Music Information Retrieval Past, Present and Future

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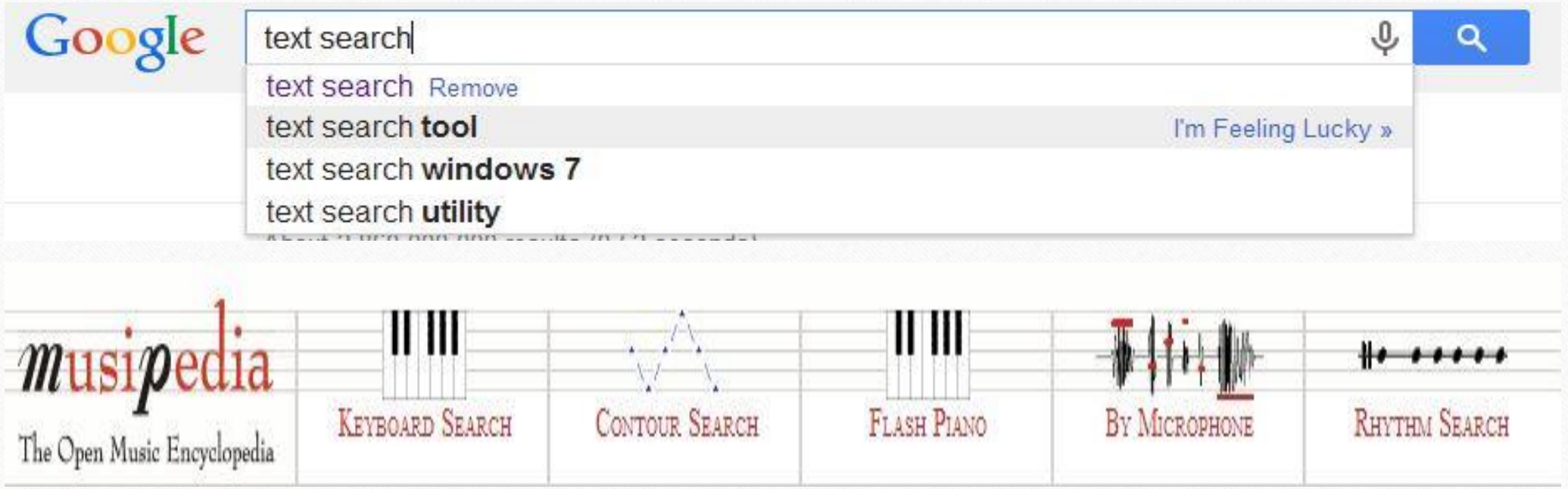
When did all this start?

- The term music information retrieval was heard in 1960's.
- MIR research was first started by various universities in early 1990's.
- The first international conference was started in 2000, ISMIR by Stephen Downie, Donald Byrd, Simon Dixon.

What is MIR?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Initial works in MIR

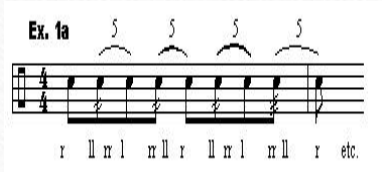
- Text Based
  - A meta-data of music.
  - Categories for describing music.
  - Artist information, Album information, genre, album title, artist title.
  - Any text based retrieval approaches can then be used.

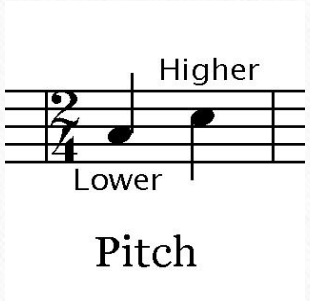
Current work in MIR

- Text based features are still in use.
- Research focus has moved on to finding similarity between music files.
- Difficult as music files have variety of features.
- Recommendations systems that are suggestion based are gaining interests.

