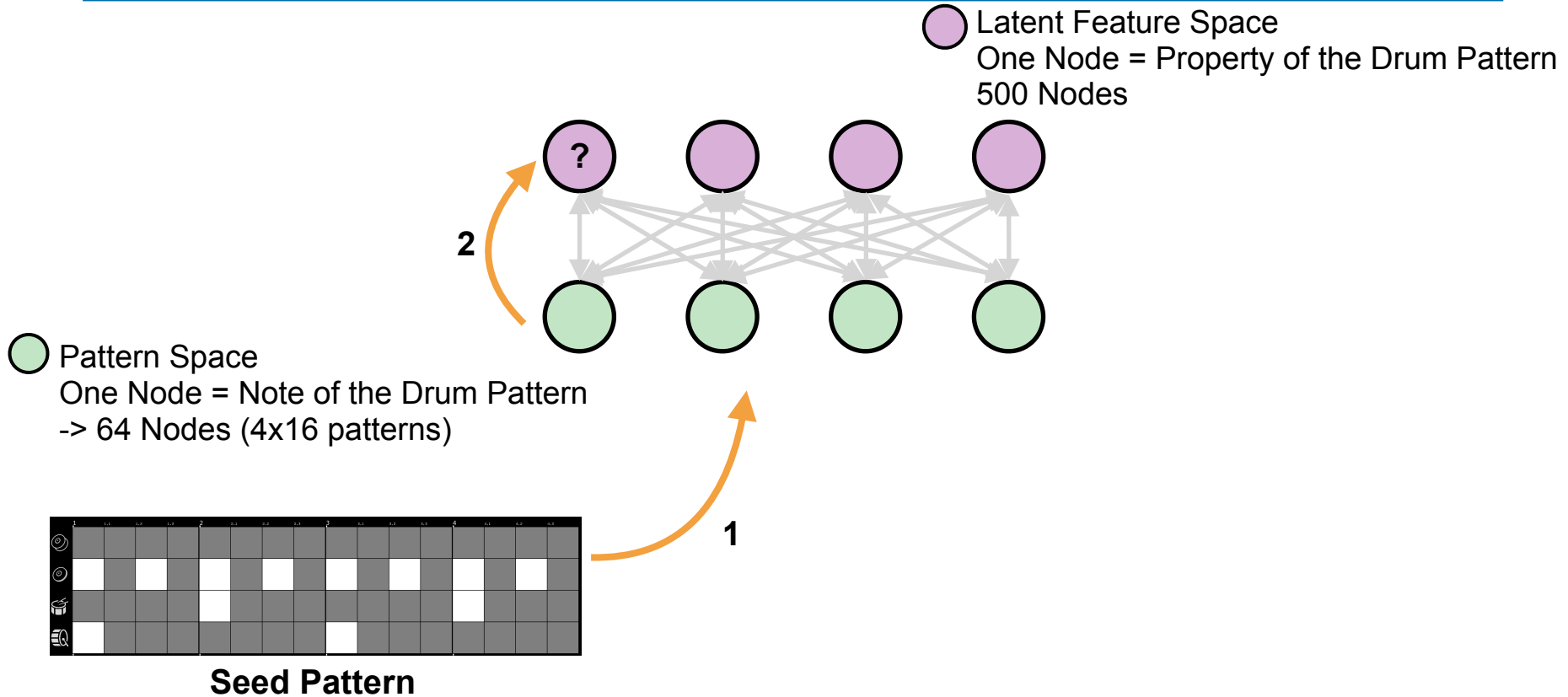


● Pattern Space
One Node = Note of the Drum Pattern
-> 64 Nodes (4x16 patterns)

