



Music AI: Threats and Opportunities

overview

alexander lerch

■ education

- Electrical Engineering (Technical University Berlin)
- Tonmeister (music production, University of Arts Berlin)

■ professional

- Associate Dean for Research & Creative Practice, **College of Design**, Georgia Tech
- Associate Professor, **School of Music**, Georgia Tech
- prev: 2000-2013: CEO at **zplane.development**

■ background

- machine learning for audio and music (20+ years)
- audio algorithm design (20+ years)
- commercial music software development (10+ years)
- entrepreneurship (10+ years)



introduction

artificial intelligence

■ artificial intelligence

- unclear definition: everything that is perceived to act intelligently
- changes over time

■ machine learning

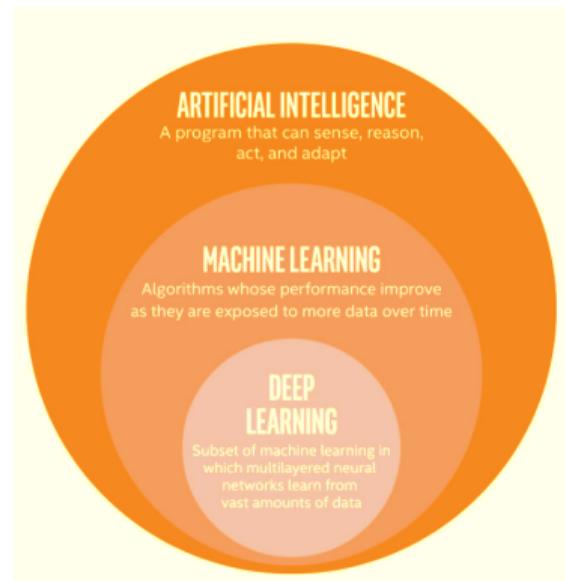
- data-driven: algorithm is more agnostic to task and is parametrized through training with data

■ deep learning

- deep neural networks are the ML approach used

■ generative AI

- deep neural networks *generating content*



machine learning

importance of data



machine learning: generic algorithm mapping an input to an output

- mapping function is learned from patterns and characteristics **from data**
⇒ model success largely depends on training data

■ technical challenges concerning data

- *imbalance & bias* (distribution is skewed, biased)
- *diversity & representativeness*
- *subjectivity* of annotations
- *noisiness* (bad quality, bad annotations, ...)
- *amount*



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musical communication

chain of musical communication



■ creation of musical ideas (“score”)

- defines style and idea

■ realization of musical ideas into acoustical rendition

- interpretation, modification, addition, and dismissal of score information
- unique acoustic representation of score

■ recording, mixing, and editing (in case of record media)

- editing and splicing of recorded data; timbre, equalization choices
- not separable from performance in a recording

■ distribution & listening

- music recommendation and discovery



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musical communication paradigm shift

historical technological disruptions:

- **music**
 - ▶ recording devices (tape, grammophone)
 - ▶ digitization/softwarization of recording studio
- **general:**
 - ▶ internet
 - ▶ introduction of photography



systematic evaluation

evaluation targets

■ system output

- originality
 - ▶ plagiarism
 - ▶ diversity
 - ▶ creativity
- audio quality
- musical & aesthetic qualities

■ user experience

■ other criteria

- explainability
- bias
- ethical use of data & data curation practices
- resource use & environmental impact



systematic evaluation methods

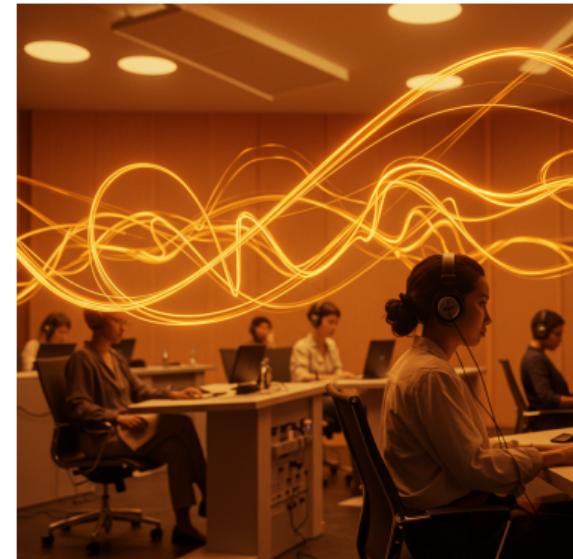
■ subjective testing

- preference test
- Turing test
- rating of properties

■ objective testing

- *reference-independent*
- *comparison of distributions*

⇒ even fundamental, trivial properties are often not matched between training and generated data



