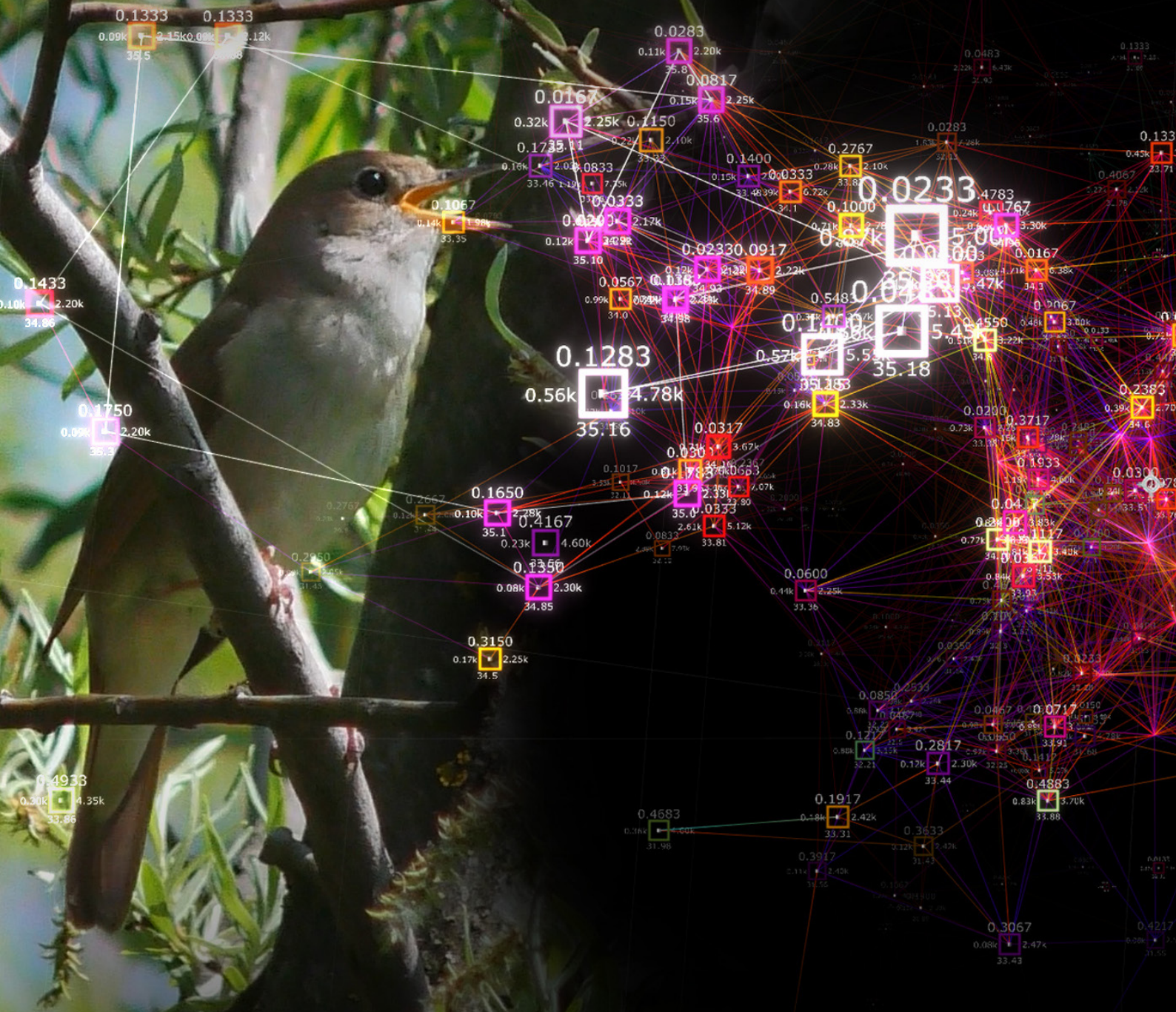


SEEING BIRDSONG



A REALTIME SYSTEM TRANSLATING
AVIAN VOCALIZATIONS INTO DYNAMIC
THREE DIMENSIONAL STRUCTURES

WHY BIRDSONG?

