
Musically Embodied
Machine Learning

Musically Embodied Machine Learning

- AHRC Fellowship Project
- 18 months
- People
  - Chris Kiefer – PI (Music / Emute Lab)
  - Andrea Martelloni – Research Fellow (Music / Emute Lab)
  - Nic Seymour-Smith - Researcher Software Engineer (SHL)

UKRI Arts and Humanities Research Council

Expressive Potential of ML in Musical Instruments

- Gesture Processing
- Mapping design
- Sound synthesis
- Signal Processing
- Generative pattern / sound production

- Wider possibilities:
  - Generating organic complexity / encouraging serendipity
  - Creating adaptive (personalisable) instruments
  - Opening up complex DSP to musicians without technical experience

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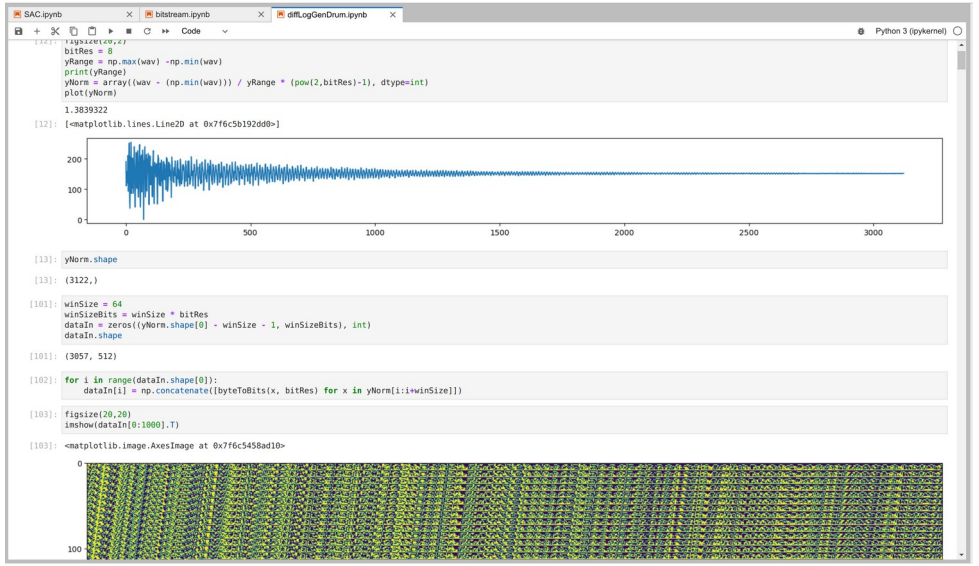
Problems with ML and Musical Instruments

- Disembodied split between instrument and machine learning toolsets
- Focus on static pre-trained models



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ITMLs

- Instruments with Tuneable Machine Learning
  - The entire process of training and running models is embedded within the instrument
  - Unified interface with the musical instrument
  - Using machine learning *musically*
  - Implications
    - Low-power portable computing
    - Simplified interface to machine learning
    - Instruments that adapt and evolve over their lifetime

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Research Questions

- **Musical Practice** When musicians play ITMLs, what are the approaches they develop to playing and tuning the instruments?
- **Processes in Musical Machine Learning** What are musical, technical and ethical considerations that emerge when designers and musicians work with ML models that can be adapted during the ongoing life of an instrument?
- **Design and Technology** Considering the new creative possibilities opened up by instruments with tuneable ML, what design techniques and principles can support their development? Furthermore, how can the complexity of contemporary ML be encapsulated into simpler interfaces, that integrate with the playable feel (or ergodynamics) of an instrument?

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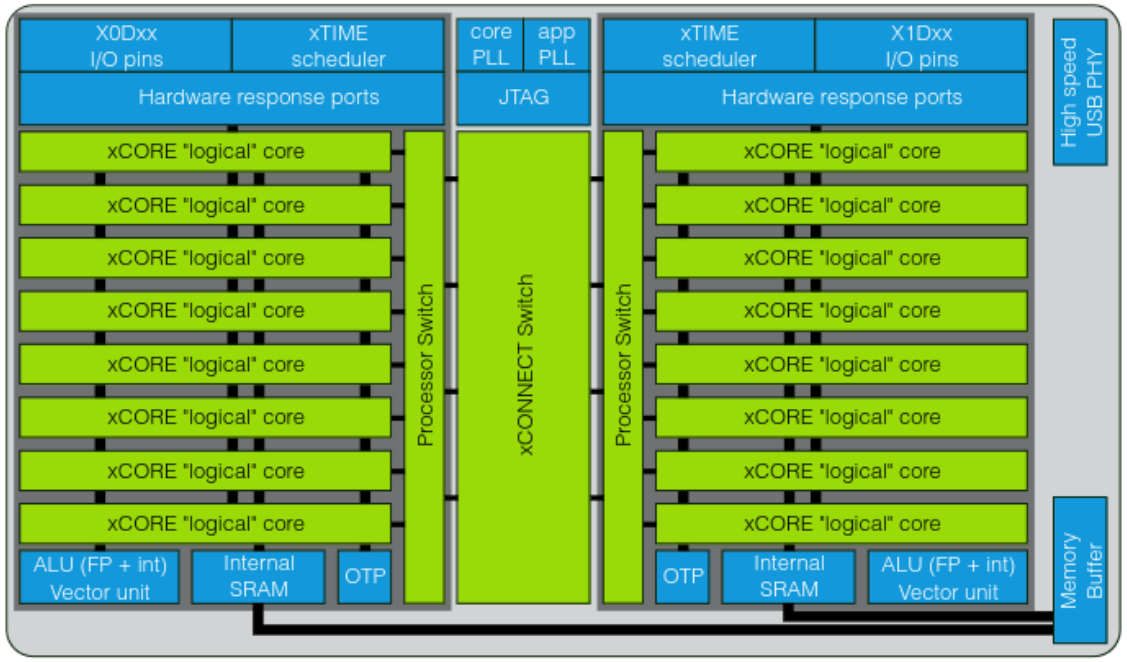
Methods