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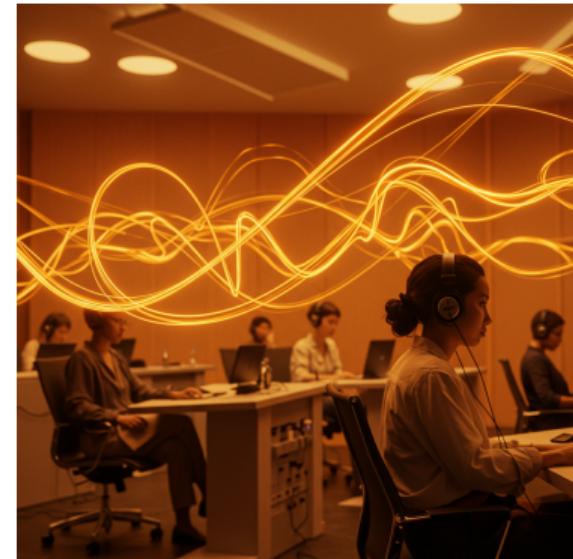
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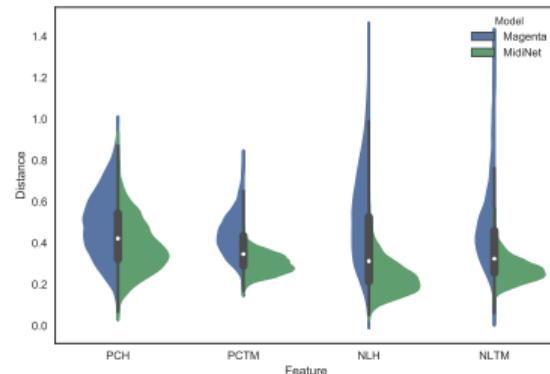
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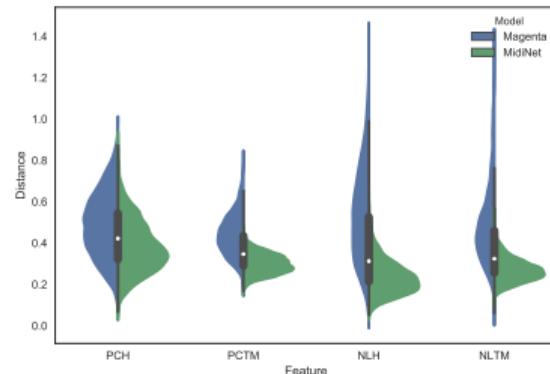
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music ai

where we are now



- ML/AI used by and **impacting all stakeholders** in chain of music communication
 - content creators
 - performers
 - producers
 - labels/music industry
 - distributors
 - consumers
- technologies are **here to stay**
- technologies **will improve** in usability, reliability, and accuracy

¹generated on suno.com with the same prompt for different genres

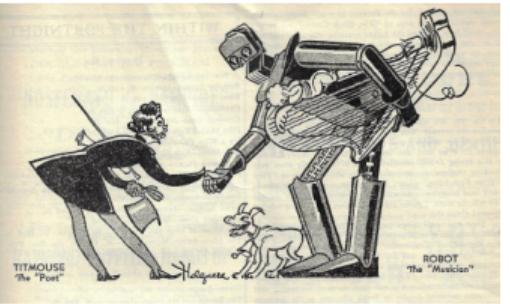
music ai opportunities

■ content creation, production:

- increased efficiency
- expanded creative options (separation, morphing, etc.)
- co-creative idea generation
- democratization of music making

■ consumption:

- personalization
- effective discovery and accessibility
- (inter)active listening experiences



music ai

risks & threats

■ content creation, production:

- ethical use of data
- growth in plagiarism, impersonation
- liability for harmful content
- livelihood of creators
- value perception of artistic content

■ consumption:

- consumer distrust through
 - ▶ inflationary ai-generated content
 - ▶ inexplainable black-box systems

■ general:

- 'mainstreamification' (novelty vs. homogeneity)
- bias (data curation)
- monopolization (for-profit system control)
- sustainability and energy



music ai

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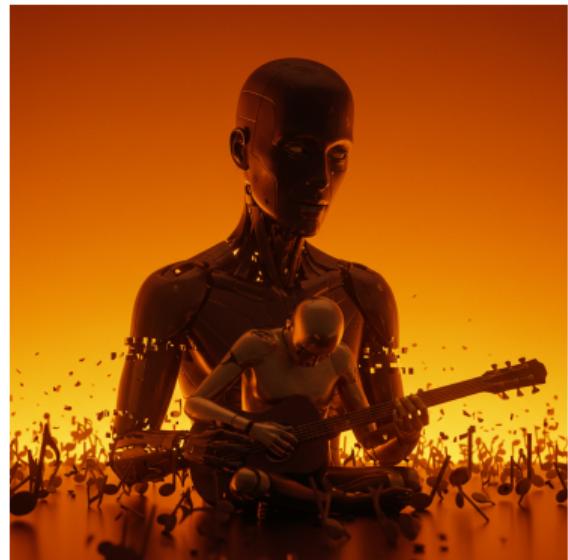
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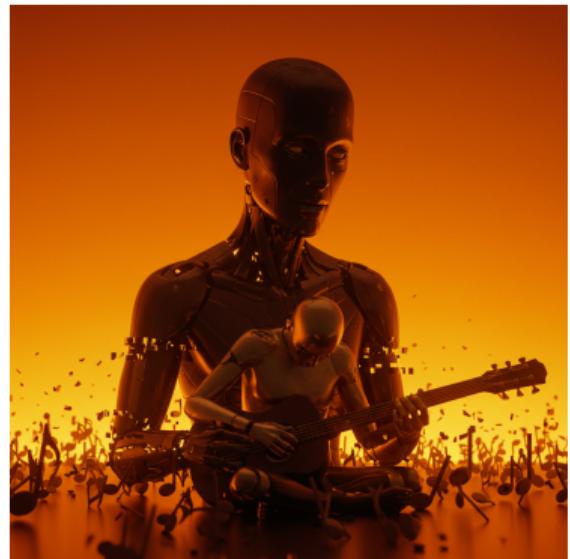
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conclusion

impact

■ society & culture

- value of music/art, value of human origin
- musical bias, increasing homogeneity

■ science

- measuring progress

■ economy

- livelihoods/workforce
- new business models

■ environment

- energy, local impact

■ regulatory & legal

- fair use terms
- monopolies
- labeling of ai-created content
- accountability and liability



conclusion

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■ many opportunities

- increased efficiency in content production
- new tech will always be used in unforeseen creative ways
- accessibility increases dramatically

■ paradigm shift has to be actively managed

- management and mitigation of impact on workforce/livelihood
- transparency and informed consumers
- models for fair compensation

■ old questions worth asking anew

- when is a musical piece considered creative
- what makes a human performance unique
- can generated content be art



thank you!

links

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