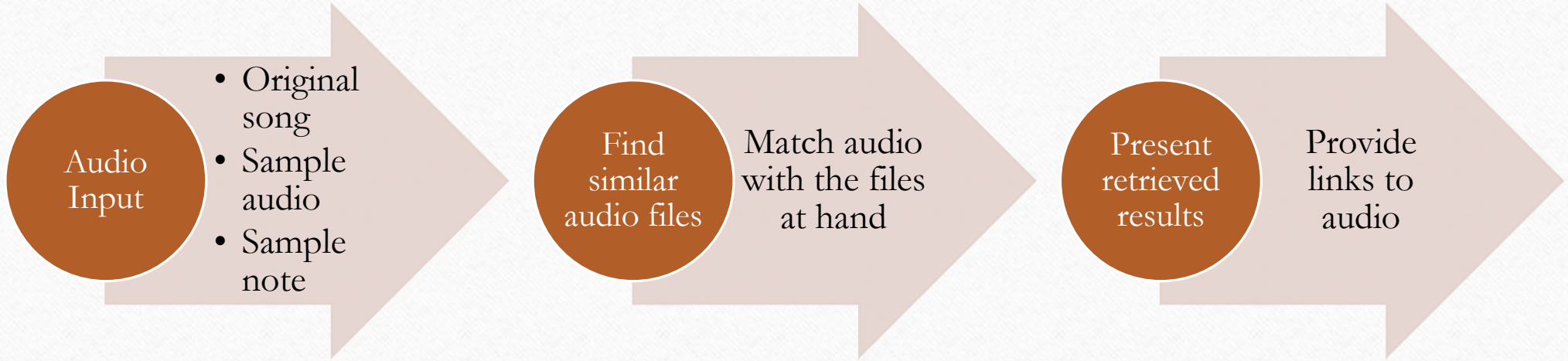
How is it done?

- Content Based
  - More difficult than the text based.
  - Collection of raw audio files.
  - Pre process the data by extraction of pitch, melody, rhythm.





Query Process



How to find similar audio files?

- Monophonic tunes are easier to compare than polyphonic tunes
- Monophonic tunes have only single pitch. Audio feature extraction becomes easier.
- Polyphonic tunes have multiple pitches and thus comparing becomes difficult.

Similarity music files

- Feature vector formation. Similar to vector formation in text documents.
- Audio extraction uses digital signal processing techniques.
- Each track is represented as Mel Frequency Cepstral Coefficients (MFCCs)
- MFCC's are obtained as a result of FFT, DCT techniques.
- Songs are represented as MFCC's in the feature dimension.
- Dimension reduction is done to match only specific features.
- Importance of a feature is calculated by chi-square test.
- When a new track is presented, a proximity feature is used to find similar tracks.

Common features

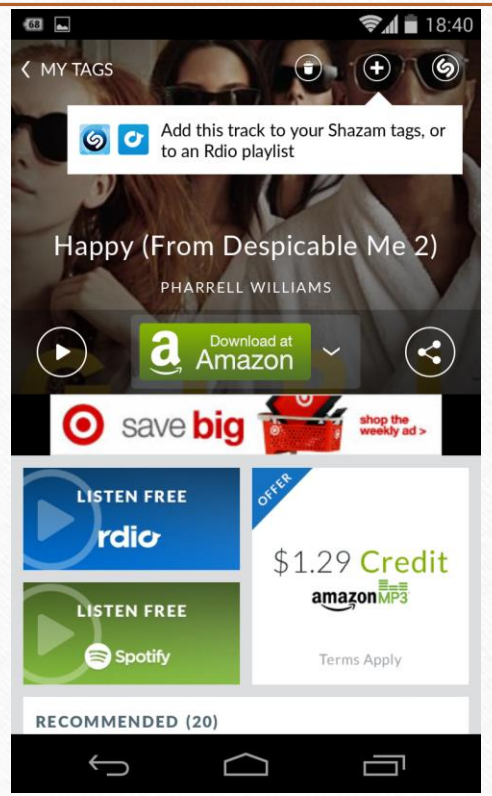
- Frequency, time, pitch (Also as intensity) are the most common features.
- Sometimes, temporal factors are ignored to find similarity.
- If an exact match is to be obtained, temporal features become crucial.

