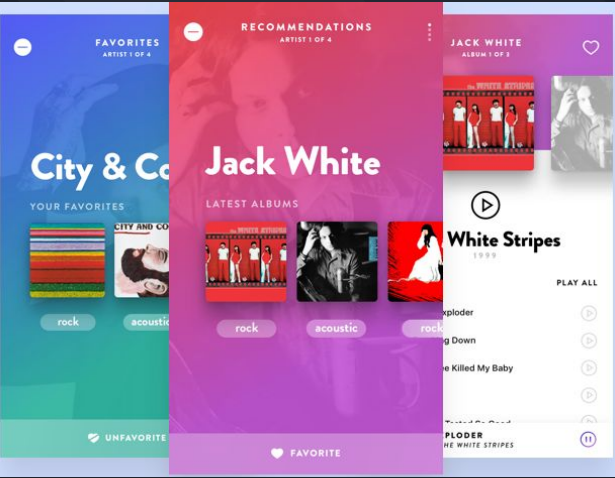# Music Recommender System

ISI Delhi Summer Internship 2020 Project

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Problem Statement and Objective

- To develop a (Smart) Music Recommender System which (may or may not) uses User Preferences (like history of songs user has listened to, the listening count / implicit rating of the song by the user) and based on these preferences of User, Recommends him/ her the best possible list of Songs which he/she might be interested in.
- Even if User doesn't provide any Preferences, then also, our Music Recommender System should be able to recommend him/her relevant songs and this is what makes it Smart.
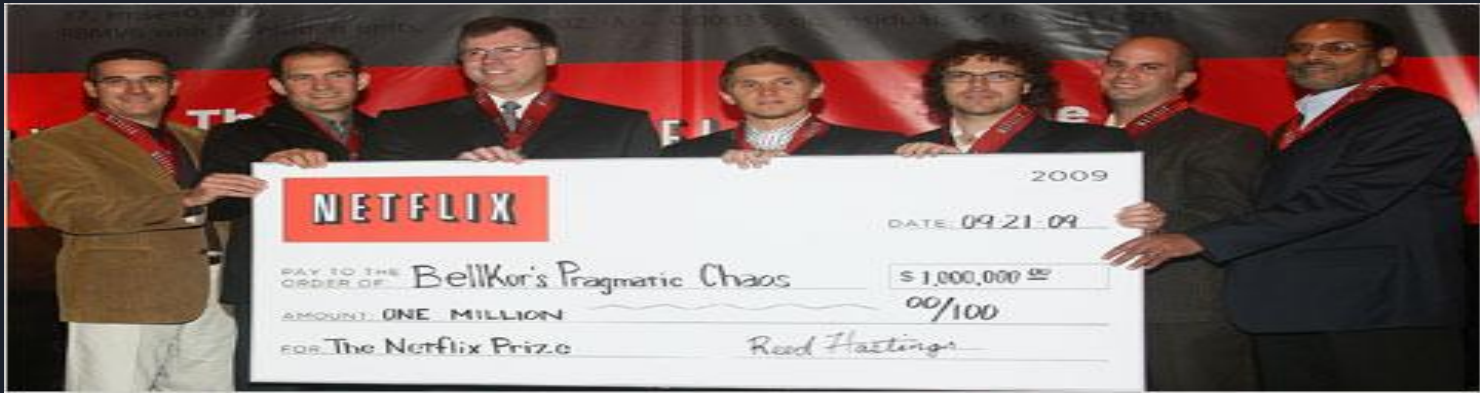
Why we need Music Recommender System ?

With growing availability of Internet in today's world (especially in our Country India), a lot of digital engagement of Users is increasing tremendously. People are now more habitual of watching videos, TV shows, Web Series, Movies, listening Music, etc. all online digitally and Online, we have a huge database of Music and a huge amount of Creators and even more amount of Audience. So, why don't we use our Huge database of Music Songs to provide a better experience to our Users.

From that Huge Database of Music, it is very difficult for our users to decide what and which song to listen to. So, We need a smart system which can help them or even better recommend them the songs which they like to listen. It is where the tools of Computer Science and Mathematics (mainly AI) comes into picture for the rescue and a strong need for a Smart Music Recommendation System comes into Picture.

