GCT634: Musical Applications of Machine Learning

Fall 2021 Syllabus

KAIST Graduate School of Culture Technology

Juhan Nam

Course Objective

- Understanding of machine learning with applications to the music and audio domains:
  - Music and audio classification
  - Automatic music transcription
  - Sound source separation and sound synthesis
  - Music generation

- Hand-on experiences with Python language and machine learning / deep learning libraries

- Gain experience of the full cycle of research

Class Format

- This course is served as an **100% online format** due to the campus-wide COVID-19 policy

- There are two types of online sessions
  - Pre-Recorded videos
    - Cover lecture slides
    - Uploaded weekly in KLMS
    - Students must watch the videos before the weekly Zoom meeting
  - Weekly Zoom meeting
    - Focus on review, interactive Q&A and hand-on practice
    - **Every Monday 1:00-2:15 PM**

Schedules

- Week 1
  - Course introduction: **the first lecture is served on Aug 30 (Zoom meeting)**
  - Audio representations

- Week 2
  - Audio Features
  - Unsupervised learning

- Week 3
  - Supervised learning

- Week 4
  - Introduction to Deep Learning
  - Chusuk (no class)

Schedules

- Week 5
  - Convolutional neural network (CNN)
  - Music and audio classification

- Week 6
  - Recurrent neural network (RNN)
  - Automatic music transcription

- Week 7
  - Dynamic time warping and musical applications

- Week 8
  - Break (no class)

Schedules

- Week 9
  - Auto-encoder and U-net
  - Source separation

- Week 10
  - Variational auto-encoder (VAE), Generative adversarial network (GAN)
  - WaveNet, DDSP
  - Sound synthesis

- Week 11
  - Symbolic music representation
  - Music language models using RNN
  - Music generation

Schedules

- Week 12
  - Transformer for music generation

- Week 13
  - Student project meetings

- Week 14
  - Invited talk or advanced topics (TBD)

- Week 15
  - Invited talk or advanced topics (TBD)

- Week 16
  - Final project presentations

Pre-requisite

- Linear Algebra

- Probability and Statistics

- Basic understanding of machine learning and deep learning

- Digital Signal Processing: discrete Fourier transform and Filters

- Programming Language: Python

Software

- Scikit-learn

- PyTorch

- Librosa

- And more

Grading

- Assignments: 50%

- Final project (paper review, presentation and report): 50%

Course Website

- https://mac.kaist.ac.kr/~juhan/gct634