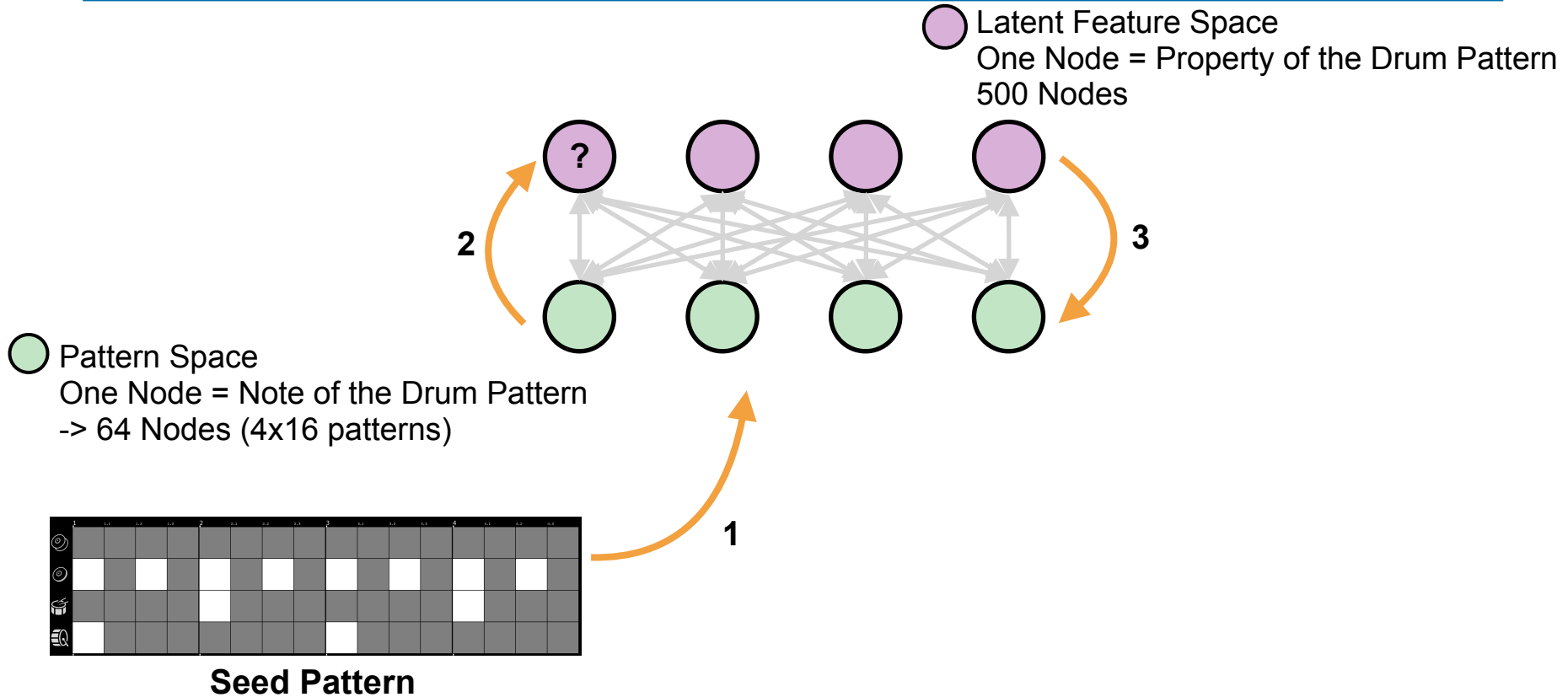
Pattern Variation Method



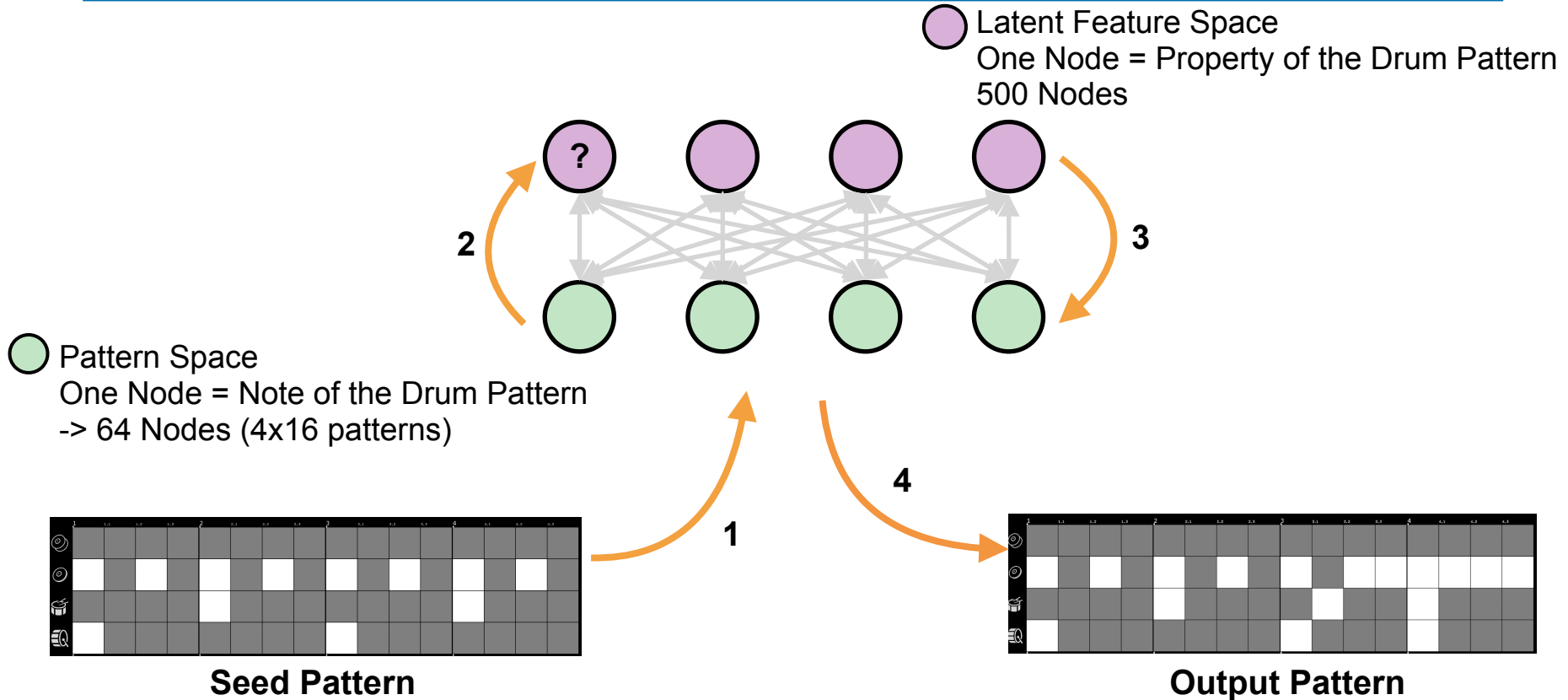
Pattern Variation Method



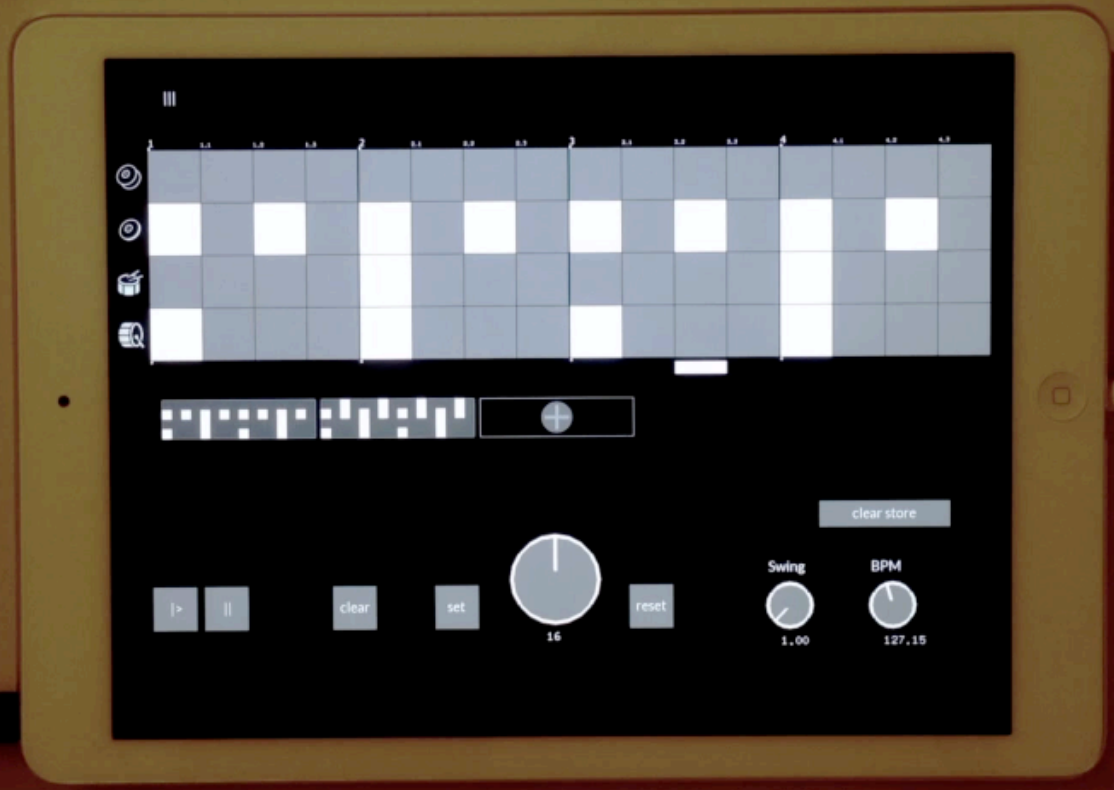
Pattern Variation Method



