USC | IMSC

Music Information Processing

IMSC graduate student: **Yun-Ching Chen** IMSC undergraduate students: **Joann Emmanuel, Aaron Yang**

faculty: **Elaine Chew**

Research Goal

Systematic study of music, *""the art of arranging sounds in time so as to produce a continuous, unified, and evocative composition, as through melody, harmony, rhythm, and timbre",* using the computational resources available to us today.

Role in IMSC

a link between three Vision Areas: Entertainment, Communication and Education. **a cross-disciplinary effort** reaching across four Research Areas: Information Management, User-Centered Sciences, Sensory Interfaces and Media Communication.

Uniqueness and Research Approach

The Spiral Array Model (Chew, 2000) offers multiple ways to visualize music streams as trajectories or transformations in 3D space; and provides an effective tool for seeing and quantifying what we hear when we listen to music.

Accomplishments

Music Engineering Lab (PHE330), founded 2002.

New Course: Engineering Approaches to Music Perception and Cogniion (ISE599)

Lecture: "*Music Appreciation for Computers*", a Sigma Xi Lecture, General Motors Research, Detroit, MI.

Demonstrations: MuSA, MuSA.RT

Award: Expression Synthesis Project presented by Aaron Yang: Best paper award, 7th Annual IMSC Student Conference.

Publications

Chew, Elaine & Alexandre François (2003). ***Real-Time Music Information Processing.*** In Proceedings of the 31st International Conference for Computers and Industrial Engineering, San Francisco, CA.

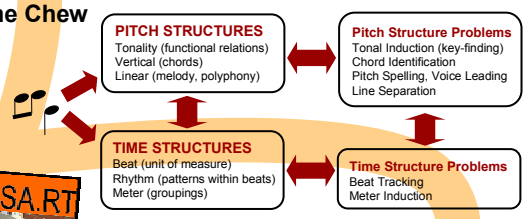
Chew, Elaine & Chen, Yun-ching (2003). *Mapping MIDI to the Spiral Array: Disambiguating Pitch Spellings.* In H. K. Bhargava and Nong Ye, eds., Computational Modeling and Problem Solving in the Networked World, Kluwer, pp.259-275. Proceedings of the 8th INFORMS Computer Society Conference, Chandler, AZ.

Chew, Elaine (2002). *Music Information Processing: a new application for Operations Researchers.* In the Winter 2002 issue of AIROnews, the official newsletter of the Associazione Italiana di Ricerca Operativa (AIRO), pp.9-14.

Chew, Elaine (2002). *The Spiral Array: An Algorithm for Determining Key Boundaries.* In C. Anagnostopoulou, M. Ferrand, A. Smaill (Eds.): *Music and Artificial Intelligence* - Proceedings of the Second International Conference on Music and Artificial Intelligence, Edinburgh, Scotland, UK. Springer LNCS/LNAI #2445, pp.18-31.

Related Work: can be found at …

Austrian Research Institute for Artificial Intelligence
Ctr for Computer-Assisted Res in the Humanities, Stanford University
Music, Informatice and Cognition Group, University of Edinburgh
MusEn Project, University of Michigan
Music, Mind & Machine Group, Amsterdam
Rencon, performance rendering piano contest, Japan

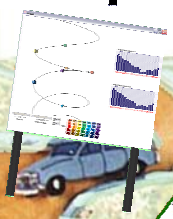


Five Year Plan : continuing research in …

MuSA.RT – Music on the Spiral Array . Real Time

Co-PI: Alexandre François

An interactive environment for content-based music visualization. MIDI output from a live performance is mapped to the Spiral Array model, revealing important pitch, chord and key structures. The user can also navigate through the Spiral Array space using a gaming device. The software was implemented using SAI.



MuSA and pitch spelling

Student: Yun-Ching Chen

Pitch spelling is a fundamental problem in any music transcription and analysis system. Pitch names are assigned using nearest neighbor search on the Spiral Array Model.

Re-inventing Bach

Student: Arpi Mardirossian

Computer-generated music using triangular transformations on the Harmonic Network. Neighboring triangles and duration patterns are selected.

Chord Recognition

Student: Xumei Tan

Chord recognition algorithm utilizing a voting method using the Harmonic Network and weights from the Spiral Array Model. No knowledge of metric structure required.

Similarity Assessment

Students: Arpi Mardirossian and Joann Emmanuel

Summarization and comparison of longterm and short-term tonal patterns using Euclidean metrics inside the Spiral Array. A test set is Mozart's *"Ah! Vous dirai-je, Maman"* (Twinkle Twinkle Little Star) piano variations.

VoSA – Voice Separation Analyzer

Student: Phillip Wu

Many algorithms for music comparison and retrieval use monophonic information. This project aims to separate polyphonic MIDI files into their component voices. The GUI allows the user to visualize and analyze results.

Classification of Hindustani Music

Student: Shivani Yardi

Classification of parent classes for north Indian raags and mapping of raag melodies to their parent class. Generative models are developed for improvization in Hindustani music.

ESP – Expression Synthesis Project

Students: Yun-Ching Chen and Aaron Yang

Almost anyone can drive a car, but not everyone can play an instrument. Musical expression is the result of speed, dynamics and articulation. We create a driving interface for controlling speed and generating expression consistent with musical structure. Implemented using SAI.