1. **Introduction**

Audio data analysis is a fascinating field that delves into the intricate world of sound, transforming raw acoustic signals into meaningful insights. From speech recognition and music information retrieval to environmental sound monitoring and medical diagnostics, the ability to effectively analyse audio is crucial across numerous disciplines. At its core, audio data exists as a wave signal, a continuous representation of pressure variations over time. However, directly interpreting complex wave signals can be challenging due to their inherent temporal nature.

To unlock the rich information embedded within these signals, a powerful set of mathematical tools known as the Fourier Transform and its various derivatives come into play. The fundamental idea behind the Fourier Transform is to decompose a signal from its time-domain representation into its constituent frequencies, revealing the underlying spectral components that define the sound. This transformation allows us to understand not just when a sound occurs, but also what frequencies are present and at what intensity.

This introduction will explore the foundational concepts of audio data analysis, focusing on the characteristics of wave signals and the indispensable role of the Fourier Transform family, including the Fast Fourier Transform (FFT) and the Short-Time Fourier Transform (STFT). By understanding how these techniques allow us to transition between the time and frequency domains, we can effectively extract features, identify patterns, and ultimately gain a deeper comprehension of the complex auditory world around us.

* 1. *Literature review*

This is the part for literature review

**References**