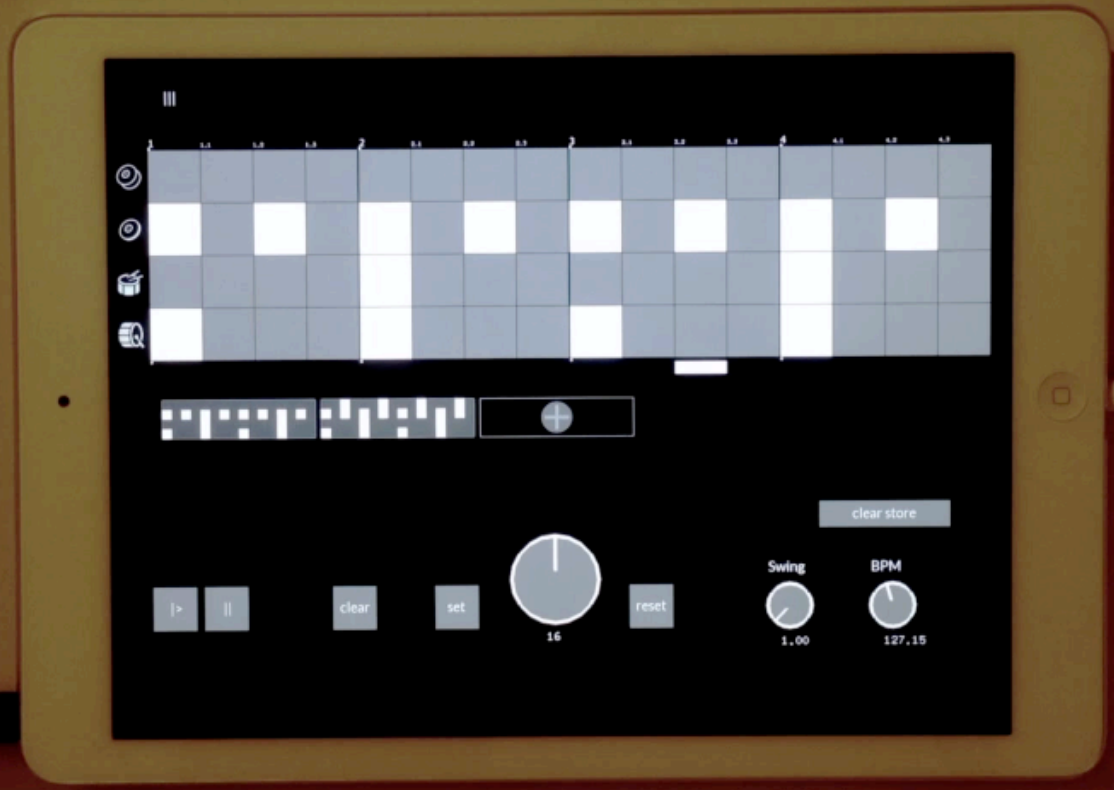
Pattern Variation Method



Demo



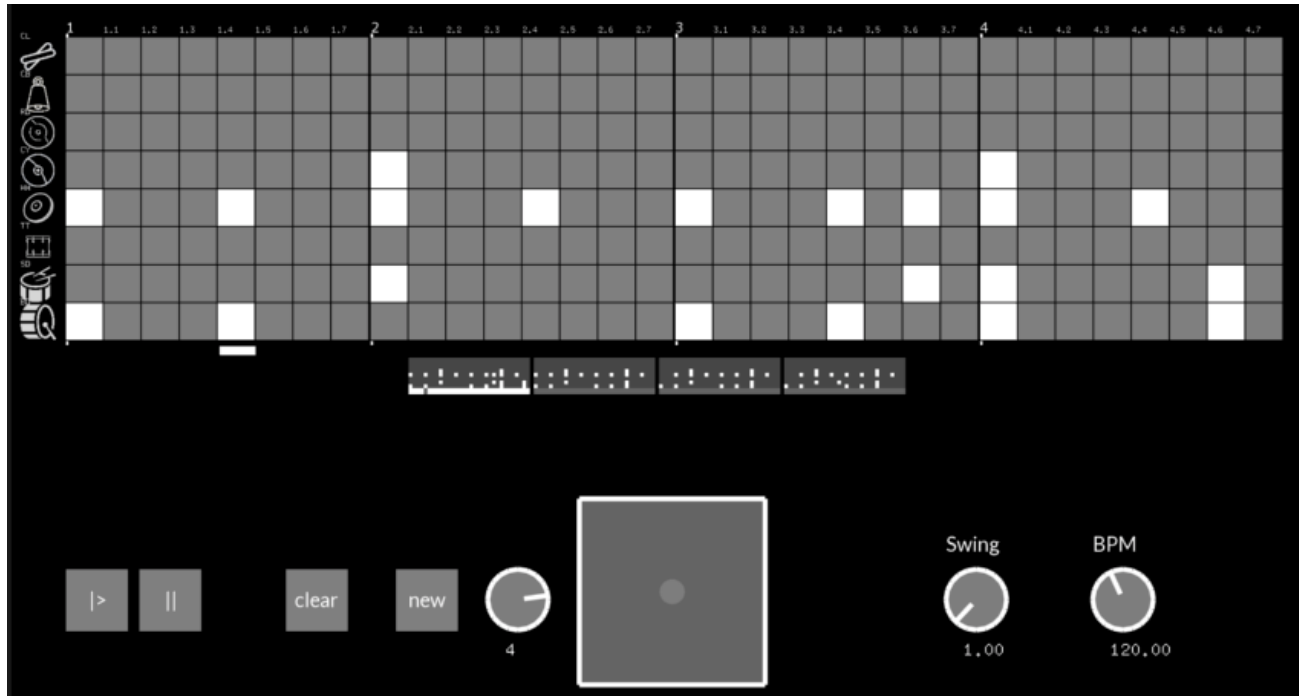
Demo



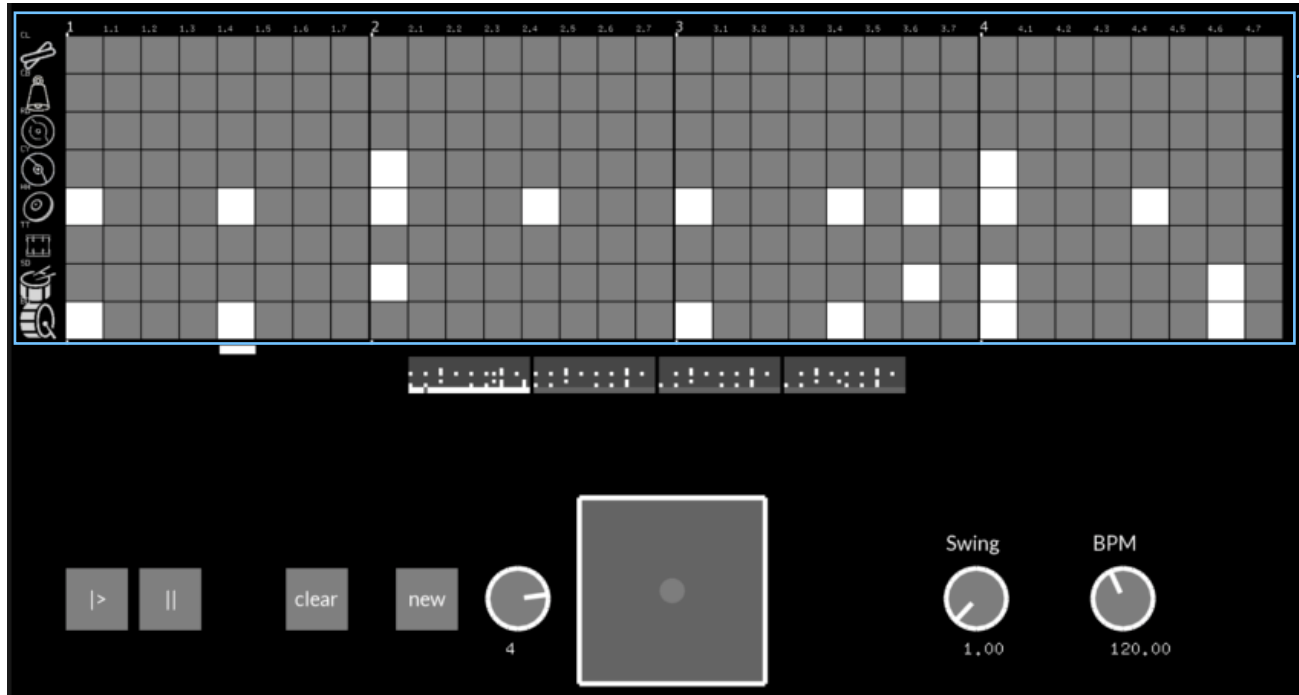
Parametric Drum Pattern Generation

- Create drum patterns given certain properties:
 - Genre
 - Complexity
 - Loudness
- Usually this is done using labeled pattern libraries
 - e.g.: Logic Drummer
 - Often perceived to be unoriginal
- Let's use a stochastic generative model!

