Analysis of 2000s Hit Songs

Why this experiment was done?

To analyze the sonic characteristics of the 2000s decade to understand what contributed to its distinct sound. There were several advancements taking place such as the using DAWs for end-to-end productions and loudness war. By extracting a few features, the experiment is aimed at uncovering those patterns.

About The Experiment -

Using Librosa, the following features were extracted –

1. *Key* – although there is not direct function to detect the key of a song, using the Chroma Features and thereby identifying the dominant Chroma we are able to estimate the key of the song. The distinction between minor and major is made by mapping the strongest frequency to its key.
2. *Root Mean Square Energy* – Helps in detecting how loud/quite a song is. This is detected using the rms feature present in the library.
3. *Dynamic Range* – this is again done using the rms feature.
4. *Spectral Centroid* – Represents where most of the energy is concentrated (in terms of frequencies). This was done using the spectral_centroid function.
5. *Spectral Bandwidth* – Represents the difference between highest and lowest frequencies

Once all the datapoints were in place, I analyzed each metric by taking the average.

Dataset Used –

Consists of top 10 hits of each year from 2000 to 2010 based on the commercial success and the cultural impact they've had. Since all these songs are copyrighted, these were used for only personal experimentation purposes.

Observations & Learnings –

1. **Key**
   Key detection using Chroma features was not very accurate as Chroma features only capture the harmonic content. A more accurate method could be used to determine the scale. Improvements could be made by integrating machine learning models for better accuracy.

2. **Root Mean Square Energy**
   The average RMSE value was found to be 0.20 which is said to be moderately loud. RMSE gives us a picture of the loudness as well dynamics of a song. The 2000s decade saw the explosion of the "loudness war"

3. **Dynamic Range**
   To measure Dynamic Range, min and max values were initially used but I ran into an issue of taking outliers into consideration which gave wrong results, hence after a lot of trial and error, the 90th and 10th percentiles were taken into consideration and the results obtained were compared to the values obtained using an industrial standard metering plugin (Youlean Loudness Meter)
   It can be observed that the average Dynamic Range is 12dB with 35% of all the songs having

dynamic range of less than 11dB which shows that many mixes were optimized for loudness.

4. **Spectral Centroid**
The average value of spectral centroid turned out to be **2400Hz**, which shows that the songs produced were high energy productions which aligns with the advent of genres such as Pop Rock and Electronic music.

5. **Spectral Bandwidth**
The average value of the spectral bandwidth throughout the decade, is **2500Hz** which shows that spread of frequencies is balanced.

Conclusion
1. Through this experiment we get to understand certain sonic characteristics of how music was produced in the 2000s. A comparison could be made with music from 1990s and 2010s to understand the change in sound that has occurred. Another learning is getting to know the functionalities in Librosa and the limitations; using alternate functions/libraries is something to focus on in the future.
2. Beyond this, using the above discussed characteristics and more such parameters, we can aim to setup a genre classification system.