



# artificial intelligence and music

threats & opportunities

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

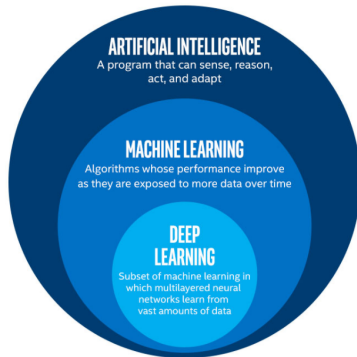
- data-driven: algorithm is more agnostic to task and is parametrized through training with data

### ■ 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*



# machine learning

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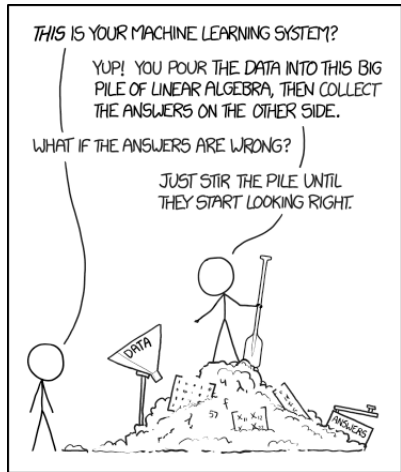


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[https://imgs.xkcd.com/comics/machine\\_learning.png](https://imgs.xkcd.com/comics/machine_learning.png)

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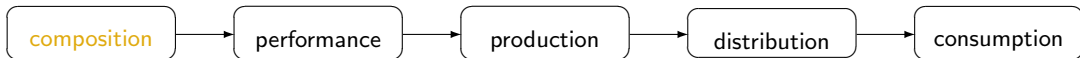
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# musical communication

## 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

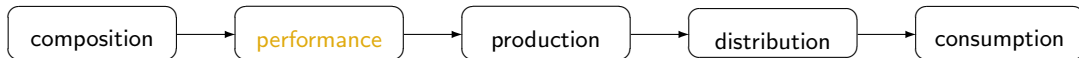
### ■ distribution & listening

- music recommendation and discovery



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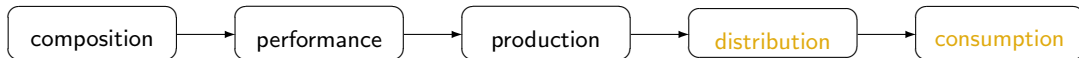
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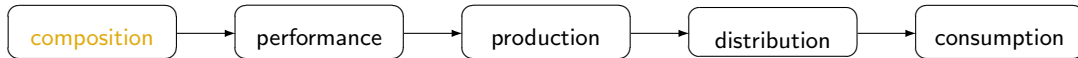


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## musical communication and AI



### ■ composition

- intelligent assistance, e.g., ideas, auto-arrangements
- automatic composition

### ■ performance

- interactive music education systems
- generation of 'human' performance

### ■ production

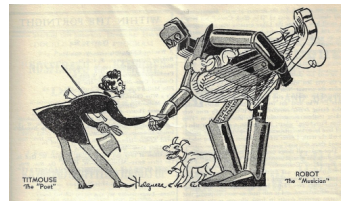
- auto-edit and auto-mix

### ■ distribution

- match music style and consumer

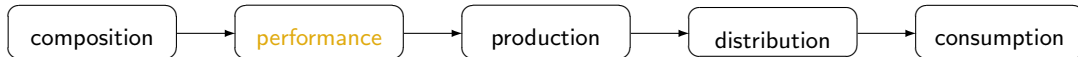
### ■ consumption

- intelligent music discovery & adaptable music



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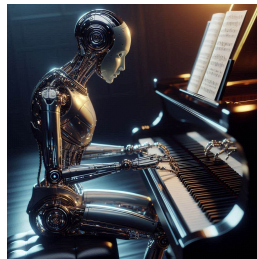
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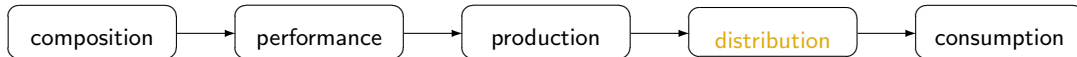
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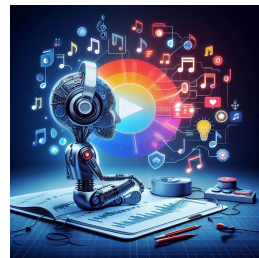
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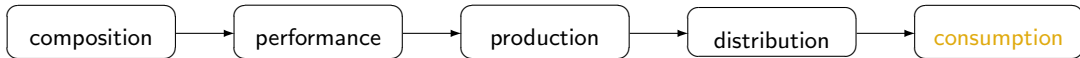
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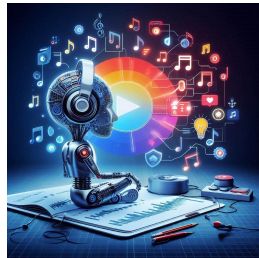
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# music ai

## opportunities & threats

### opportunities

- content creation:
  - speed-up, increased efficiency
  - creative possibilities (morphing, etc.)
  - co-creative idea givers
  - democratization
- consumption:
  - personalization
  - effective discovery and accessibility

### threats

- both:
  - 'mainstreamification'
  - bias through for-profit system control
  - sustainability and energy
- content creation:
  - ethical use of data
  - plagiarism growth
  - liability for harmful content
- consumption:
  - user distrust through
    - ▶ inflationary ai-generated content
    - ▶ inexplorable block-box systems

# conclusion

## ■ paradigm shift has to be actively managed

- management and mitigation of impact on workforce
- transparency and informing consumers
- models for fair compensation

## ■ short-term

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

## ■ fundamental questions worth asking

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



# thank you!

## links

alexander lerch: [www.linkedin.com/in/lerch](https://www.linkedin.com/in/lerch)

mail: [alexander.lerch@gatech.edu](mailto:alexander.lerch@gatech.edu)

book: [www.AudioContentAnalysis.org](http://www.AudioContentAnalysis.org)

music informatics group: [musicinformatics.gatech.edu](http://musicinformatics.gatech.edu)

