



Live Coding Using Crowdsourced Sounds and a Virtual Agent State of Affairs and Implications for HCI Research

Anna Xambó

Music, Technology and Innovation - Institute for Sonic Creativity (MTI²)
De Montfort University

ATLAS Colloquium 23.2.2021

about me

Research

Teaching

Practice

about DMU / MTI²



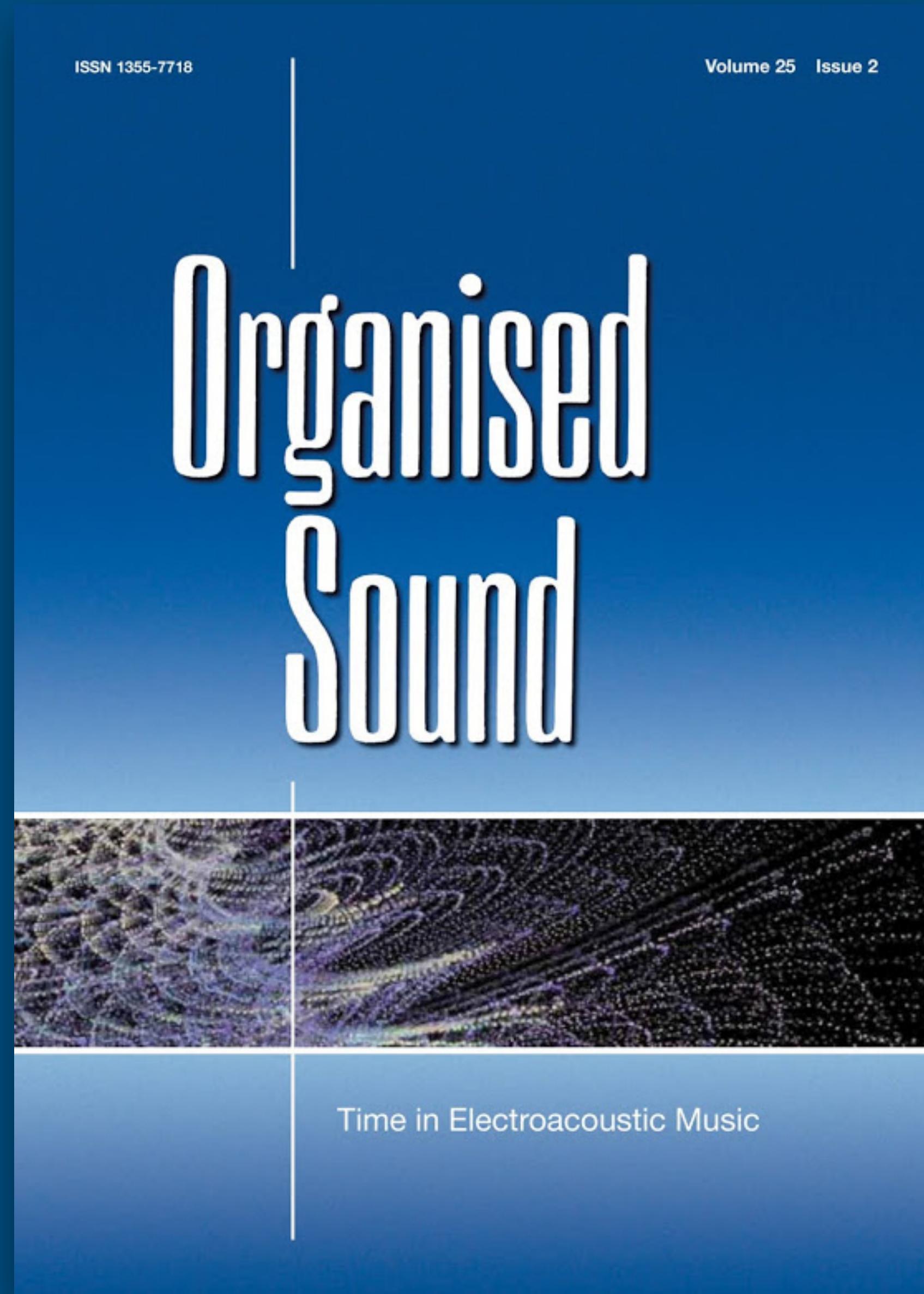


MTI²
INSTITUTE FOR
SONIC
CREATIVITY



- 27K students, +3K staff
- 4 faculties: ADH, BAL, H&LS, CEM
- Gold rating in the 2017 Teaching Excellence Framework





Music, Technology and Innovation - Institute for Sonic Creativity (MTI²)

- RC established in 1999 by Prof. Leigh Landy (RC part of LMS, CEM).
- Topics: new technologies for electroacoustic music & sonic art.
- Related undergraduate and postgraduate courses.
- International research: OS journal, EMS21 (7-10 July 2021)...

Organised Sound: <https://www.cambridge.org/core/journals/organised-sound>
EMS21: <http://www.ems-network.org/ems21>

about the project



MIRLCAuto: A Virtual Agent for Music Information Retrieval in Live Coding

Partners: IKLECTIK, Leicester Hackspace,
L'Ull Cec, Phonos, MTI²

Collaborators: TOPLAP Barcelona, FluCoMa, Freesound

Awarded with an EPSRC HDI Network Plus Grant

Partners

IKLECTIK [off-site]



phonos



Collaborators

toplaphbcn



freesound

Online Workshop Performing with a virtual agent: machine learning for live coding

London (IKLECTIK)

7/9/11.12.2020 - 19:00-21:00 (GMT)

Barcelona (L'Ull Cec)

11/13/15.1.2021 - 19:00-21:00 (CET)

Leicester (Leicester Hackspace)

25/27/29.1.2021 - 19:00-21.00 (GMT)

More info at:

mirlca.dmu.ac.uk/workshops

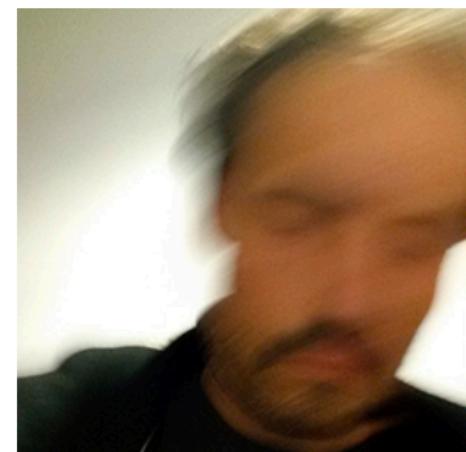
Team



Anna Xambó is a Senior Lecturer in Music and Audio Technology at De Montfort University, a member of Music, Technology and Innovation - Institute of Sonic Creativity (MTI^A2), and an experimental electronic music producer. Her research and practice focus on sound and music computing systems looking at novel approaches to collaborative, participatory, and live coding experiences. She is PI of the EPSRC HDI Network Plus funded project "MIRLCAuto: A Virtual Agent for Music Information Retrieval in Live Coding", investigating the use of a live coder virtual agent and the retrieval of large collections of sounds.
annaxambo.me



Active as an experimental music maker, **Ángel Faraldo** extends his work with sound installations, site-specific actions and sound design for dance and opera. He is interested in processes that maximise minimal resources, developing a critical and ecological perspective of live-electronic music, as materialised in his cycle The Feedback Study Series, his digital synthesiser MISS or his approach towards the no-input-mixer. Furthermore, he does significant labor performing and producing live-electronic music, especially as a member of Vertixe Sonora Ensemble, and as artistic director of the Phonos Foundation in Barcelona. He has studied at the Royal Conservatoire of Music (Madrid) and the Institute of Sonology (The Hague), obtaining his PhD degree from the Music Technology Group at Pompeu Fabra University (Barcelona), where he is currently a teaching associate.
www.angelfaraldo.info | www.upf.edu/web/phonos



Since 2006, helped by a fuzzy network of collaborators, **Sam Roig** has been directing l'ull cec, a cultural organization that has produced a wide assortment of public events and artistic projects related to sonic arts and experimental music, as well as dissemination activities around audio technology topics related to these disciplines. He is currently a PhD candidate at the University of Huddersfield and co-organises the MIRLCAuto's project workshops.
lullcec.org



