Title: Audio spectrum and its use in music information retrieval applications
Presenter: Baris Bozkurt, Assoc. Prof. Dr., Zayed University

Lectures plan:

Lecture 1:
The first lecture of this series will begin by introducing the Music Information Retrieval (MIR) domain, its widely used applications, commonly studied research problems, and current challenges. Music data representations other than audio, such as symbolic data representations and metadata, will be presented. Resources commonly used by the research community for standardizing data access, feature extraction, and performance measurement will be reviewed and demonstrated with jupyter notebooks. This lecture will conclude by discussing the computational analysis problems involved in processing non-Western music traditions.

Lecture 2:
This lecture will first lay the foundations of spectral feature extraction by relating the audio spectrum to various components of music production. Chromagram representation and its use in various applications, such as audio alignment, key/mode detection, chord detection, and structural analysis, will be discussed. The lecture will include a hands-on coding exercise for audio-score alignment and key detection. It will conclude by reviewing the current advances and challenges in other application domains that make use of spectral features, such as genre detection and cover song identification.

Lecture 3:
This lecture focuses on the musical pitch (melody) space. The significance of mono and multi-pitch estimation problems in various applications, such as automatic music transcription and melodic pattern discovery, will be discussed. Both conventional and neural network-based pitch estimation techniques will be briefly discussed and demonstrated through a hands-on coding exercise, comparing the performances of various available tools across different types of musical signals. Additionally, the use of pitch distributions in tuning, temperament analysis, and mode detection problems will be presented and demonstrated using jupyter notebooks.

Lecture 4:
Lecture 4 is planned in two parts. The first part is dedicated to rhythm analysis, covering tasks such as onset detection, beat detection, and tempo estimation. The second part will focus on the automatic assessment of student performances of musical exercises, which are widely used in music education technologies. Two dimensions of the assessment problem will be considered: the assessment of rhythmic pattern repetition performance and the assessment of melody repetition performance.