User Interface

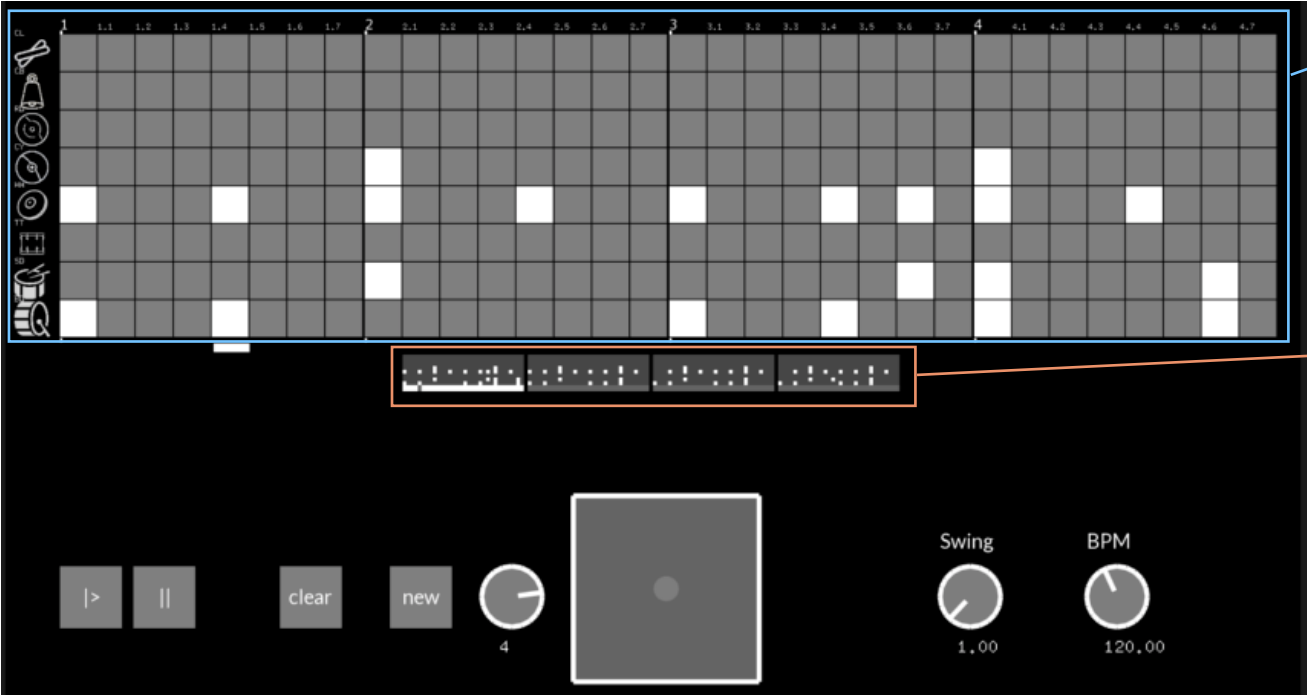


User Interface



step sequencer
grid

User Interface



step sequencer grid

bar position indicator

User Interface

The image shows a screenshot of a music software interface with several annotated components:

- step sequencer grid:** A large grid at the top with columns labeled 1-1 through 4-7 and rows of icons. It contains a sequence of white squares representing notes.
- bar position indicator:** A horizontal bar below the grid showing the current bar and beat position.
- tempo and swing controls (playback):** Two circular controls labeled 'Swing' (set to 1.00) and 'BPM' (set to 120.00).
- playback controls:** A set of buttons including play, stop, clear, new, and a large square button.

User Interface

The image shows a software interface for music production. At the top is a large grid labeled "step sequencer grid" with columns numbered 1-4 and sub-columns 1-7. Below the grid is a "bar position indicator" showing a sequence of notes. At the bottom are three control sections: "playback controls" with play and stop buttons; "generator controls" with "clear", "new", a knob set to 4, and a square display; and "tempo and swing controls (playback)" with two knobs labeled "Swing" (1.00) and "BPM" (120.00).

step sequencer grid

bar position indicator

playback controls

generator controls

tempo and swing controls (playback)

User Interface

The image shows a user interface for a music production application. At the top is a large step sequencer grid with 4 columns and 8 rows. The columns are labeled 1, 2, 3, and 4, with sub-labels like 1-1, 1-2, etc. A bar position indicator is located below the grid. Below the grid are playback controls (play and stop buttons), generator controls (clear, new buttons, a knob set to 4, and a large square pad), and tempo and swing controls (two knobs labeled Swing and BPM, with values 1.00 and 120.00). A vertical toolbar with icons is on the left side of the grid.

step sequencer grid

bar position indicator

playback controls

generator controls

loudness/complexity - pad

tempo and swing controls (playback)

Generation Method

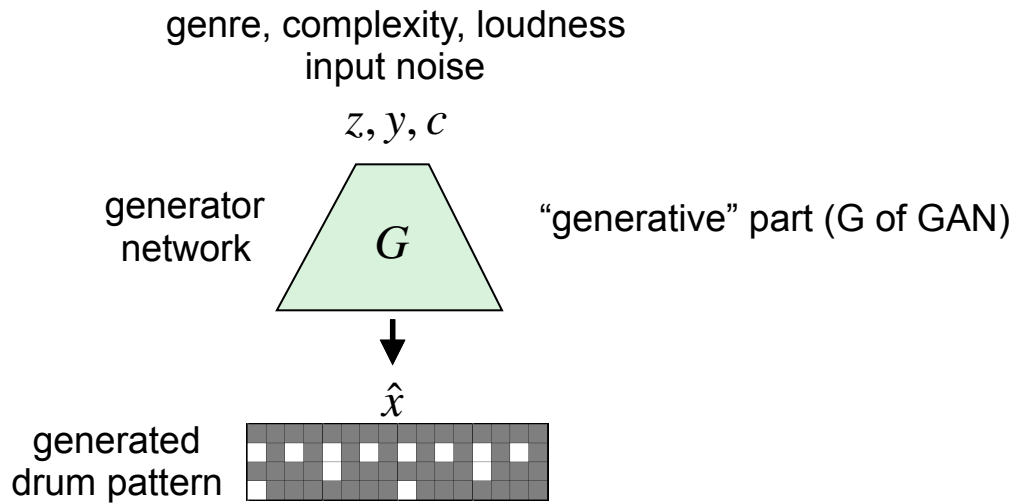
Generation Method

- Train on dataset with **multiple musical genres**
- **Step sequencer interface**
 - 4/4 time signature
 - 32nd note resolution, 8 instruments