Richard Forrest is a retired Electronics / Software engineer who worked in the Automotive and Aerospace industries. He is a member of Leicester Hackspace which is a venue for people to pursue their creativity in digital, electronic, mechanical and computer projects. He has just launched his own embedded software consultancy which offers to design embedded software using techniques that Richard has developed using the experience he has gained during his working career. Richard has performed music as a violin player in a symphony orchestra and as a chorister, having sung all the harmony parts at different times during his life. He has an appreciation of classical, modern, jazz, film and television theme music and a good grasp of music theory.
leicesterhackspace.org.uk
zoag.net



Eduard Solaz founder and director of IKLECTIK, London. IKLECTIK focuses on experimentation in arts, sound art, installation and cross disciplinary works. They expand their space as a research arts laboratory where interdisciplinary lines can overlap to create projects that explore processes and techniques, address social, political, cultural and critical issues.
iklectikoffsite.org



Tony Abbey is a retired Space Electronics engineer specialising in cooled CCD cameras for X-ray astronomy at Leicester University. Now volunteering at The National Museum of Computing at Bletchley Park where he is helping to rebuild the 1949 Valve Computer - EDSAC which kickstarted computing in the UK. Helped start up Leicester Hackspace where he was a director and is now company secretary. Interested in electronic music from a teenager. Built his first transistor oscillator keyboard instrument in the 1960's so he could play 'Telstar' by the Tornados. He became interested in electronic music at Southampton Uni where he did an Electronic Engineering degree and have the LP of 'Switched on Bach' by Walter Carlos (later Wendy Carlos). Fan of Kraftwerk and the Pet Shop Boys. He wants to learn if the on-line composing project is music as he would define it.
leicesterhackspace.org.uk



Isa Ferri is IKLECTIK's assistant curator and sound engineer. After obtaining her Master in Collection and Exhibition Registrar (2009), she started her career working for Massimo De Carlo and Massimo Minini Gallery, for then specialising in production and development of automated artworks facilitating the meeting of Engineering and Art. In 2017 she got the Diploma in 'Music Technology and Production' becoming permanent part of the IKLECTIK team in London and of the Sziget Festival Main Stage Sound Engineering team in Budapest.
iklectikoffsite.org

<https://mirlca.dmu.ac.uk/team/>

outline

- **The Context**
- **The System**
- **Outreach**
- **Discussion**
- **Conclusion**

the context

machine musicianship

- AI applied to computer music systems where the systems have the ability to learn and evolve (Rowe 2001).
 - Voyager (Lewis 2000), ability to improvise with a human improviser.
 - The Continuator (Pachet 2003), ability to learn and play with the performer's style.
 - Shimon (Hoffman et al. 2010), a robotic musician with ability to improvise with humans.

ML + NIMEs

- Embedded devices that incorporate trained ML models:
 - Augmented acoustic instruments (DeSmith et al. 2020; Macionis & Kapur 2018).
 - New DMIs (Fiebrink & Sonami 2020, Næss & Martin 2019).
- ML toolkits for music e.g. Wekinator (Fiebrink et al. 2009), ml.lib (Bullock & Momemi 2015); FluidCorpusMap (Roma et al. 2019), and so on.

IML

- Interactive machine learning (Fails and Olsen 2003).
- Interactive machine learning as a creative musical tool (Fiebrink and Caramiaux 2016).
 - Long-term co-design process (Fiebrink & Sonami 2020).
 - Multi-user models in mobile music (Roma et al. 2018).

ML + live coding

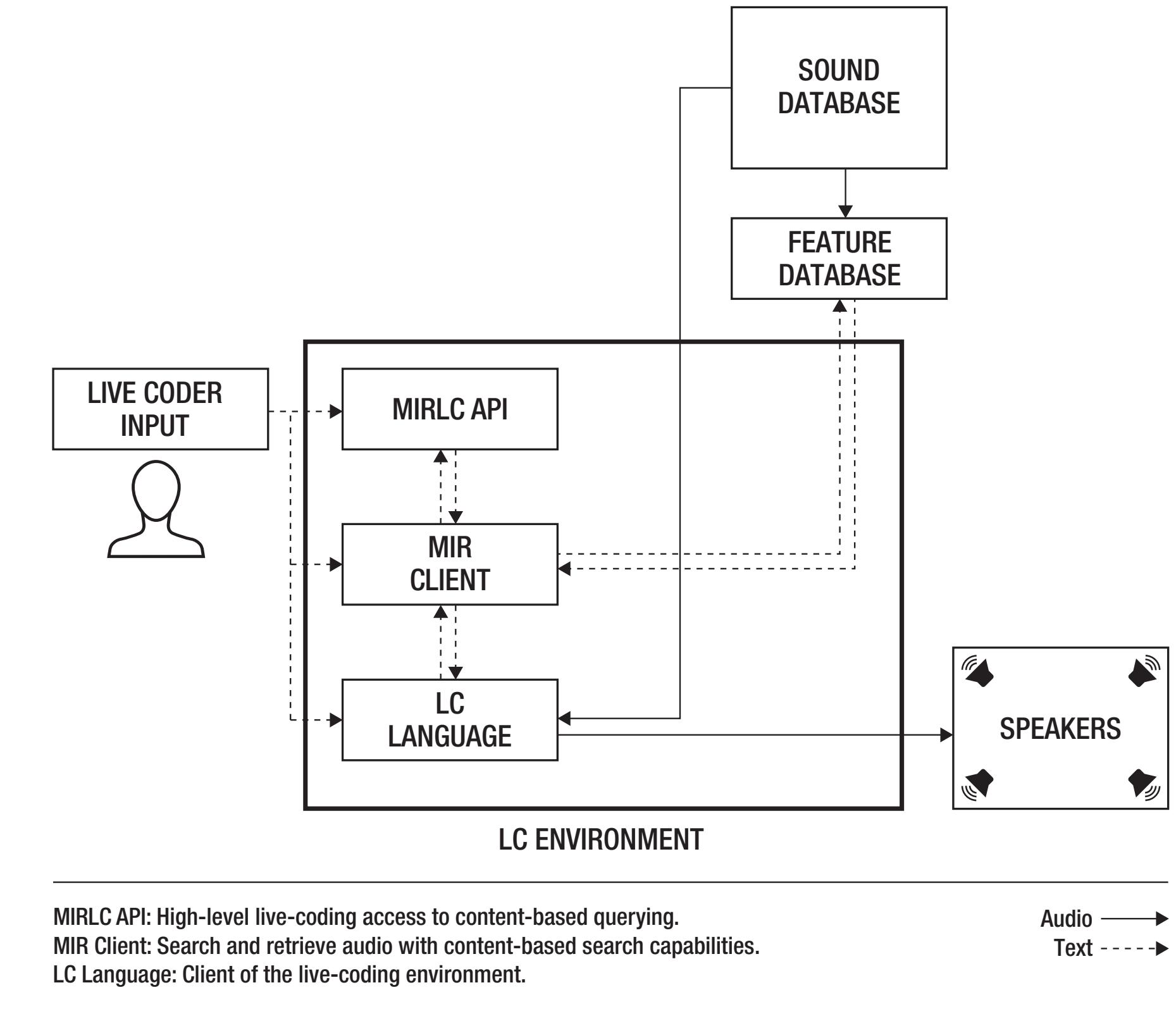
- **Machine listening**
 - Algoravethmic remix system (Collins 2015).
 - APICultor (Ordiales and Bruno 2017).
 - Cacharpo (Navarro and Ogborn 2017).
- **Online training process**
 - The Mégra system (Reppel 2020).
 - Sema (Bernardo et al. 2020).

other approaches to ML + live coding...

- Rule learning (Paz 2015).
- Cibo's performance style generation (Stewart et al. 2020).
- Collaborative live coding improvisation (Subramanian et al. 2012).
- Gamification (Lorway et al. 2019).

MIRLCRep

- Provides a high-level musical approach to operate with audio clips in live coding using music information retrieval techniques.
- Mid- and high-level content-based queries (e.g., duration, bpm, pitch, key, or scale) and text-based queries (i.e., tags).
- Use of an online database with preanalyzed audio features.
- It is designed for repurposing audio samples from Freesound using SuperCollider.
- Demo: <https://vimeo.com/249968326> (8:36)



Xambó, A., Lerch, A. and Freeman, J. (2019). "Music Information Retrieval in Live Coding: A Theoretical Framework". *Computer Music Journal*, 42(4), Winter 2018, pp. 9-25.