Birdsong is one of nature's most expressive voices.

This project began as an artistic attempt to give it **visible form**, transforming sound into **spatial structures** through early oscillator-driven experiments.

Extensive research and development evolved it into a **rigorous system of acoustic analysis**. The framework now bridges **art and science**, turning avian voices into **dynamic, data-rich structures**. It offers a new way to perceive, study, and preserve the complexity of bird vocalizations.

A blackbird is perched on a dark branch, facing right. The background is a dense thicket of green leaves. Overlaid on the image is a complex network of thin, colorful lines (red, orange, yellow, green, blue, purple) connecting various numerical data points. These points are scattered across the frame, with some appearing in small colored boxes (red, orange, yellow, green, blue, purple). The numbers are in various sizes and colors, matching the lines. The overall effect is a visualization of bird song data, with the bird itself acting as the source of the data. The text 'WHY BIRDSONG?' is written in large, white, sans-serif capital letters across the middle of the image. Below it, a paragraph of text is written in a smaller, white, sans-serif font. The text is centered and reads: 'Birdsong is one of nature's most expressive voices. This project began as an artistic attempt to give it visible form, transforming sound into spatial structures through early oscillator-driven experiments. Extensive research and development evolved it into a rigorous system of acoustic analysis. The framework now bridges art and science, turning avian voices into dynamic, data-rich structures. It offers a new way to perceive, study, and preserve the complexity of bird vocalizations.'

WHY BIRDSONG?

Birdsong is one of nature's most expressive voices.

This project began as an artistic attempt to give it **visible form**, transforming sound into **spatial structures** through early oscillator-driven experiments.

Extensive research and development evolved it into a **rigorous system of acoustic analysis**. The framework now bridges **art and science**, turning avian voices into **dynamic, data-rich structures**. It offers a new way to perceive, study, and preserve the complexity of bird vocalizations.

A blackbird is perched on a dark branch, facing right. The background is a dense thicket of green leaves. Overlaid on the image is a complex network of thin, colorful lines (red, orange, yellow, green, blue, purple) connecting various numerical data points. These points are scattered across the frame, with some appearing in small colored boxes (red, orange, yellow, green, blue, purple). The numbers are in various sizes and colors, matching the lines. The overall effect is a visualization of bird song data, with the bird itself acting as the source of the data. The text 'WHY BIRDSONG?' is written in large, white, sans-serif capital letters across the middle of the image. Below it, a paragraph of text is written in a smaller, white, sans-serif font. The text is centered and reads: 'Birdsong is one of nature's most expressive voices. This project began as an artistic attempt to give it visible form, transforming sound into spatial structures through early oscillator-driven experiments. Extensive research and development evolved it into a rigorous system of acoustic analysis. The framework now bridges art and science, turning avian voices into dynamic, data-rich structures. It offers a new way to perceive, study, and preserve the complexity of bird vocalizations.'

WHY BIRDSONG?

Birdsong is one of nature's most expressive voices.

This project began as an artistic attempt to give it **visible form**, transforming sound into **spatial structures** through early oscillator-driven experiments.

Extensive research and development evolved it into a **rigorous system of acoustic analysis**. The framework now bridges **art and science**, turning avian voices into **dynamic, data-rich structures**. It offers a new way to perceive, study, and preserve the complexity of bird vocalizations.

