**Introduction:**

The sync.py script is used to synchronize multiple videos based on the detection of claps sequences within their audio tracks. Users should perform 3 loud claps to indicate where the video begins and where the video ends, as the script synchronizes videos by trimming them based on clap detection.

**Imports:**

* We import matplotlib.pyplot to plot visualizations of audio waveforms, enabling users to know whether their clap was detected or whether background noise is too loud.
* We import librosa.display to detect key audio features and metrics from our audio files. This is used to display the audio waveforms onto the graph for debugging purposes.
* We import numpy manipulate and perform complex operations on multi-dimensional arrays. This is used to set and calculate thresholds, finding audio peaks, and calculate time differences between claps.
* We import ffmpeg handle video and audio processing tasks. This is used to extract audio from input videos and trim videos based on clap detection times.
* We import os to interact the files within the operating system and manage directory and file paths.

**Functions:**

The **extract\_audio** method utilizes ffmpeg to extract audio from an input video and save it as a separate file.

The **detect\_valid\_claps** method detects valid clap sequences of three in the audio file and returns the time range between the first and last detected claps.

* First, we load the audio file and return the audio time and sample rate. We then apply a high-pass filter to the audio signal to emphasize the waveforms of claps, which increase the accuracy of sound detections. Next, we compute the ‘onset\_env’ array to represent the strength of sudden changes in energy over time, thus detecting claps or sharp sounds within the audio. We use this to calculate a threshold to identify significant onsets by multiplying a threshold factor (which can be adjusted) by the maximum onset, at which only soundwaves above this threshold are considered potential claps. We then find all frames where the onset strength exceeds the threshold value and find their times. We identify and consider sequences of three consecutive claps that occur each within half a second as valid clap sequence. We only consider sequence of three so that are used so that outside noise is not detected as a false clap. If less than two sequence are detected, then an error is returned, otherwise we use the first clap of the first triplet and last clap of the last triplet and return their times.
* This function also plots the audio waveforms over time and the threshold for debugging. It informs the user whether their claps were detected or whether outside noise was detected and considered claps.

The **sync\_videos** method performs synchronization by trimming the input videos based on their valid clap detection times.

* The script calls the extract\_audio function and detect\_valid\_claps function to extract the audio and detect valid clap sequences. If valid claps are detected, this range determines the start and end times to trim each video. It specifies the file in which the synchronized videos will be saved.