Xambó, A., Roma, G., Lerch, A., Barthet, M., Fakelas, G. (2018) "Live Repurposing of Sounds: MIR Explorations with Personal and Crowdsourced Databases". In Proceedings of the New Interfaces for Musical Expression (NIME '18). Blacksburg, Virginia, USA. pp. 364-369.

```
// instantiation
~a = MIRLCRep.new
~b = MIRLCRep.new

// GET SOUNDS BY TEXT

// getsound(id=31362, size=1)
~a.id(323399)
~a.id(19246)
~a.id(19247)
~b.id(19248)
~b.id(192468)

// random(size=1)
~a.random
~a.random(2)
~a.random(3)
~b.random

// tag(tag="noise", size=1)
~a.tag("nail", 3)
~a.tag("chimes", 2)
~a.tag("noise", 2)
~a.tag("hammer", 2)
~b.tag("grain", 2)
~b.tag("humming", 3)
```

```

// GET SOUNDS BY CONTENT & GET SOUNDS BY CONTENT WITH FILTER

// content(size=1, feature = 'dur', fvalue = 1, fx = 'conf', fxvalue = 'hi')
~a.content // sounds of 1 sec of duration
~a.content(1, 'dur', 10) // sounds of 10 sec of duration
~a.content(1, 'dur', 1, 'key', 'A')
~a.content(1, 'dur', 4, 'scale', 'minor')
~a.content(1, 'dur', 1, 'conf', 'lo')
~a.content(2, 'pitch', 100, 'conf', 'lo')
~a.content(1, 'key', 'Asharp')
~a.content(5, '.lowlevel.spectral_complexity.mean:', 1, 'conf', '[0 TO 0.3]') // Using directly Essentia's format
~b.content(1, 'bpm', 120)

// GET SIMILAR SOUNDS BY EXAMPLE

// similar(targetnumsnd=0, size=1)

~a.similar
~a.similar(0)
~a.similar(0, 2)
~b.similar(1)

// GET SIMILAR SOUNDS BY FILTER

// filter (targetnumsnd=0, size=1, fx = 'conf', fxvalue = 'hi')

~a.content(1, 'dur', 4, 'scale', 'minor')
~a.filter(1, 1, 'conf', 'lo')
~a.filter(1, 1, 'conf', 'hi')
~a.filter(2, 1, 'conf', 'hi')

~b.content(1, 'dur', 2)

```

MIRLCRep: Music Improvisation by Jack Armitage

Sound samples used:

Ambience, Jacksonville Zoo, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/400831/>
Birds Singing 03.wav by DCPoke <https://freesound.org/people/DCPoke/sounds/387978/>
Birds in the forest.wav by straget <https://freesound.org/people/straget/sounds/402809/>
Bird Whistling, Single, Robin, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/416529/>
Wind long.ogg by vandale <https://freesound.org/people/vandale/sounds/379465/>
Children screaming in a Pirate Ship Playground, church bell in background by felix.blume <https://freesound.org/people/felix.blume/sounds/410518/>
Ambience, Children Playing, Distant, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/398160/>
lawnmower.wav by gadzooks <https://freesound.org/people/gadzooks/sounds/20737/>
Cat, Screaming, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/415209/>
High Street of Gandia (Valencia, Spain) by Jormarp <https://freesound.org/people/Jormarp/sounds/207208/>
Dog Barking, Single, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/406085/>
TRAIN_VOICE.mp3 by Manicciola <https://freesound.org/people/Manicciola/sounds/173314/>
Walking in Long Grass.wav by Leafs67 <https://freesound.org/people/Leafs67/sounds/155589/>
Group_of_Dogs_Barking.WAV by ivolipa <https://freesound.org/people/ivolipa/sounds/337101/>
Dog Barking, Single, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/406085/>
Two Barks.wav by Puniho <https://freesound.org/people/Puniho/sounds/115536/>
cat meow II by tuberatanka <https://freesound.org/people/tuberatanka/sounds/110010/>
Cat, Screaming, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/415209/>
cat meow by tuberatanka <https://freesound.org/people/tuberatanka/sounds/110011/>
Ambience, London Street, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/398159/>
High Street of Gandia (Valencia, Spain) by Jormarp <https://freesound.org/people/Jormarp/sounds/207208/>
On A Bus by thef1like <https://freesound.org/people/thef1like/sounds/412932/>
political_discussion(IT) by Manicciola <https://freesound.org/people/Manicciola/sounds/182860/>
TRAIN_VOICE.mp3 by Manicciola <https://freesound.org/people/Manicciola/sounds/173314/>
Inside Car Ambience Next to School More Quiet Version.wav by 15050_Francois https://freesound.org/people/15050_Francois/sounds/326146/
Heavy Rain by lebcraftlp <https://freesound.org/people/lebcraftlp/sounds/243627/>
Train upon us.wav by markedit <https://freesound.org/people/markedit/sounds/157873/>
Large_crowd_medium_distance_stereo.wav by eguobYTE <https://freesound.org/people/eguobYTE/sounds/360703/>
On A Bus by thef1like <https://freesound.org/people/thef1like/sounds/412932/>
Coffee Maker by Villaperros <https://freesound.org/people/Villaperros/sounds/170621/>
London Underground, Arriving, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/401989/>
German / English Airport Announcement by euromir <https://freesound.org/people/euromir/sounds/256878/>
tannoying remix of 245957_kwahmah-02_tannoy-chime-05.flac by Timbre <https://freesound.org/people/Timbre/sounds/246322/>
Spaceship Fly-by, A by InspectorJ <https://freesound.org/people/InspectorJ/sounds/397948/>
plane.wav by inchadney <https://freesound.org/people/inchadney/sounds/275138/>
20070117.takeoff.wav by dobroide <https://freesound.org/people/dobroide/sounds/29612/>

MIRLCRep: Music Improvisation

by Alo Allik

Sound samples used:

Rainstick 2.wav by gevaroy <https://freesound.org/people/gevaroy/sounds/347380/>
Instrument_rainstick.aif by vrodge <https://freesound.org/people/vrodge/sounds/119547/>
Glass Smash, Bottle, E.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/344272/>
sword_01.wav by dermotte <https://freesound.org/people/dermotte/sounds/263015/>
Footsteps, Ice, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/338265/>
Celery crunch.wav by xenognosis <https://freesound.org/people/xenognosis/sounds/137228/>
b1.wav by deleted_user_2195044 https://freesound.org/people/deleted_user_2195044/sounds/243212/
Bullroarer by m.newlove <https://freesound.org/people/m.newlove/sounds/242926/>
Didgeridoo, A.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/398272/>
Infrasound - 12hz - Sine Wave.wav by Headphaze <https://freesound.org/people/Headphaze/sounds/235209/>
Infrasound - 20hz - Sine Wave.wav by Headphaze <https://freesound.org/people/Headphaze/sounds/235212/>
Laser/Machine humming by Shredster7 <https://freesound.org/people/Shredster7/sounds/166098/>
bit.aif by matthewgeorge <https://freesound.org/people/matthewgeorge/sounds/34909/>
Infrasound - 12hz - Sine Wave.wav by Headphaze <https://freesound.org/people/Headphaze/sounds/235209/>
Apple crunch.wav by xenognosis <https://freesound.org/people/xenognosis/sounds/137231/>
Eating chips by giddster <https://freesound.org/people/giddster/sounds/383398/>
Boots on Scree going downhill.wav by corble <https://freesound.org/people/corble/sounds/402846/>
Glass Smash, Bottle, E.wav by InspectorJ <https://freesound.org/people/InspectorJ/sounds/344272/>