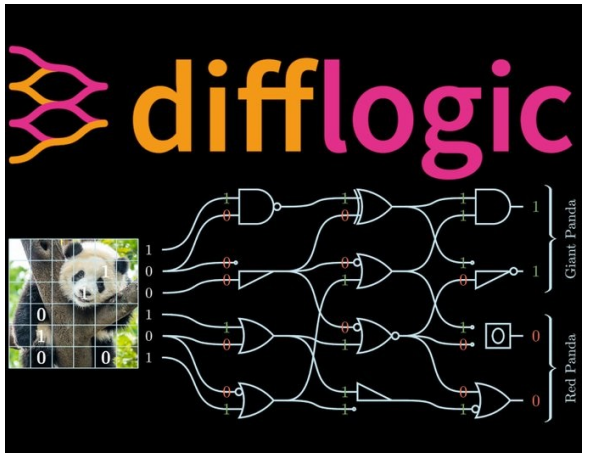
- Long-term participatory design with practicing musicians
- Probe instruments
- Workshops
  - Sound and Music Computing, Aalborg Universitat Copenhag
  - Intelligent Instruments Lab, Reykjavik
- Autobiographical design
- Industrial collaborations
  - Schlappi Engineering
  - Emute Lab Instruments

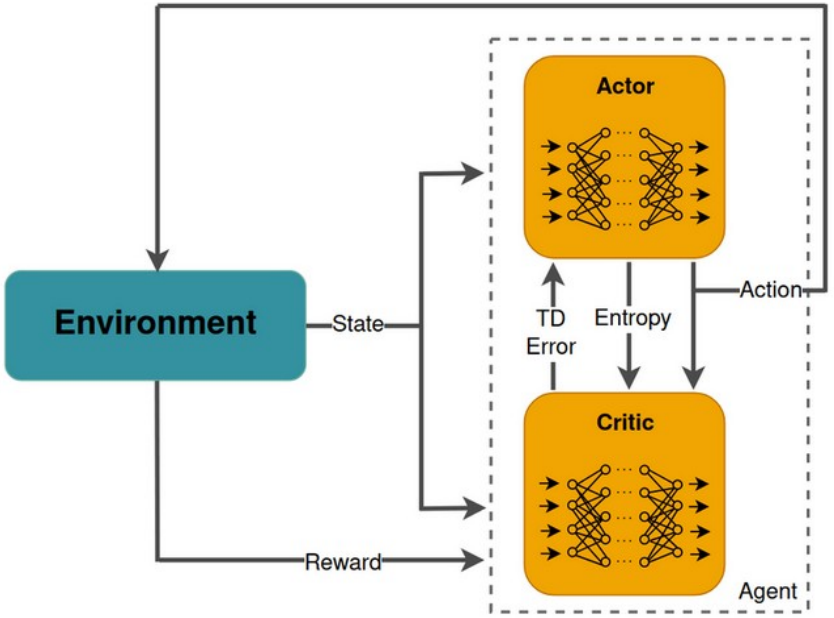
Hardware Platforms

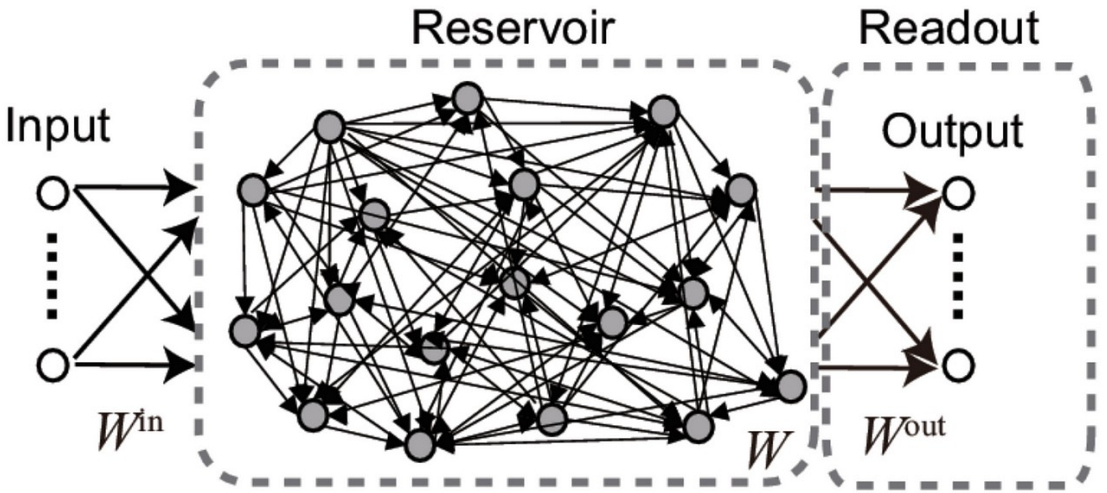


Machine Learning Approaches

- Soft Actor-Critic Reinforcement Learning
- Reservoir Computing
- Differentiable Logic Networks







Questions?