The problem

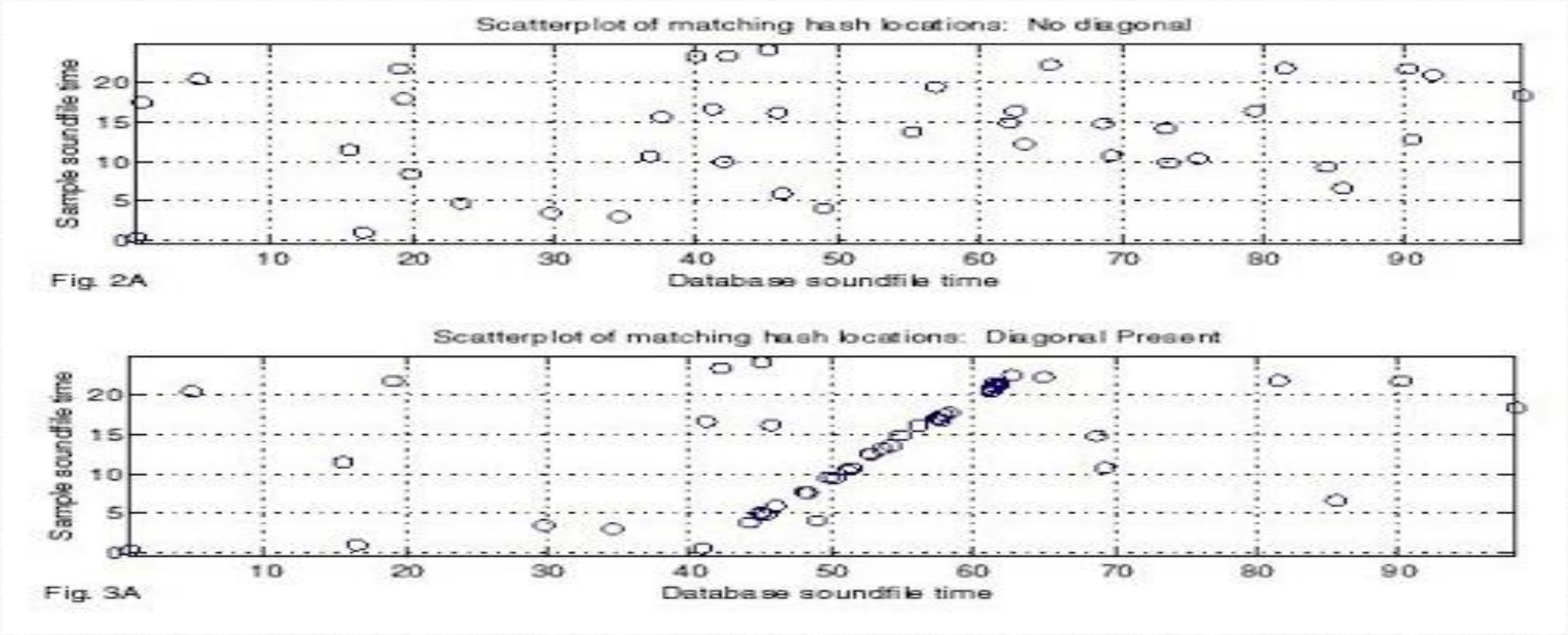
- Easier said than done.
- Humans can easily identify tunes, pitch, rhythm, beats.
- Songs evoke emotions.
- Integrating the features together in an almost perfect way is an ongoing research in MIR.
- There is no clear definition yet for polyphonic sounds.

An Example

- Shazam – Phone based music identification service.
- Identifies songs based on audio samples.
- Uses acoustic fingerprinting to find similarity between songs

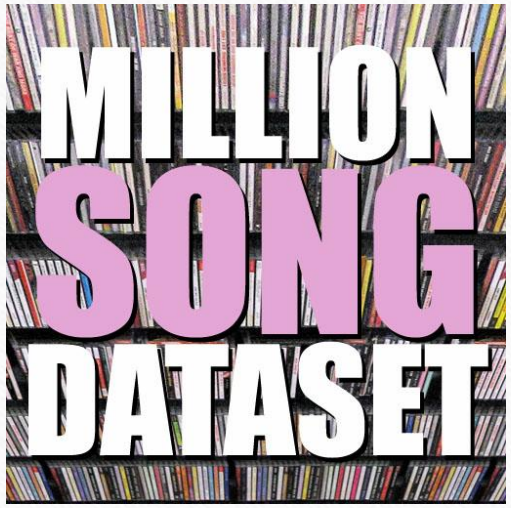


Fingerprint comparison



Applications of MIR

Few available databases



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last.fm

Future Work

- Good Recommender Systems are yet to come by.
- Extraction of polyphonic audio pitches.
- Providing similar audio files based on social media.

References

[1] Casey, M.: Audio Tools for Music Discovery. [http://www.methodsnetwork.ac.uk/redist/pdf/casey.pdf]

[2] Problems of Music Information Retrieval in the Real World, Donald Byrd University of Massachusetts Amherst

[3] An Industrial-Strength Audio Search Algorithm, Avery Li-Chun Wang, Shazam Entertainment, Ltd.

[4] Cheng Yang, "MACS: Music Audio Characteristic Sequence Indexing For Similarity Retrieval", in IEEE Workshop on Applications of Signal Processing to Audio and Acoustics, 2001

[5] Can Humans Benefit from Music Information Retrieval? Frans Wiering

[6] Million Song Dataset, Proceedings of the 12th International conference on music information retrieval, 2011