Equinox-22-03-2020-19-30.scd

```

31
32 // Hello !
33
34
35
36
37
38
39 // Tag
40
41 a.tag("morse"+"two")    []
42
43
44 b|
45
46
47
48 c
49
50
51 d
52
53
54 e
55
56
:: Anna Xambó ::

  Post window
  server 'localhost' already booting
  server 'localhost' already booting
-> a MIRLCRep2
Booting server 'localhost' on address 127.0.0.1:57110.
Found 0 LADSPA plugins
Number of Devices: 8
  0 : "Built-in Microph"
  1 : "Built-in Output"
  2 : "Scarlett 6i6 USB"
  3 : "BlackHole 16ch"
  4 : "Soundflower (2ch)"
  5 : "Soundflower (64ch)"
  6 : "ZoomAudioDevice"
  7 : "Multi-Output Device"
"Scarlett 6i6 USB" Input Device
  Streams: 1
    0 channels 6
"BlackHole 16ch" Output Device
  Streams: 1
    0 channels 16
SC_AudioDriver: sample rate = 44100.000000, driver's block size = 512
SuperCollider 3 server ready.
Requested notification messages from server 'localhost'
localhost: server process's maxLogIns (1) matches with my options.
localhost: keeping clientID (0) as confirmed by server process.
Shared memory server interface initialized
Sounds selected by tag: 1
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'https://www.freesound.org/api/sounds/?tag=morse&count=7'
-> a MIRLCRep2
{"count":7,"next":null,"results":[{"id":47487,"name":"sw-13.wav","tags":["electronic","morse","noise"]}]
found sound by tag, id: 47487 name: sw-13.wav
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'https://www.freesound.org/api/sounds/47487'
{"id":47487,"url":"https://freesound.org/people/galeku/sounds/47487/","name":"sw-13.wav","tags":[]}
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'https://freesound.org/api/sounds/47487'
[0]: id: 47487 name: sw-13.wav by: galeku dur: 83.5293

```

Interpreter: Active Server: 0.22% 0.29% 8u 1s 52g 134d 0.0dB M R

“Crowdsourced Eulerisms”. Eulerroom Equinox 2020.
Streaming from Sheffield, UK. March 23, 2020.

MIRLCRep 2.0

Unwanted Situations: The Guitar Case

n02-peterMann
from [noiselets](#) by [carpal tunnel](#)

04:13 / 11:10

Digital Track
Streaming + Download
Includes high-quality download in MP3, FLAC and more. Paying supporters also get unlimited streaming via the free Bandcamp app.

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[Send as Gift](#)

[Buy the Full Digital Album](#)

from [noiselets](#), released January 8, 2018
List of sounds used from [Freesound.org](#) coming soon.

© all rights reserved

peterMann



Share / Embed Wishlist

[https://carpal-tunnel.bandcamp.com/
track/n02-petermann](https://carpal-tunnel.bandcamp.com/track/n02-petermann) (around 04:26)

overarching research question

Can we build a **virtual agent** that **learns** from human live coders using **machine learning** algorithms and a **large dataset of sounds** which goes beyond the approach of following live coder actions (also known as the call-response strategy) and creates **legible and negotiable actions**?

research question - ML task 1

Can we build a **VA** that **learns** from the **musical preference** of a live coder within a **situated musical action** by means of machine learning algorithms applied to the live exploration of a large database of sounds?

“situated musical actions”

- Lucy Suchman (1987)'s introduced the term “**situated action**” to refer any action as being linked to the context where it happens (from a study on users using an expert photocopier system designed to help them).
- A “**situated musical action**” refers to any musical action related to a specific context (where we expect the VA to help us in that action within that context).

the system

ML tasks

1. Identify ML tasks.
2. Implement the ML tasks with suitable tools.
3. Test the implemented ML tasks.

1. Identify ML Tasks

Identify ML Tasks

- **Two tasks identified (supervised learning):**
 1. **NN-1** learns my musical taste when retrieving sounds from Freesound: do I like it or not?
 2. **NN-2** learns to reply (call-response) with another query based on the existing sound and my musical taste. The response can be based on pitch, bmp or similarity.
- **For each NN:**
 - Phase 1. **Training.**
 - Phase 2. **Testing.**

Identify ML Tasks

- So far, task 1 implemented:
 1. **NN-1** learns my musical taste when retrieving sounds from Freesound: do I like it or not?
 2. **NN-2** learns to reply (call-response) with another query based on the existing sound and my musical taste. The response can be based on pitch, bmp or similarity.
- For each NN:
 - Phase 1. Training.
 - Phase 2. Testing.

NN-1: Learning my musical taste

1. Creation of a dataset.
2. Identifying suitable feature descriptors that describe the sound.
3. Training a suitable machine learning model using a binary classifier based on a MLP neural network => *this results in the default model of the system.*

<https://mirlca.dmu.ac.uk/posts/towards-learning-my-musical-taste/>

2. Implement the ML tasks with suitable tools

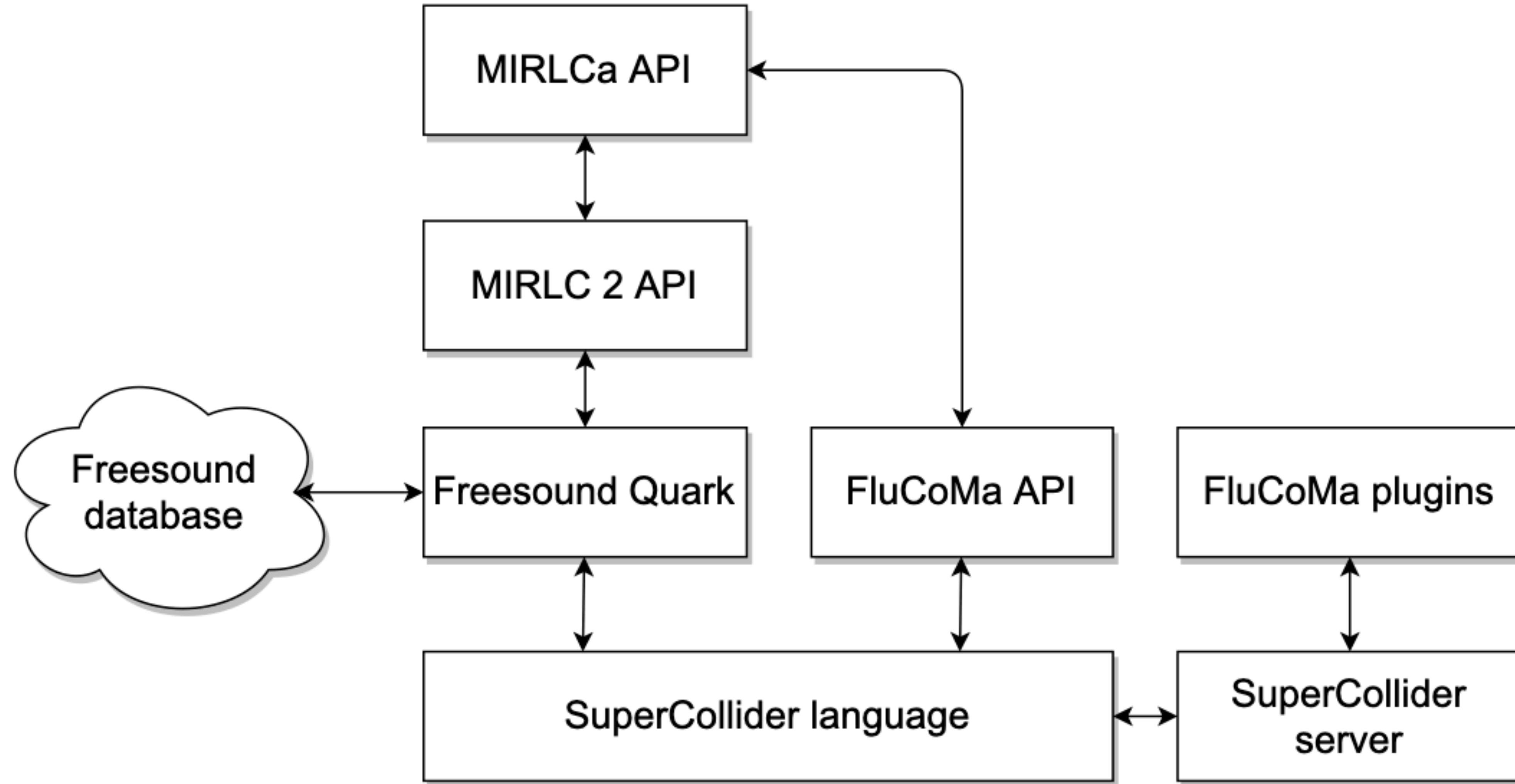
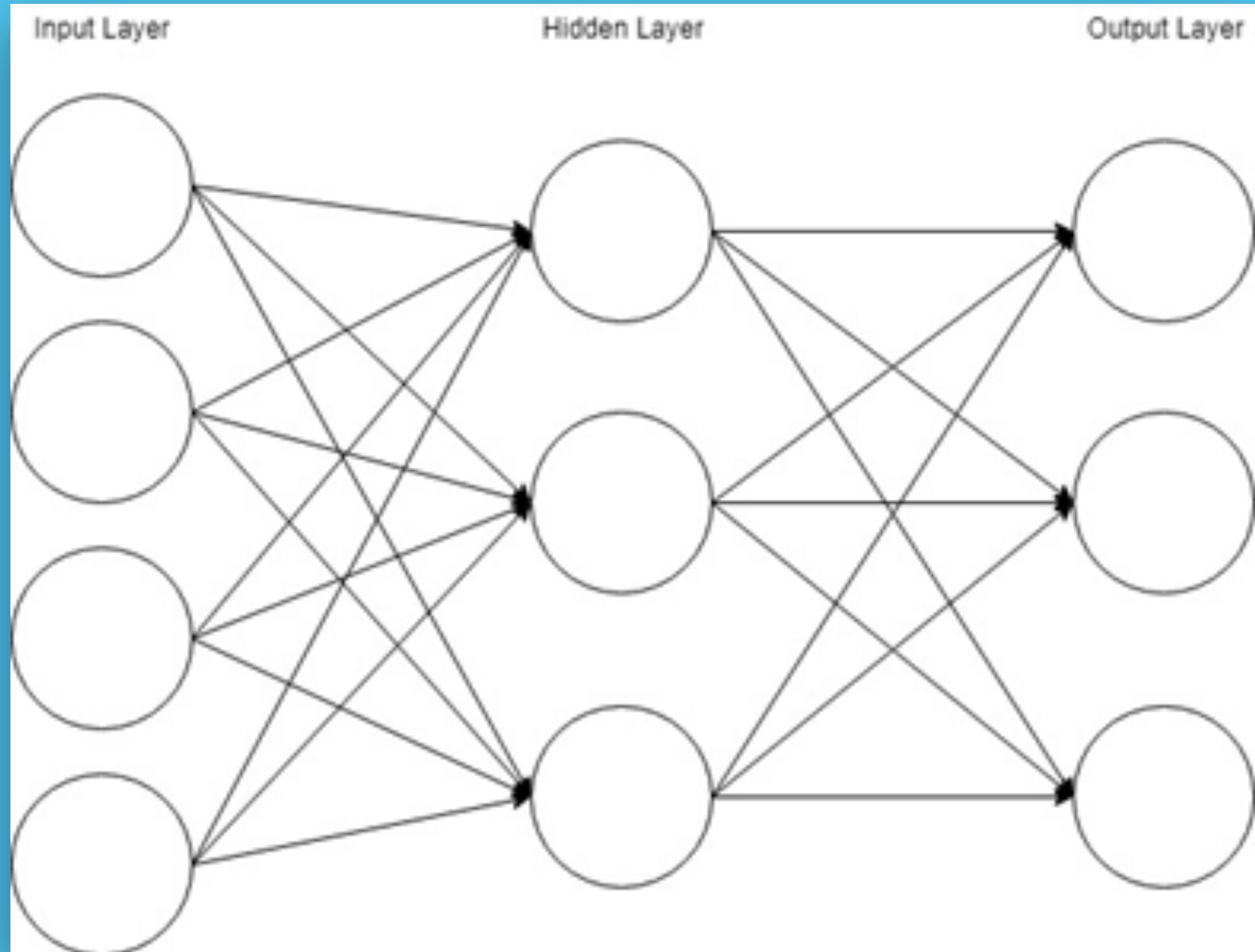