A blackbird is perched on a dark, textured branch, facing right. The background is a dense thicket of green leaves, some of which are brightly lit by sunlight, creating a dappled light effect. Overlaid on the entire image is a complex, semi-transparent network of lines and numerical data points. The lines are primarily red and orange, with some purple and blue lines. The numerical data points are small, multi-colored squares (red, orange, purple, blue) containing numbers. These numbers are often followed by 'k' or 'Hz', suggesting frequency or amplitude measurements. The network of lines and points is most concentrated around the bird and the branch, with some lines extending into the background foliage. The overall effect is a visual representation of bird song data, where the bird's position and the surrounding environment are mapped with acoustic information.

WHY BIRDSONG?

Birdsong is one of nature's most expressive voices.

This project began as an artistic attempt to give it **visible form**, transforming sound into **spatial structures** through early oscillator-driven experiments.

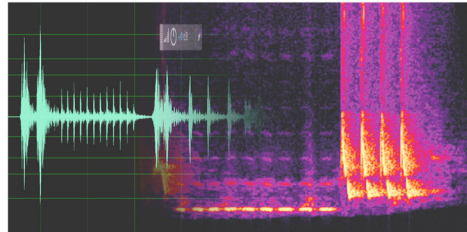
Extensive research and development evolved it into a **rigorous system of acoustic analysis**. The framework now bridges **art and science**, turning avian voices into **dynamic, data-rich structures**. It offers a new way to perceive, study, and preserve the complexity of bird vocalizations.

PROCESS WORKFLOW

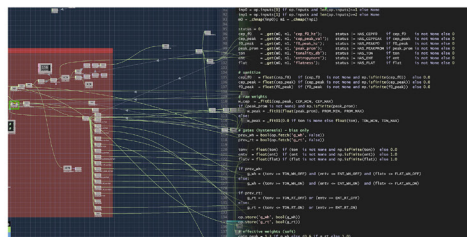
1. Audio Input
(field recordings, live mic, archives)



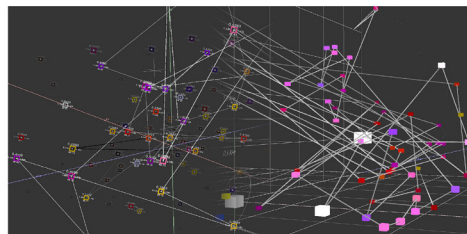
2. Preprocessing
(denoise, dereverb, signal isolation)



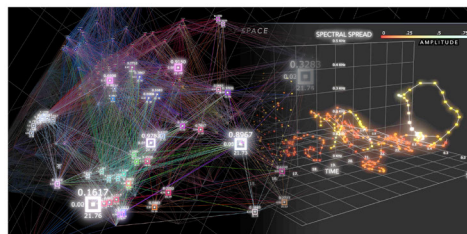
3. Feature Extraction
(spectral descriptors, MFCC, modulation)



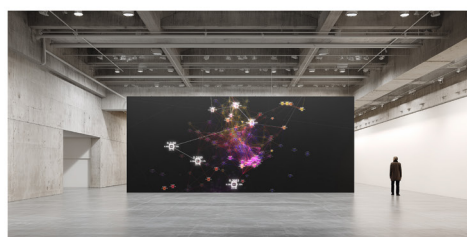
4. Data Mapping
(geometry, motion, color)