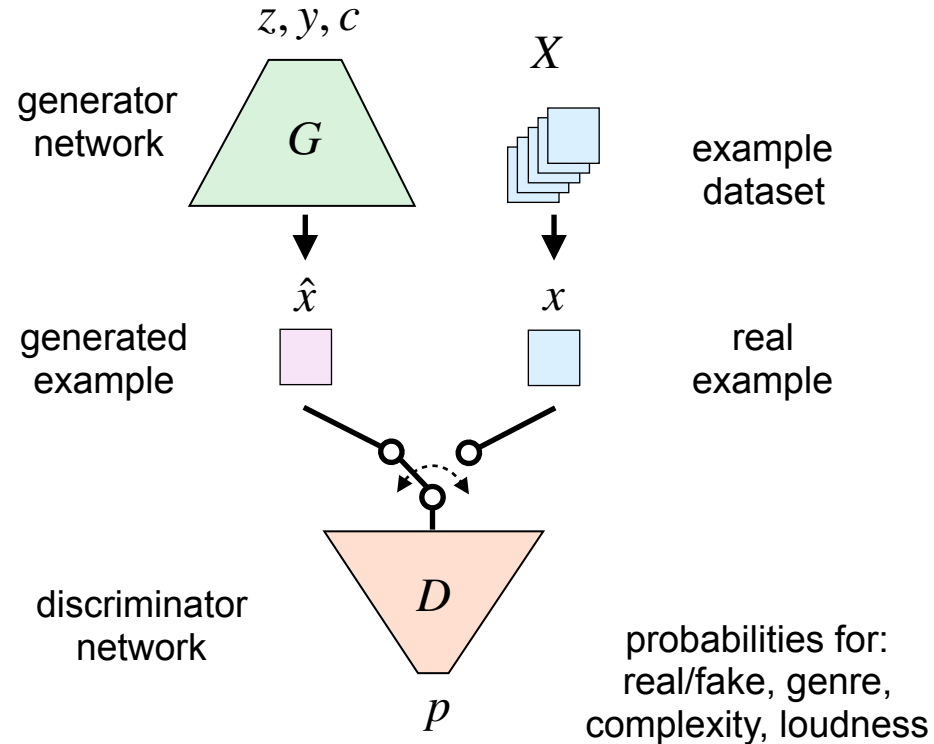
Generation Method

- Train on dataset with **multiple musical genres**
- **Step sequencer interface**
 - 4/4 time signature
 - 32nd note resolution, 8 instruments
- **Generative model**
 - Generative Adversarial Neural Network (GAN)

Pattern Generation Method



Pattern Generation Method



Demo

The interface features a piano roll at the top with a grid. The horizontal axis is labeled with measures 1 through 4, and sub-measures (e.g., 1.1, 1.2, ..., 4.7). The vertical axis is labeled with notes: C, D, E, F, G, A, B. A sequence of white notes is plotted on the grid. Below the piano roll is a control panel with several elements:

- A menu icon (three horizontal lines) in the top left.
- A vertical toolbar on the left with icons for various musical functions.
- A horizontal slider with a central knob.
- A central square control element with a dot in the middle, labeled "loud" at the top, "low" at the bottom, "simple" on the left, and "complex" on the right. It is flanked by two circular dials with values 12 and 0.
- Control buttons: a play button (>), a stop button (||), and a "clear" button.
- Two more circular dials labeled "Swing" (value 2.89) and "BPM" (value 120.55). Above them is a "store" button.
- A large circular button on the right side of the interface.

Demo

The interface features a piano roll at the top with a grid. The horizontal axis is labeled with measures 1 through 4, and sub-measures (e.g., 1.1, 1.2, etc.). The vertical axis is labeled with notes: C, D, E, F, G, A, B. A sequence of white notes is plotted on the grid. Below the piano roll is a control panel with several elements:

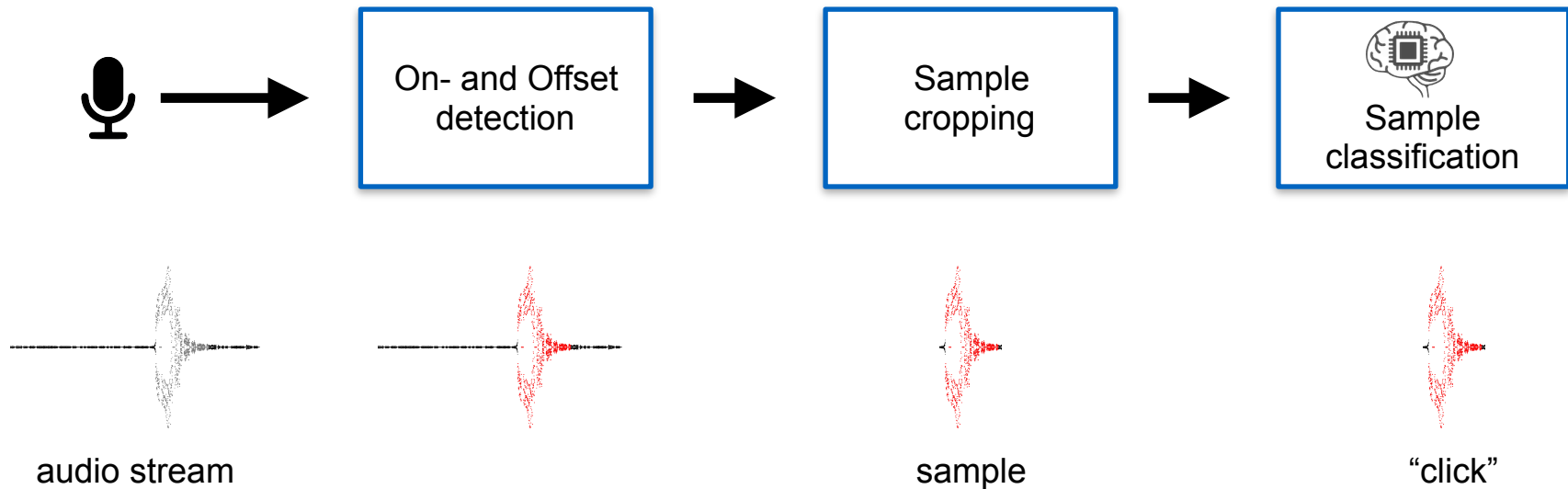
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- A horizontal slider with a central knob.
- A central square control element with a dot in the middle, labeled "loud" at the top, "low" at the bottom, "simple" on the left, and "complex" on the right. It is flanked by two circular dials with values 12 and 0.
- Control buttons: a play button (right-pointing triangle), a stop button (two vertical bars), and a "clear" button.
- Two circular dials on the right labeled "Swing" (value 2.89) and "BPM" (value 120.55). Above them is a "store" button.
- A large circular button on the far right.