Diagram of the system's architecture.

Multilayer Perceptron



- Left: example of a multilayer perceptron (ML), which is a NN with an input layer, output layer, and may have hidden layers in between.
- A complex architecture suitable to learn regression and classification models for difficult datasets.

[https://deepai.org/machine-learning-glossary-and-terms/
multilayer-perceptron](https://deepai.org/machine-learning-glossary-and-terms/multilayer-perceptron)

best audio descriptors...

- **First round with 9 descriptors:**
 - pitch, bpm, centroid, flatness, **pitch_confidence** (mean and variance).
 - **73% accuracy with flatness and pitch_confidence (mean and variance)**
- **Second round with 26 descriptors:**
 - Mel-frequency cepstral coefficients (MFCCs) (mean and variance) + PCA
 - **76%-83% accuracy**

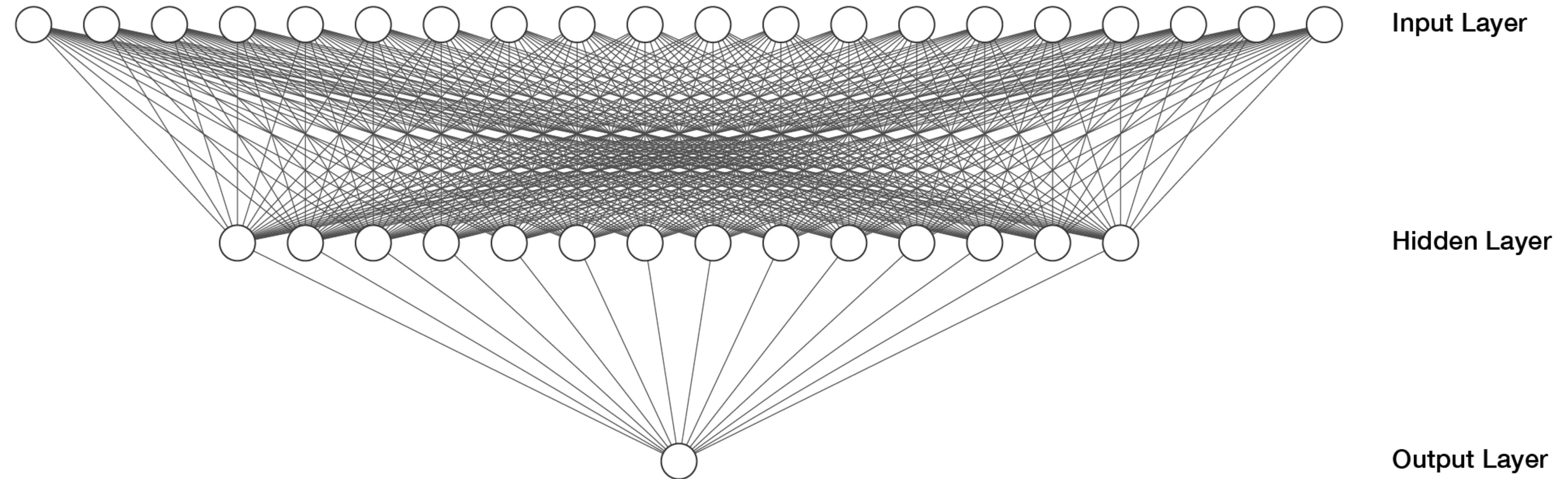
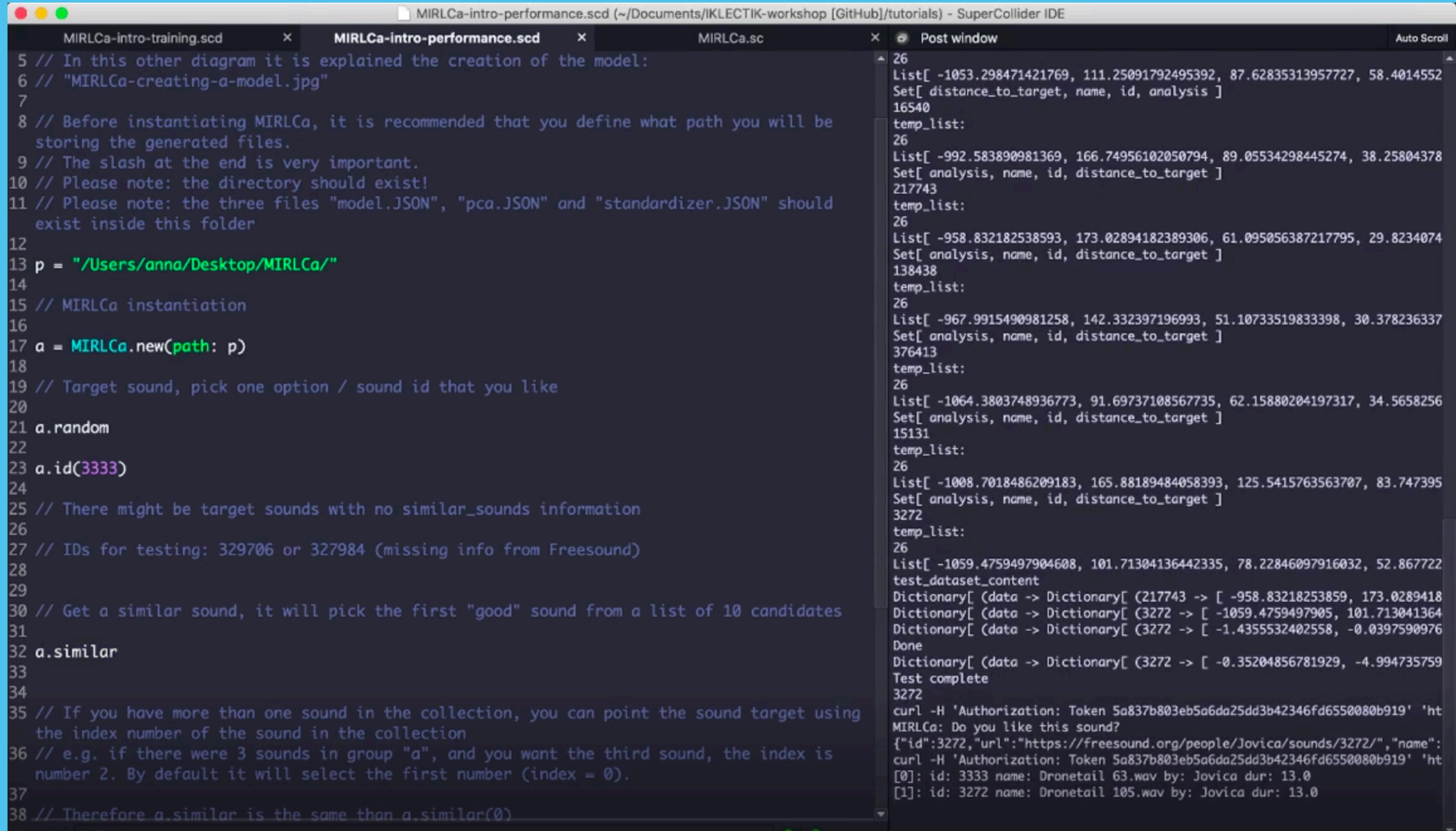


