MIRAGE: A Comprehensive AI-Based System for Advanced Music Analysis

- ☐ to improve **computers**' capability to listen to and understand music
- ☐ to conceive technologies to facilitate music understanding & appreciation
- ☐ to make music more accessible and engaging

Rich and detailed description of music?

Objectives: **Automatic** music analysis? **Objective**, **formalised** music analysis?

Previous works:

- from musicology and linguistics: semiotics (Nattiez), structuralism (Ruwet), …
- formalised music cognition: Lerdahl & Jackendoff's GTTM, …
- **computational** approaches: **Music Information Retrieval (MIR)**

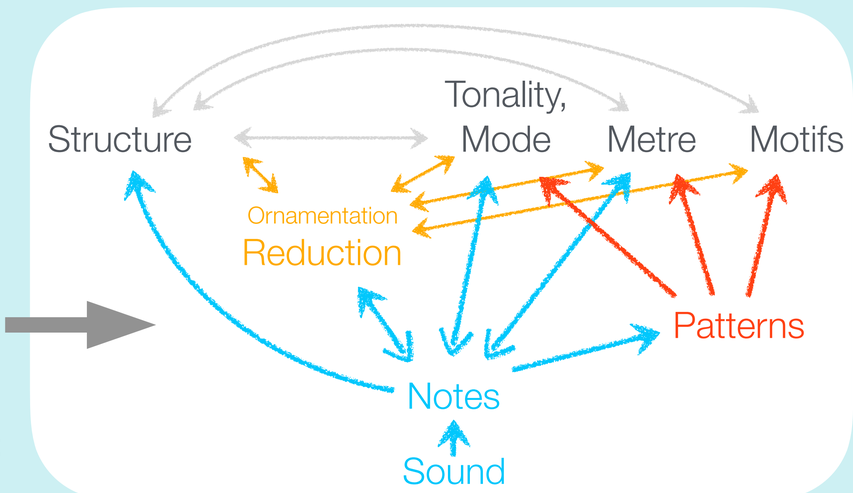
But very limited progress so far, hardly meeting musicology's needs. A large and significant part of the logic of the musical language remains out of reach.

Proposed solution: a more elaborate modelling of music in the form of a **complex system** featuring a large amount of **interdependencies** between facets that are traditionally considered separately.

An answer to theoretical musicological problems, related to the formalisation of music analysis.

Establishment of the computational model and test on a large corpus of music from various genres: classical, popular, traditional folk (from various cultures), contemporary, electro-acoustic, jazz, …

Establishment of international musicology and ethnomusicology boards collaborating on the project.



Comprehensive Model for Music Analysis

New perspectives for **musicology**

through a close dialog with musicologists.

Maximising the informativeness of music visualisation
Offering a maximum amount of information, but as intuitive as possible. Interactive interface, where the degree of complexity of the representation should adapt to the progressively increasing degree of expertise of the musicologist in understanding these new formalisms. Visualising whole corpora, by projecting the pieces into spaces, each piece represented in a condensed form. The objective is to enable to grasp in the quickest possible way the content and structure of the whole corpus.

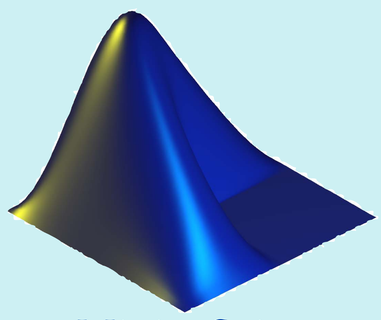
Retrieval technology tailored to musicological queries
Automatically find particular pieces of music based on particular requests from the musicologists: a theme, musical characteristic, …

Unveiling music intertextuality
Automatically detect interesting correspondences between pieces of music in a given catalogue, in an unsupervised way. Detect citations, imitations and other phenomena of **mimicry** that plays a core role in the constitution of music **styles**. One application is to detect in the Norwegian folk music database melodies that relate to same families or same old religious songs.

Application in particular to the Norwegian folk music database, **in collaboration with the National Library of Norway**.

Theoretical and practical impact on **music cognition**

Computational blueprints for cognitive models
The computational model forms a complex system of interdependent modules. Each module is composed of a set of heuristics designed to be as simple as possible, yet presenting a behaviour mimicking as closely as possible the way listeners would tend to understand music. As such, the whole framework can offer interesting insights about computational possibilities and requirements underlying a cognitive modelling of music understanding.



Application to music cognition research
Extending further the momentum gathered by our previous software ***MIRtoolbox*** in the domain of music cognition, the new computational framework for music analysis will be fully integrated in our new open source toolbox ***MiningSuite***.
Application: enriching **predictive models** formalising the **relationships between musical characteristics and their impact in listeners' appreciation of music**. Will be considered in particular music **shape** and **mental images**, **groove**, **emotions**, musical **form**.

In collaboration and close interaction with researchers at RITMO, in Norway and abroad.

Technological and **societal** repercussions

Valorisation of online music catalogue
As a continuation to the ***SoundTracer*** project, we will prototype apps to browse into the Norwegian folk music catalogue, understand the characteristics of the different music recordings, interactively search for particular musical characteristics and get personalised recommendations based on the music you listen and like.

Impact to the general public
Interactive, intuitive video animations to **better understand how music works and appreciate the richness of music more deeply**. Complementing traditional music critique or music videos. Visualisations published in mainstream music or technology magazines, showcased in concert, art projects, … Apps for smartphones, tablets, PCs and TVs, showcase websites, …

Music therapy tools
Among others, we will extend further our ***Music Therapy ToolBox (MTTB)***, dedicated to the analysis of free improvisations between therapists and clients.

Unveiling important parts of the **cultural heritage** currently largely unknown to the public, due to apparent **lack of accessibility** (technically and cognitively speaking). E.g., Norwegian traditional folk music and **art music** from the 20th and 21st centuries. Answering the problem of **compartmentalisation of musical tastes** as well as **standardisation** towards most popular trends, thus fostering a boost of the "**biodiversity**" of music consumption.

UiO : RITMO
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Principal Investigator: Olivier Lartillot