Introduction: about Music Information Retrieval

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關於本課程

- 課程名稱：音樂資訊檢索(music information retrieval)
- 課程內容：包含但不限於音樂資訊檢索，盡量涵括一切與音樂有關的資訊技術
- 新興學科「音樂資訊檢索」的定義：a multidisciplinary research endeavor that strives to develop innovative content-based searching schemes, novel interfaces, and evolving networked delivery mechanisms in an effort to make the world's vast store of music accessible to all (Stephen Downie, 2004)
- 這個定義目前還在改變中 (例如：自動音樂生成在近幾年的發展)

課程核心

- Briefly speaking: music AI
  - Music + {data science/AI/machine learning/deep learning…}
- Robert Rowe (2001): computer musicianship
  - 讓機器具備如音樂家一般「理解音樂」的能力
- 哪些理解音樂的能力？
  - 聽力(聆賞者)：分辨音色、音高聽力、自動採譜
  - 跟隨(演出者)：跟譜、自動伴奏
  - 創作(作曲者)：自動作曲、自動編曲
  - 論斷(評論者)：評分、修正

Why music?

- Music as a subject of artificial intelligence research – just fantastic!

- Digital music market is growing rapidly

- Music is a critical topic of interdisciplinary well-being research

- Music AI has become the arena of the world-leading AI companies
  - Google Magenta, Facebook AI Research, Tencent Music, …

Pattern recognition in music

- An example: "semantic segmentation" in music

- Music signal -> spectrogram

- Why audio is hard?

  - Harmonics

  - Time-frequency uncertainty

  - Overlapped components

- The importance of data representation
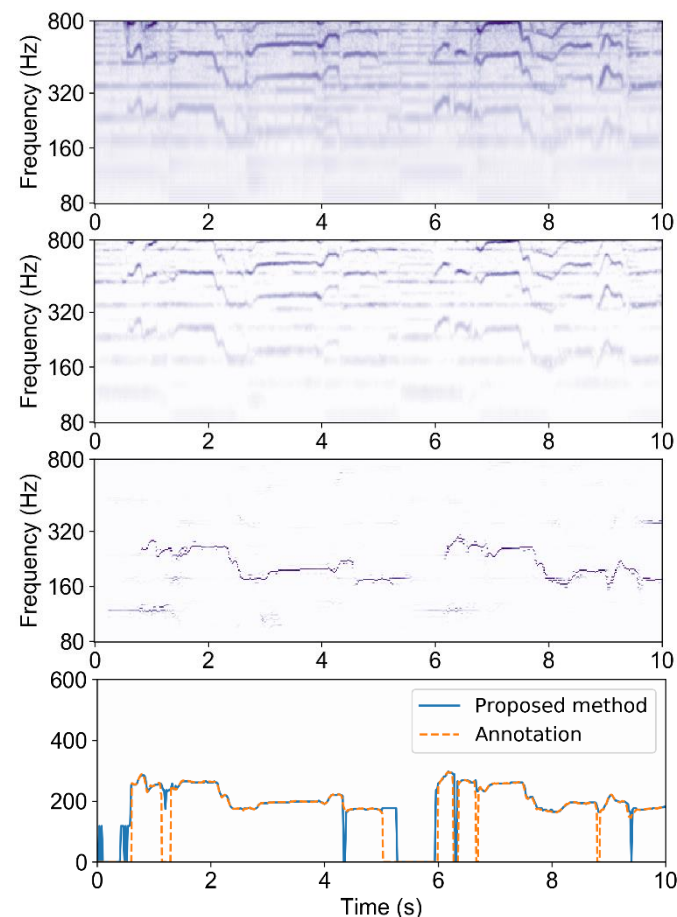
Music generation and interaction

- Online streaming and music recommendation

- Virtual singer

- Automatic page turner

- Robots that can play music

- Automatic music generation

- How to verify "good music"?

From Google


From TechNews

From Wikipedia

The cores of MIR

- You will learn a lot on the modeling process: everybody uses deep learning

- An ironic truth: since people are believing that deep learning solves everything, so the thing before and after deep learning becomes more important!