Diagram of the system's architecture.

**3. Test the implemented ML
tasks...**

Performance Mode



The screenshot shows the SuperCollider IDE interface with three tabs: "MIRLCa-intro-training.sc", "MIRLCa-intro-performance.sc", and "MIRLCa.sc". The "MIRLCa-intro-performance.sc" tab is active, displaying the following code:

```
5 // In this other diagram it is explained the creation of the model:  
6 // "MIRLCa-creating-a-model.jpg"  
7  
8 // Before instantiating MIRLCa, it is recommended that you define what path you will be  
storing the generated files.  
9 // The slash at the end is very important.  
10 // Please note: the directory should exist!  
11 // Please note: the three files "model.JSON", "pca.JSON" and "standardizer.JSON" should  
exist inside this folder  
12  
13 p = "/Users/anna/Desktop/MIRLCa/"  
14  
15 // MIRLCa instantiation  
16  
17 a = MIRLCa.new(path: p)  
18  
19 // Target sound, pick one option / sound id that you like  
20  
21 a.random  
22  
23 a.id(3333)  
24  
25 // There might be target sounds with no similar_sounds information  
26  
27 // IDs for testing: 329706 or 327984 (missing info from Freesound)  
28  
29  
30 // Get a similar sound, it will pick the first "good" sound from a list of 10 candidates  
31  
32 a.similar  
33  
34  
35 // If you have more than one sound in the collection, you can point the sound target using  
the index number of the sound in the collection  
36 // e.g. if there were 3 sounds in group "a", and you want the third sound, the index is  
number 2. By default it will select the first number (index = 0).  
37  
38 // Therefore a.similar is the same than a.similar(0)
```

The right pane shows the "Post window" containing the output of the code execution, which includes lists of analysis data and command-line interactions with curl.

```
26  
List[ -1053.298471421769, 111.25091792495392, 87.62835313957727, 58.4014552  
Set[ distance_to_target, name, id, analysis ]  
16540  
temp_list:  
26  
List[ -992.583890981369, 166.74956102050794, 89.05534298445274, 38.25804378  
Set[ analysis, name, id, distance_to_target ]  
217743  
temp_list:  
26  
List[ -958.832182538593, 173.02894182389306, 61.095056387217795, 29.8234074  
Set[ analysis, name, id, distance_to_target ]  
138438  
temp_list:  
26  
List[ -967.9915490981258, 142.332397196993, 51.10733519833398, 30.378236337  
Set[ analysis, name, id, distance_to_target ]  
376413  
temp_list:  
26  
List[ -1064.3803748936773, 91.69737108567735, 62.15880204197317, 34.5658256  
Set[ analysis, name, id, distance_to_target ]  
15131  
temp_list:  
26  
List[ -1008.7018486209183, 165.88189484058393, 125.5415763563707, 83.747395  
Set[ analysis, name, id, distance_to_target ]  
3272  
temp_list:  
26  
List[ -1059.4759497904608, 101.71304136442335, 78.22846097916032, 52.867722  
test_dataset_content  
Dictionary[ (data -> Dictionary[ (217743 -> [ -958.83218253859, 173.0289418  
Dictionary[ (data -> Dictionary[ (3272 -> [ -1059.4759497905, 101.713041364  
Dictionary[ (data -> Dictionary[ (3272 -> [ -1.4355532402558, -0.0397590976  
Done  
Dictionary[ (data -> Dictionary[ (3272 -> [ -0.35204856781929, -4.994735759  
Test complete  
3272  
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht  
MIRLCa: Do you like this sound?  
{"id":3272,"url":"https://freesound.org/people/Jovica/sounds/3272/","name":  
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht  
[0]: id: 3333 name: Dronetail 63.wav by: Jovica dur: 13.0  
[1]: id: 3272 name: Dronetail 105.wav by: Jovica dur: 13.0
```

Training Mode

The screenshot shows the SuperCollider IDE interface with four tabs open: MIRLCa-intro-training.scd, MIRLCa-intro-performance.scd, MIRLCa.sc, and Post window.

The MIRLCa-intro-training.scd tab contains the following code:

```
8 p = "/Users/anna/Desktop/MIRLCa/"
9
10 // MIRLCa instantiation
11
12 a = MIRLCa.new(path: p)
13
14 // Start the training
15
16 a.starttraining
17
18 // If you like the sound, execute this command
19
20 a.ok
21
22 // If you don't like the sound, execute this command
23
24 a.ko
25
26 // You can either pause the process or stop training. Pause should be executed when a
   new sound has been downloaded, otherwise you might need to execute this command
   twice.
27
28 a.pause
29
30 // A new sound will appear, sometimes you need to wait. Keep saying if you like the
   sound or not.
31
32 // Once you are done, you can stop the training. Stop training should be executed
   when a new sound has been downloaded. Otherwise you might need to execute "Pause" to
   stop playing the latest sound.
33
34 a.stoptraining
35
36 // If you don't like the result, you can continue training
```