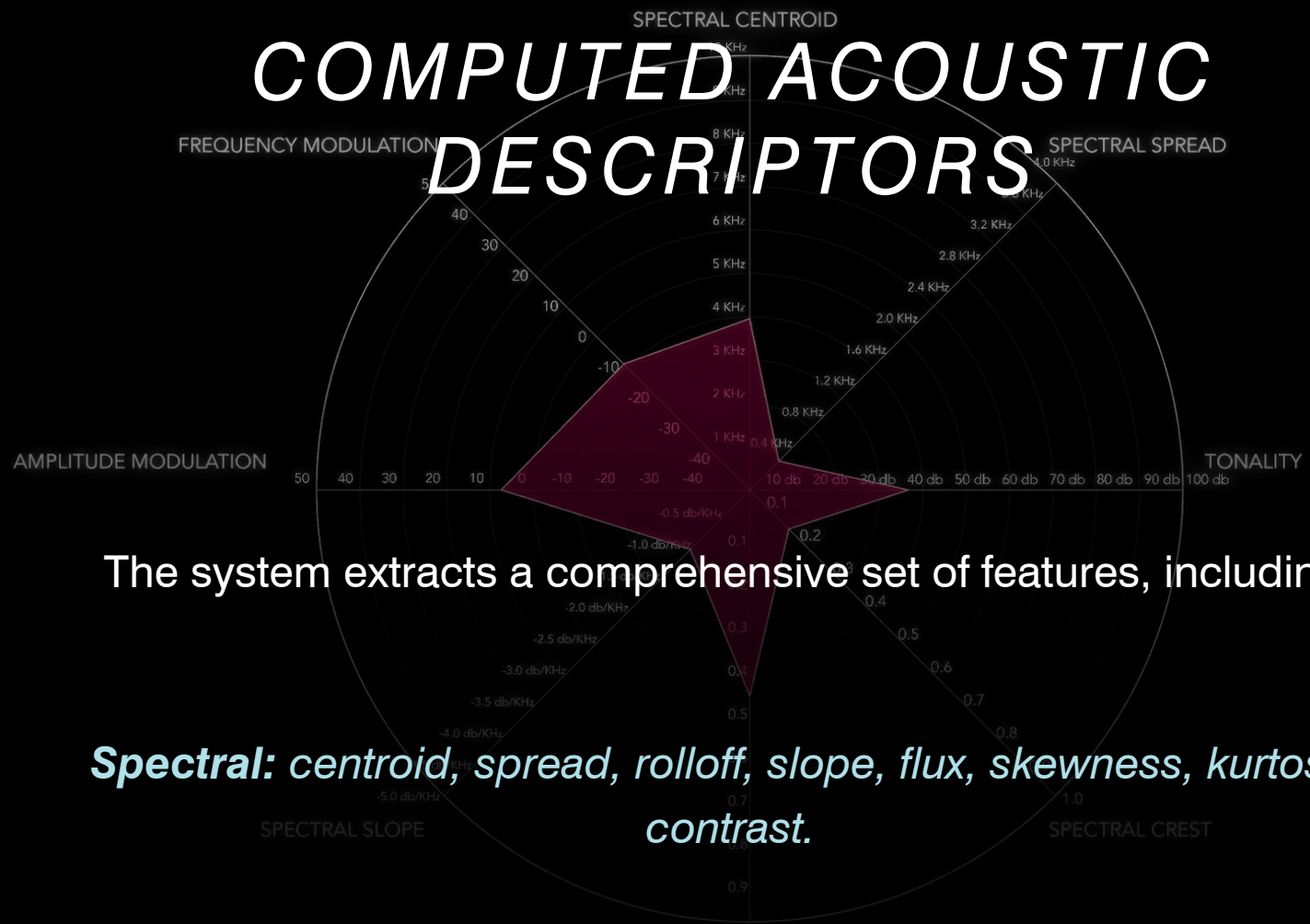
5. Visual Output
(realtime sculptures, graphs, stills, interactive)