- So in this course you will learn more on:
  - How to process music data? (signal processing)
  - How to understand music data? (musicology)
  - How to evaluate the outcome? (user study)

Processing → Modeling → Evaluation
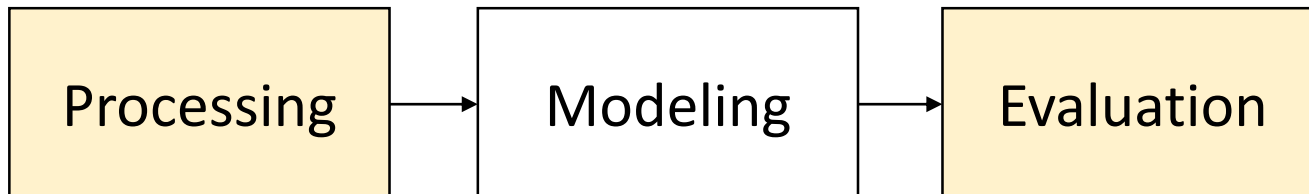
The past and the present of MIR

- As a part of music theory (before 1970)
- Computer music (1970 -)
- Music information retrieval (2000 -)
- A interdisciplinary field now
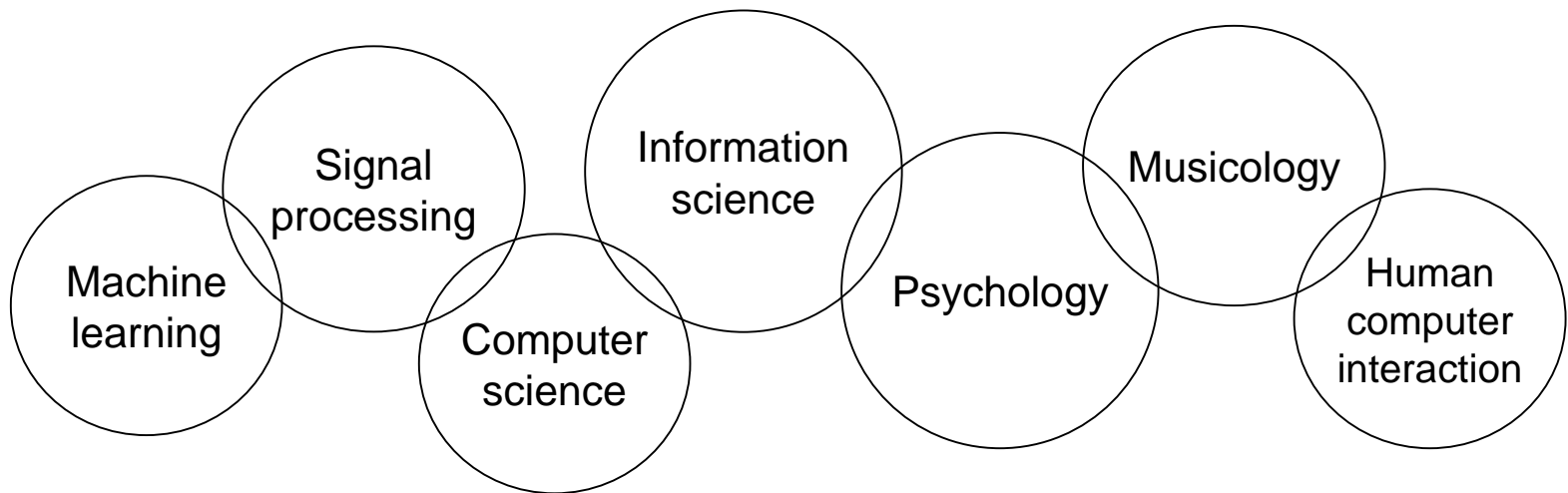
感興趣的資料

- 影像 (image)
  - 樂譜 (scoresheet)
- 符號 (symbolic data)
  - MIDI
  - MusicXML
- 聲音 (audio data)
- 影音 (video)
- 後設資料 (metadata)
  - User data

課程規劃

- 本課程規劃五大主題(假如上得完的話)
- 轉譯(transcription)：自動採譜、各種音樂辨識
- 同步(synchronization)：自動跟譜
- 辨識(recognition)：曲風、情緒等之自動辨識
- 分離(separation)：聲源分離
- 生成(generation)：聲音合成、自動作曲

Schedule (1)

Week	Date	Content	Note
1	2/19	Introduction	
2	2/26	Signal processing	
3	3/5	Pitch	
4	3/12	Pitch and harmony	
5	3/19	Symbolic data	HW1 announced
6	3/26	Machine learning	
7	4/2	Timbre	HW1 due
8	4/9	Onset, Tempo	Term project group
9	4/16	Beat, Structure	HW 2 announced

Schedule (2)