The Post window tab displays the following output:

```
*****
You have 9 sounds in your dataset
The sound IDs are: Set[ 362349, 464127, 152562, 280091, 220698, 304655, 178
*****
Fading out the previous sound...
Number of sounds fading out: 1
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
-> a MIRLCa
{"detail":"Not found."}
Sound analysis does not exist
Either SoundID or sound analysis does not exist
I'm getting another sound...
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"detail":"Not found."}
Sound analysis does not exist
Either SoundID or sound analysis does not exist
I'm getting another sound...
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"detail":"Not found."}
Sound analysis does not exist
Either SoundID or sound analysis does not exist
I'm getting another sound...
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"detail":"Not found."}
Sound analysis does not exist
Either SoundID or sound analysis does not exist
I'm getting another sound...
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"detail":"Not found."}
Sound analysis does not exist
Either SoundID or sound analysis does not exist
I'm getting another sound...
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"id":164176,"url":"https://freesound.org/people/bmoreno/sounds/164176/","n
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"id":164176,"url":"https://freesound.org/people/bmoreno/sounds/164176/","n
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
[0]: id: 164176 name: 0371 People_ambience.wav by: bmoreno dur: 181.075
{"lowlevel":{"mfcc":{"min":[-1138.4200593123592,1.396759147763041e-05,-45.4
List[ 164176, good, -720.9884737485957, 136.8912376372041, -4.0182580596830
*****
You have 10 sounds in your dataset
The sound IDs are: Set[ 178232, 304655, 464127, 400170, 308073, 164176, 280
*****
Fading out the previous sound...
Number of sounds fading out: 1
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
-> a MIRLCa
{"id":343299,"url":"https://freesound.org/people/Kalou/sounds/343299/","nam
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
{"id":343299,"url":"https://freesound.org/people/Kalou/sounds/343299/","nam
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'ht
[0]: id: 343299 name: Goodge St - TCR ambience.wav by: Kalou dur: 257.29
{"lowlevel":{"mfcc":{"min":[-1138.4200593123592,1.396759147763041e-05,-65.9
```

outreach



MIRLCAuto: A Virtual Agent for Music Information Retrieval in Live Coding

Partners: IKLECTIK, Leicester Hackspace,
L'Ull Cec, Phonos, MTI²

Collaborators: TOPLAP Barcelona, FluCoMa, Freesound

Awarded with an EPSRC HDI Network Plus Grant

Partners

IKLECTIK [off-site]



phonos



Collaborators

toplaphbcn



freesound

Online Workshop Performing with a virtual agent: machine learning for live coding

London (IKLECTIK)

7/9/11.12.2020 - 19:00-21:00 (GMT)

Barcelona (L'Ull Cec)

11/13/15.1.2021 - 19:00-21:00 (CET)

Leicester (Leicester Hackspace)

25/27/29.1.2021 - 19:00-21.00 (GMT)

More info at:

mirlca.dmu.ac.uk/workshops

the workshops

- 3 workshops, ~20 attendees / workshop, 62 attendees in total.
 - 19 countries / 37 cities.
 - Mainly from Europe, but also from Asia, North America and South America.
- *Virtual* London (IKLECTIK), *virtual* Barcelona (l'ull cec), *virtual* Leicester (Leicester Hackspace).
- 3 sessions of 2h/session (on Zoom) + 1-2 project-based drop-in/help-desk sessions.
- Mini-lectures combined with demos and break-out groups.
- Instructors: Sam Roig and Anna Xambó.

learning outcomes

- Get a sense of the practice of live coding (music live performance using code) by manipulating online crowdsourced sounds and the automatic use of feature descriptors obtained from Freesound.org.
- Get familiar with the application of neural networks, in particular a multilayer perceptron used as a classifier, to improve the practice of live coding with crowdsourced sounds.
- Be exposed to the main steps to solve a problem using machine learning techniques: the creation of a dataset, training a model, testing the model, and performing with / evaluating the model in an iterative cycle.
- Understand how to combine different technologies in SuperCollider to build a prototype for live coding performance.
- Get insight on a participatory design approach to designing a prototype for live coding performance.

upon completion participants will be able to...

- Use SuperCollider and the MIRLC2 library to retrieve sounds from Freesound.org based on a live coding approach.
- Use a trained model using the FluCoMa library to retrieve sounds that are based on personal musical taste.
- Train your own model using the FluCoMa library to retrieve sounds that are based on your personal musical taste.
- Explore creative strategies to perform with a virtual agent using machine learning for live coding.
- Analyse how to define a virtual agent that can react to the live coder inputs using the FluCoMa library.



File Edit Options Buffers Tools SCLang Help

```
// different similar sounds

s.boot;

p = "/home/hvillase/Escritorio/MIRLCa/";
a = MIRLCa.new(path: p);

a.random
a.similar(1)
a.delay
a.play
a.autochopped(36, 4)
a.mute
a.fadeout(4)

b = MIRLCa.new(path: p)
b.random
b.similar

-:**- different-similar-sounds.scd All L18 (SCLang)
now playing...[0]: id: 276150 name: Coins_Single_10.wav by: Little
Synth('synth_mono_fs' : 1014)
now playing...[1]: id: 8364 name: HTtickC.aiff by: hanstimm dur:
Synth('synth_mono_fs' : 1015)
now playing...[2]: id: 100040 name: saz_hyena.wav by: soundbytez
Synth('synth_mono_fs' : 1016)
Play backwards <<

```

-localhost (127.0.0.1) 1.8|1.8 % u: 95 s: 29 g: 6 d: 296

File Edit View Selection Find Packages Help

QBRNTHSS_MIRLC.scd tidal.scd sclang://localhost:57120

```
1
2 p = "/home/rcasamajo/MIRLC2/"; // Define a patch for out data
3
4 // Hi! This is a little test of how to integrate the use of MIRLC
5 // with Tidal Cycles (the language I usually use to live coding)
6
7 a = MIRLCa.new(path: p);
8 a.tag("voice");
9 a.similar;
10 a.similarauto(0,3,10);
11 a.solo();
12 a.mute(6);
13 a.stop;
14 a.info;
15 a.play;
16 a.playauto // args: |times = 4, tempo = 30|
17
```

scratch.tidal

```
1 -- tempo
2 setcps (140/60)
3
4 hush
5
6 d2
7 -- $ sometimes (# coarse 15)
8 $ pan "0.5*12"
9 # s (slow 5 $ (segment 1 $ choose ["Fairchild808:3","glitchtoys:3","vermonaDM:3"])
10 # gain (range 0 0.85 $ slow 5 $ tri)
11 # pan (slow 2 $ (segment 1 $ rand))
12 # ...+ 1
```

~/Documents/scratch.tidal 4:5

LF UTF-8 TidalCycles GitHub Git (0) 2 updates

Collaboration with l'ull cec and Phonos in *virtual* Barcelona
Follow-up workshop: 4 special teasers in preparation
Follow-up concert with TOPLAP Barcelona (TBD)

This is the project website & blog of *MIRLCAuto: A Virtual Agent for Music Information Retrieval in Live Coding*, a project funded by the [EPSRC HDI Network Plus Grant - Art, Music, and Culture theme](#).

12. [**Different Similar Sounds: An Interview with Ramon Casamajó**](#) 04 Feb 2021 [RESEARCH](#) [INTERVIEWS](#)
[VIDEOS](#) [LIVE-CODING SESSIONS](#) [WORKSHOPS](#)
11. [**Diferents Sons Similars: Una Entrevista amb Ramon Casamajó**](#) 04 Feb 2021 [RESEARCH](#) [INTERVIEWS](#)
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10. [**Diferentes Sonidos Similares: Una Entrevista con Ramon Casamajó**](#) 04 Feb 2021 [RESEARCH](#)
[INTERVIEWS](#) [VIDEOS](#) [LIVE-CODING SESSIONS](#) [WORKSHOPS](#)
09. [**Different Similar Sounds: An Interview with Hernani Villaseñor**](#) 28 Jan 2021 [RESEARCH](#) [INTERVIEWS](#)
[VIDEOS](#) [LIVE-CODING SESSIONS](#) [WORKSHOPS](#)
08. [**Diferentes Sonidos Similares: Una Entrevista con Hernani Villaseñor**](#) 28 Jan 2021 [RESEARCH](#)
[INTERVIEWS](#) [VIDEOS](#) [LIVE-CODING SESSIONS](#) [WORKSHOPS](#)
07. [**Towards Learning My Musical Taste When Retrieving Sounds From Freesound**](#) 28 Dec 2020
[RESEARCH](#)
06. [**Welcome to Our New Collaborator: Freesound!**](#) 07 Dec 2020 [ANNOUNCEMENTS](#)
05. [**3 Online Workshops Announced!**](#) 30 Nov 2020 [ANNOUNCEMENTS](#) [WORKSHOPS](#)
04. [**Presentation at MUST5001 Aesthetics and Ideas in the Sonic Arts – November 25, 2020**](#) 25 Nov 2020 [OUTREACH](#) [PRESENTATIONS](#)
03. [**Welcome to Our New Collaborators: TOPLAP Barcelona and FluCoMa!**](#) 24 Nov 2020
[ANNOUNCEMENTS](#)
02. [**Presentation at Women in Art and Technology Meetup at NOTAM – September 21, 2020**](#) 21 Sep 2020 [OUTREACH](#) [PRESENTATIONS](#)
01. [**The MIRLCAuto project has started!**](#) 24 Jul 2020 [ANNOUNCEMENTS](#)