6. Applications
(research, education, art)



COMPUTED ACOUSTIC DESCRIPTORS



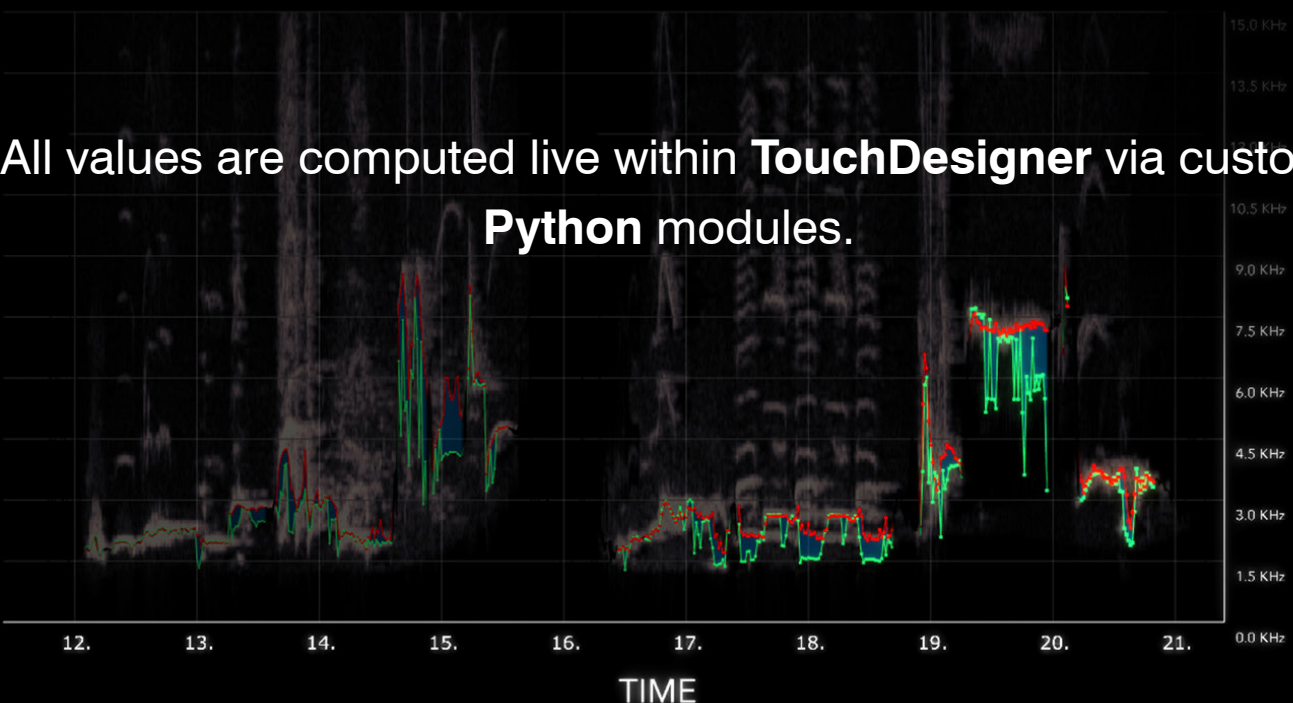
The system extracts a comprehensive set of features, including:

Spectral: centroid, spread, rolloff, slope, flux, skewness, kurtosis, contrast.

Cepstral: 40 Mel-Frequency Cepstral Coefficients (MFCCs).

Energy/Amplitude: RMS energy, crest, flatness, tonality.

Temporal/Modulation: onset/offset, amplitude and frequency modulation.



All values are computed live within **TouchDesigner** via custom **Python** modules.

COMPUTED 3D MODELS

The project employs two main 3D models: one **generative**, one **analytical**. Each one can be configured to highlight different acoustic relationships.

Audio-Driven Oscillators

A visual model translating **envelope, pitch, and spectral features** into **spatial shapes**.

Developed aside from formal analysis, it conveys **structure at a glance** and **supports live performance**.

PCA Acoustic Manifold

A mathematical model: **40 MFCCs** reduced into 3D space via **Principal Component Analysis**.

Each point represents a time slice; distances reflect timbral similarity; trajectories show vocal evolution.

APPLICATIONS

Scientific

Visual complement to traditional **bioacoustic analysis**.

Teaching and **outreach** tool for
students and the **public**.

A **novel way** to archive and compare bird vocalizations.

Artistic

Generative sculptures and **audiovisual installations**.

Museum and **gallery exhibitions**.

Aesthetic exploration of the hidden structures of sound.

For collaborations or inquiries:

contact@lucioarese.net



www.lucioarese.net