Week	Date	Content	Note
10	4/23	Alignment	
11	4/30	Applications	HW2 due
12	5/7	ICASSP (停課一次)	
13	5/14	Voice processing	HW3 announced
14	5/21	Sound synthesis	
15	5/28	Separation	
16	6/4	Generation	HW3 due
17	6/11	Open problems and discussion	
18	6/18	Term project presentation	

Introduction

- Fundamentals of music theory
- Fundamentals of signal processing
- Fundamentals of machine learning

Transcription

- Single pitch detection
- Multiple pitch detection
- Chord recognition
- Tempo estimation
- Beat tracking

Synchronization

- Audio-to-score alignment
- Automatic accompaniment
- Discussion on real-time processing

Recognition

- Timbre classification
- Genre classification
- Mood classification
- Music recommendation

Synthesis and generation

- Phase vocoder
- Source separation
- Deep generative models and music generation

Prerequisites

- Strong motivation

評分方式

- Homework 1 (30%)
- Homework 2 (30%)
- Term project (1~4 people as a group) (40%)

About the term project

- Topics
  - MUST be related to music
  - If you want to explore other areas like speech or soundscape, please incorporate them into music application
- Interdisciplinary collaboration is highly encouraged.
  - Programming skills + domain knowledge + collaboration
- Grading policy
  - Integration
  - Multimodal
  - Practicality in music industry
  - User experience
  - Demo

More about the topics of the term project

- Ways to find a good topic
  - 自訂題目
  - 指定題目: music expression/new dataset
  - 好題目不一定需要困難的技術

- On interdisciplinary collaboration
  - 跨領域合作
  - 水平整合(horizontal integration)垂直整合(vertical integration)

"New dataset" term project

- Data collection/annotation is a very important contribution

- Examples:
  - Taiwan aboriginal music pieces with transcription and annotation (ethnic groups, years)
  - Functional harmony annotation of a classical music repertoire
  - Amateur recordings with playing fault annotation or with evaluation of quality for educational purpose

Introducing music technology from technology conferences

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Why conference?

- Reading conference papers is the best way to know "what is happening" in the academic society.

- Comparing to the news reporting new technology, conference papers give you more technical information and reasoning.

- Conference papers are (usually) shorter than journal papers.

- Nowadays, most of the conference papers in the music technology society are freely accessible online.

Key word: music technology

- International Society of Music Information Retrieval Conference (ISMIR)
- Digital Audio Effects (DAFX)
- IEEE International Conference on Acoustics, Speech, and Signal Processing (ICASSP)
- European Signal Processing Conference (EUSIPCO)
- International Conference on New Interfaces for Musical Expression (NIME)
- International Community for Auditory Display (ICAD):
- International Computer Music Conference (ICMC)
- Sound and Music Computing (SMC)
- Audio Engineering Society (AES)

Music technology workshops

- Timbre 2018
- International Conference on Analytical Approaches to World Music
- International Digital Libraries for Musicology workshop
- IEEE Workshop on Applications of Signal Processing to Audio and Acoustics
- 13th International Symposium on Computer Music Multidisciplinary Research
- Workshop on Intelligent Music Production
- Conference on Computer Simulation of Musical Creativity
- Audio Mostly 2017
- Web Audio Conference
- International Workshop on Musical Metacreation
- International Symposium on Musical Acoustics
- International Workshop on Folk Music Analysis
- International Conference on Technologies for Music Notation and Representation (TENOR)

Multimedia

- ACM Multimedia (ACM MM)
- ACM ICMR
- IEEE ICME
- MMsys
- MMM

符合 "*music*" 的前 20 篇熱門文章

	文章	H5 指數	H5 中位數
1.	Psychology of Music	31	48
2.	International Society for Music Information Retrieval Conference	29	42
3.	Music Perception: An Interdisciplinary Journal	23	34
4.	Journal of Research in Music Education	19	26
5.	Music Educators Journal	18	26
6.	Journal of New Music Research	18	23
7.	International Journal of Music Education	17	24
8.	New Interfaces for Musical Expression (NIME)	17	22
9.	Nordic Journal of Music Therapy	16	20
10.	Music Education Research	15	24
11.	EURASIP Journal on Audio, Speech, and Music Processing	15	21
12.	British Journal of Music Education	15	16
13.	Computer Music Journal	13	18
14.	International Computer Music Conference (ICMC)	13	17
15.	Update: Applications of Research in Music Education	13	17
16.	Music and Medicine	12	18

Conference proceedings

- Nowadays, many conference papers are open-access online (copyright cc)

- ISMIR 2017

- https://ismir2017.smcnus.org/

- ISMIR 2018

- http://ismir2018.ircam.fr/