Technology Demo: ClinkyDinky



Clinky Dinky

Audio Flow



Wiedergabe aktivieren (Leertaste)

Mikrofon aktivieren (r)

Alles löschen (c)

Aufnahmelautstärke

Wiedergabelautstärke

Tempo

Aufnahme-Archiv (Leertaste)

Zufällig Geräusche wählen

play	rec	clear	mic sensitivity 1.00	volume 1.00	bpm 120	archive	rand	export
------	-----	-------	----------------------	-------------	---------	---------	------	--------



1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
rand	rec	rand	rec	rand	rec	rand	rec	rand	rec	rand	rec	rand	rec	rand	rec

Step ein/ausschalten

Nächste Aufnahme hier ablegen
Mit zufälligen Sample aus dem Archiv belegen

Abspielposition

Mikrofonpegel (Aufnahmen in rot)

Aufnahmeposition

A high-speed photograph of a water droplet suspended in mid-air above a pool of water. The droplet is perfectly spherical and reflects light, creating a bright highlight. Below it, the water surface is disturbed, showing concentric ripples that spread outwards from the point of impact. The background is a dark, blurred gradient, emphasizing the clarity and motion of the water.

Reflection

There are many challenging questions left open.



The image consists of a 10x10 grid of small, identical photographs of a modern building's facade. The building features a complex, repetitive pattern of dark blue and light-colored panels, with vertical and horizontal lines creating a grid-like structure. The central portion of the grid is replaced by a white banner with a thin blue border. Inside this banner, the text "Will algorithms produce more of the same?" is written in a bold, blue, sans-serif font.

Will algorithms produce more of the same?

The image features a warm, orange-toned sunset background. In the center, a person is silhouetted with their arms raised in a celebratory gesture. Below them, two dogs are also silhouetted, one on the left and one on the right. In the bottom left corner, a bright sun is partially visible. Two birds are flying in the sky on the right side. A white horizontal band across the middle contains the text.

Will music creators be satisfied with what they deliver?

A silhouette of a person with long hair, arms outstretched, standing on a pier or balcony overlooking the ocean at sunset. The sky is a gradient of orange and yellow, and the sun is low on the horizon, creating a bright glow. The person is positioned on the left side of the frame, looking towards the right.

Will music consumers be satisfied with what they get?



Will there be a rush of self-appointed creators?





Will it be easy to identify the good creations?



***Will music lose its value?
Will human artists lose their value?***





***What about copyright / right d'auteur?
Who is the creator / author?***



Various stakeholders are affected!

end consumers

music creators

performers

music companies

platform providers

the society

Out of the Box

The Midlife Crisis of the Digital Revolution

ARS ELECTRONICA

Festival for Art, Technology and Society

POSTCITY Linz

September 5–9, 2019



AI x Music Festival

Encounters in the uncharted territories between human creativity and mechanical perfection

Das Festival AIxMusic (AI trifft Musik) wird von Ars Electronica und der Europäischen Kommission im Rahmen der Initiative STARTS in Kooperation mit vielen Partnern aus Industrie, akademischer Forschung sowie Kunst- und Bildungseinrichtungen organisiert. Es ist ein Hybrid aus Musikfestival und KI-Konferenz, aus einem philosophischen Symposium und einer Präsentation von Start-ups. Es beschäftigt sich mit Kunst und Musik, um die neuesten Errungenschaften der KI-Forschung im Hinblick auf ihre möglichen Auswirkungen auf unser Leben zu demonstrieren und zu diskutieren.

Musik trifft Technologie trifft Musik

Kreativität – die Fähigkeit, neue und unerwartete Ausdrucksformen hervorzubringen, über die Wiederholung und Veränderung des Bestehenden hinauszugehen – wird oft als ultimative Grenze angesehen, die nur dem menschlichen Geist möglich ist.

- Werden Maschinen in der Lage sein, überzeugende Kunstwerke oder wissenschaftliche Theorien zu schaffen?

European
Platform for
Digital
Humanism

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Regarding Digital Humanism...

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- Werden Maschinen in der Lage sein, überzeugende Kunstwerke oder wissenschaftliche Theorien zu schaffen?



Vienna Manifesto on Digital Humanism

A call for action!

Digital Humanism refers to an approach that describes, analyzes, and influences the complex interplay of technology and humankind. Its goal is to **put the human at the center of technological progress** to shape current and future technologies.



Vienna Manifesto on Digital Humanism

...promote **democracy and inclusion** ... safeguard **free expression** ... regulations should **ensure fairness, accountability, and transparency** of algorithms ... **intervene with tech monopolies** ... **breaking disciplinary silos** ... **engage** with the wider society ... **take responsibility** ... technology is not neutral ... a vision is needed for **new educational curricula** ...

...we must go into action and take the right direction!

VIENNA MANIFESTO ON DIGITAL HUMANISM

VIENNA, MAY 2019

»**The system is failing**« – stated by the founder of the Web, Tim Berners-Lee – emphasizes that while digitalization opens unprecedented opportunities, it also raises serious concerns: the monopolization of the Web, the rise of extremist opinions and behavior orchestrated by social media, the formation of filter bubbles and echo chambers as islands of disjoint truths, the loss of privacy, and the spread of digital surveillance. Digital technologies are disrupting societies and questioning our understanding of what it means to be human. The stakes are high and the challenge of building a just and democratic society with humans at the center of technological progress needs to be addressed with determination as well as scientific ingenuity. Technological innovation demands social innovation, and social innovation requires broad societal engagement.

This manifesto is a call to deliberate and to act on current and future technological development. We encourage our academic communities, as well as industrial leaders, politicians, policy makers, and professional societies all around the globe, to actively participate in policy formation. Our demands are the result of an emerging process that unites scientists and practitioners across fields and topics, brought together by concerns and hopes for the future. We are aware of our joint responsibility for the current situation and the future – both as professionals and citizens.

