Presentation link: https://drive.google.com/file/d/12mh3gmz5vnLhPdxGqy5b8ZZDXMrtG130/view?usp=sharing

Presentation Summary

In many disciplines of science and engineering, Fourier transform has long been a principal analytical technique in the analysis of linear time-invariant systems. The essence of the Fourier transforms of a wave- form (a periodic function defined from −∞ to ∞) is to decompose the waveform into a sum of sinusoids in different frequencies. This essence allows us to analyze the frequency components of signals. So, it is capable of solving a wide range of problems.

The process of decomposing the signal can be applied to audio signal processing and image processing, which are two major topics in many engineering disciplines, including computer science and electrical engineering. Digital recording of sound is a discrete process of data acquisition. So, using discrete Fourier transform (DFT), the input sound can be decomposed to a sum of sine functions, such that each sine function represents one frequency. Fast Fourier transform, a faster algorithm for DFT, is widely used in audio signal processing (i.e., decoding and filtering sound clips). Fourier transform is also used in image processing. The grayscale of the pixels of an image is discrete data input. So, Fourier transform can decompose different components of the image to a sum of 2-dimensional sine waves. This technique allows us to filter an image or to increase the quality of an image (i.e., reducing the noise). The most recent sparse Fourier transform (SFT) addresses the big data setting by computing a compressed Fourier transform using only a subset of the input data, in time smaller than the data set size.