Similar Sounds: A Virtual Agent in Live Coding



IKLECTIK [off-site]

Collaboration with IKLECTIK in *virtual* London

Two performances and a Q&A panel with
Sam Roig (moderator), Iván Paz (panelist), Gerard Roma (panelist/performer), Anna Xambó (panelist/performer)
<https://youtu.be/ZRqNfgg1HU0>

```
35 c.fadeout
36
37 d = MIRLCa.new
38 d.lowpf
39 d.tag("gabba",5)
40 d.volume(0.25)
41 d.play(1)
42 |
43
44 e = MIRLCa.new
45 e.lowpf
46 e.tag("gabba",2)
47 e.volume(0.2)
48 e.play(1)
49
50 f = MIRLCa.new
51 f.lowpf
52 f.tag("gabba",4)
53 f.volume(0.2)
```

```
now playing...[1]: id: 9
Synth('synth_mono_fs' :
-> a MIRLCa
now playing...[0]: id: 9
Synth('synth_mono_fs' :
now playing...[1]: id: 9
Synth('synth_mono_fs' :
now playing...[2]: id:
Synth('synth_mono_fs' :
now playing...[3]: id:
Synth('synth_mono_fs' :
now playing...[4]: id: 9
Synth('synth_mono_fs' :
now playing...
Synth('synt
now playing
Synth('synt
-> a MIRLCa
-> a MIRLCa
```

IKLECTIK [off-site]

Collaboration with IKLECTIK in *virtual* London

Performance by Gerard Roma.

<https://youtu.be/ZRqNfgg1HU0>

```

2 // hydrophones
3
4 a = MIRLCa.new
5 a.tag("hydrophone+running+water")
6 a.similar
7 a.similarauto(1, 3, 10)
8 a.autochopped(20, 1)
9 a.bitcrush
10 a.bypass
11 a.fadeout(30)
12
13 b = MIRLCa.new
14 b.tag("hydrophone+running+river")
15 b.similar
16 b.autochopped(20, 1)
17 b.delay
18 b.bypass
19 b.playauto(4, 2)
20 b.fadeout(30)
21
22
23 c = MIRLCa.new
24 c.tag("hydrophone+glass+water")
25 c.similar
26 c.similarauto(0,3,10)
27 c.playauto(10,10)
28 c.reverb
29 c.fadeout(20)
30

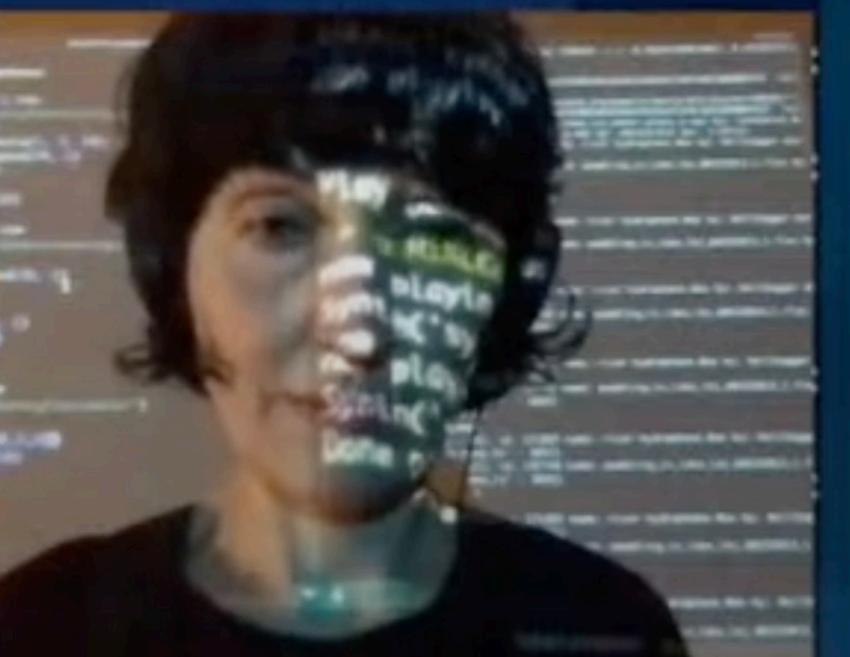
```

```

Test complete
503261
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'htt
MIRLCa: Do you like this sound?
{"id":503261,"url":"https://freesound.org/people/akester612/sounds/503261/",'
curl -H 'Authorization: Token 5a837b803eb5a6da25dd3b42346fd6550080b919' 'htt
[0]: id: 488319 name: hydrophone_mono_ice_water_glass_3.wav by: leonsptvx du
[1]: id: 503261 name: Water Bottle.wav by: akester612 dur: 5.94211
now playing...[0]: id: 271897 name: river hydrophone.Wav by: NeilSeggar dur:
Synth('synth_mono_fs' : 1031)
now playing...[1]: id: 197748 name: paddling_in_lake_lbj_08232013_1.flac by:
Synth('synth_mono_fs' : 1036)
-> a MIRLCa
-> a MIRLCa
0.2107161283493
now playing...[0]: id: 271897 name: river hydrophone.Wav by: NeilS...
Synth('synth_mono_fs' : 1031)
now playing...[1]: id: 197748 name: paddling_in_lake_lbj_08232013_...
Synth('synth_mono_fs' : 1036)
Play backwards <<
0.99745547771454
now playing...[0]: id: 271897 name: river hydrophone.Wav by: NeilS...
Synth('synth_mono_fs' : 1031)
now playing...[1]: id: 197748 name: paddling_in_lake_lbj_08232013_1.flac by:
Synth('synth_mono_fs' : 1036)
Play forwards >>
0.35729622840881
now playing...[0]: id: 271897 name: riv...
Synth('synth_mono_fs' : 1031)
now playing...[1]: id: 197748 name: pad...
Synth('synth_mono_fs' : 1036)
Play backwards <<
0.34760677814484
now playing...[0]: id: 271897 name: riv...
Synth('synth_mono_fs' : 1031)
now playing...[1]: id: 197748 name: pad...
Synth('synth_mono_fs' : 1036)
Play forwards >>
0.8658105134964

```

IKLECTIK [off-site]



Collaboration with IKLECTIK in *virtual* London

Performance by Anna Xambó.

<https://youtu.be/ZRqNfgg1HU0>

a ML model, what for?

- **Music style**
- **Music preference** (Gerard Roma)
- **Different instruments** (Hernani Villaseñor)
- **Parts in the composition** (Iván Paz)
- **Snapshots of a musical biography/life journey** (Jonathan Moss)
- ...

discussion

from workshops

- Sound-based music is not everybody's cup of tea.
- MUSIC + AI is a broad, fuzzy term, which needs to be contextualised to avoid false expectations.
- Sound-based music and live coding is a niche, but it can inform other real-time artistic activities! Remember the 3 spec levels by Bill Buxton (1997): standard spec, military spec, and artist spec.
- Working with latest technologies is a challenge for both developers and participants, but it can become a fruitful conversation.
- Seeing the participants taking ownership and adapting the tool to their needs is the best reward!

from artistic practice

- It is possible to learn from a particular “situated musical action”.
- Flexible and suitable approach for different artistic practices.
- Integration of new methods to accommodate different artistic practices.

implications for HCI

- New hybrid methodologies combining practice-based and HCI methods.
- Expand the training to other situated artistic actions, context-based models.
- The artist spec!

future work

- Improve the training and performing modes.
- Support multi-user training of a single model.
- Enabling the integration of the tool in a wider range of workflows.

thank you!!!

they are
the **robots**

<https://vimeo.com/515416972>