Today, we experience the co-evolution of technology and humankind. The flood of data, algorithms, and computational power is disrupting the very fabric of society by changing human interactions, societal institutions, economies, and political structures. Science and the humanities are not exempt. This disruption simultaneously creates and threatens jobs, produces and destroys wealth, and improves and damages our ecology. It shifts power structures, thereby blurring the human and the machine.

The quest is for enlightenment and humanism. The capability to automate human cognitive activities is a revolutionary aspect of computer science / informatics. For many tasks, machines surpass already what humans can accomplish in speed, precision, and even analytic deduction. The time is right to bring together humanistic ideals with critical thoughts about technological progress. We therefore link this manifesto to the intellectual tradition of humanism and similar movements striving for an enlightened humanity.

Like all technologies, digital technologies do not emerge from nowhere. They are shaped by implicit and explicit choices and thus incorporate a set of values, norms, economic interests, and assumptions about how the world around us is or should be. Many of these choices remain hidden in software programs implementing algorithms that remain invisible. In line with the renowned Vienna Circle and its contributions to modern thinking, we want to espouse critical rational reasoning and the interdisciplinarity needed to shape the future.

We must shape technologies in accordance with human values and needs, instead of allowing technologies to shape humans. Our task is not only to rein in the downsides of information and communication technologies, but to encourage human-centered innovation. We call for a Digital Humanism that describes, analyzes, and, most importantly, influences the complex interplay of technology and humankind, for a better society and life, fully respecting universal human rights.

In conclusion, we proclaim the following core principles:

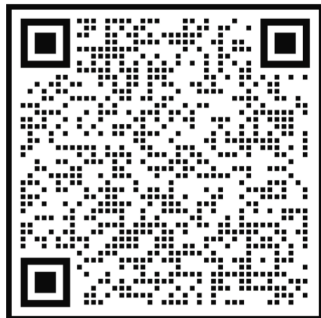
- **Digital technologies should be designed to promote democracy and inclusion.** This will require special efforts to overcome current inequalities and to use the emancipatory potential of digital technologies to make our societies more inclusive.
- **Privacy and freedom of speech are essential values for democracy and should be at the center of our activities.** Therefore, artifacts such as social media or online platforms need to be altered to better safeguard the free expression of opinion, the dissemination of information, and the protection of privacy.
- **Effective regulations, rules and laws, based on a broad public discourse, must be established.** They should ensure prediction accuracy, fairness and equality, accountability, and transparency of software programs and algorithms.
- **Regulators need to intervene with tech monopolies.** It is necessary to restore market competitiveness as tech monopolies concentrate market power and stifle innovation. Governments should not leave all decisions to markets.
- **Decisions with consequences that have the potential to affect individual or collective human rights must continue to be made by humans.** Decision makers must be responsible and accountable for their decisions. Automated decision making systems should only support human decision making, not replace it.
- **Scientific approaches crossing different disciplines are a prerequisite for tackling the challenges ahead.** Technological disciplines such as computer science / informatics must collaborate with social sciences, humanities, and other sciences, breaking disciplinary silos.
- **Universities are the place where new knowledge is produced and critical thought is cultivated.** Hence, they have a special responsibility and have to be aware of that.
- **Academic and industrial researchers must engage openly with wider society and reflect upon their approaches.** This needs to be embedded in the practice of producing new knowledge and technologies, while at the same time defending the freedom of thought and science.
- **Practitioners everywhere ought to acknowledge their shared responsibility for the impact of information technologies.** They need to understand that no technology is neutral and be sensitized to see both potential benefits and possible downsides.
- **A vision is needed for new educational curricula, combining knowledge from the humanities, the social sciences, and engineering studies.** In the age of automated decision making and AI, creativity and attention to human aspects are crucial to the education of future engineers and technologists.
- **Education on computer science / informatics and its societal impact must start as early as possible.** Students should learn to combine information-technology skills with awareness of the ethical and societal issues at stake.

We are at a crossroads to the future; we must go into action and take the right direction!

VIENNA MANIFESTO ON DIGITAL HUMANISM

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The system is falling apart, as stated by the founder of the WWW, Tim Berners-Lee, who emphasizes that while digitalization offers unprecedented opportunities, it also comes with risks concerning the manipulation of truth and the erosion of privacy and autonomy. We are surrounded by an abundance of data, but this data is often hidden in complex systems, such as social media, search engines, and software programs, which are often designed to be invisible to the user. The stakes are high, as we are entering an era of digital surveillance and data-driven decision-making. The stakes are high, as we are entering an era of digital surveillance and data-driven decision-making. The stakes are high, as we are entering an era of digital surveillance and data-driven decision-making.



Support the Manifesto as an individual or organization and help us spread the word

<https://www.informatik.tuwien.ac.at/dighum/>

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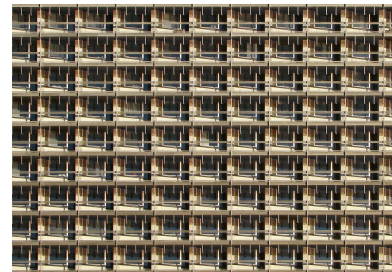
Summing up



New ideas



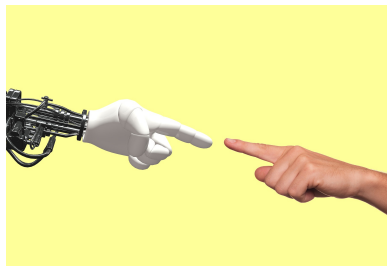
Getting out of the bubble



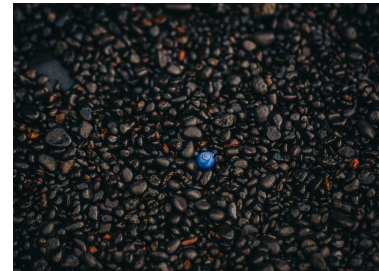
More of the same



Rush of creators



Human-computer symbiosis



Filtering noise

Wrap up



Many open questions

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