Benefits of Our Music Recommender System

- Solves the problem of our Users and helps them in Choosing the songs to listen to, from our Given database of Songs.
- Helps in Increasing the User Engagement with our Main App / Software and provides them a better User Experience.
- Give rise to multiple Research Possibilities and more Development.
- Increases the Revenue of the Company and this is the main thing which makes it so much valuable for companies like Spotify. Also, In general, Recommender Systems are so much valuable to any Company. Take example of Netflix, which announced $1 Million USD price to anyone who would increase the accuracy of their Movie Recommender System by just 10%. So, it clearly shows how valuable these systems are for any company.

Dataset for our Music Recommender System

We have used (a Subset) of Million Song Dataset (MSD), The actual Dataset was released by Columbia University Laboratory for the Recognition and Organization of Speech and Audio back in 2011. The data is open; meta-data, audio content analysis, etc. are available for all the songs. But Users are anonymous here (no information about users is given)I have used (a Subset) of Million Song Dataset (MSD), Provided by turi.com which is taken from a subset of *The EchoNest Taste Profile Subset* from here. It contains **triplets of 2M triplets of 76k unique users and 10k unique songs (user_id, song_id, listen_count)** and has been provided in a text file with triplets being seperated by '/t' (tab). Song metadata consisting of features related to song wasn't available anywhere except the official of MSD. It was in .h5 file which required a utility to convert it into .csv file. This contains metadata like loudness, title, artist name, album, danceability, genre, etc. for 10k unique Songs.

Programming Language, Libraries, Tools and Resources Used for Music Recommender System

- **Programming Language:** Python 3.7 / 3.8
- **Programming Libraries:**
    - **Numpy** (for handling matrices and calculations involving them)
    - **Scipy** (for providing linear algebra, calculus and other helpful tools to Numpy)
    - **Scikit-learn** (for using efficient machine learning and statistical tools)
    - **matplotlib** (for plotting graphs and graphical presentation)
    - **pandas** (for handling the dataset into /as DataFrames)
- **Programming Platform:** Google Colab (Online) and Xcode & Jupyter Notebook (Offline)
- **Other Relevant Resources:**
    - Divya Sardana | Building Recommender Systems Using Python (YouTube)
    - How does Netflix recommend movies? Matrix Factorization (YouTube)
    - Machine Learning | Andrew Ng | Building Recommender Systems (Coursera)
    - McFee, B., BertinMahieux,T., Ellis, D. P., Lanckriet, G. R. (2012, April). The million song dataset challenge. In Proceedings of the 21st international conference companion on World Wide Web (pp. 909916).ACM.
    - Aiolli, F. (2012). A preliminary study on a recommender system for the millionsongs dataset challenge. PREFERENCE LEARNING: PROBLEMS AND APPLICATIONS IN AI

Ideas and Methods to build Smart Music Recommender System

Many Users don't provide their useful information like they don't allow their listening histories or Profile to be saved. That creates a difficulty in recommending songs to those kind of users.

Can We Still Recommend Music to those kind of Users with no User Preferences ?? YES

- Popularity based Model:
    - Arrange the Songs in Decreasing Order of their Popularity or
    - Arrange the Songs in Decreasing Order of their Listen Count.
    - At least Our Users will have something relevant to listen to.
   - However, it involves no Personalization.

Ideas and Methods to build Smart Music Recommender System

- Content Based Model:
  - K-NN Technique Based Model:
    - K Nearest Neighbour (Unsupervised ML) Technique.
    - Create a space of songs according to songs features. We find out neighborhood of each song.
    - We look at each user's profile and suggest songs which are neighbors to the songs that he/she listens to.
  - Latent Factor Model (SVD Based):
    - Yet to be Studied / Explored from a well known Research Paper for Music Recommender System
    - Based on the idea that Listening histories are influenced by a set of factors specific to the domain (e.g. Genre, artist).
    - These factors are in general not obvious and we need to infer those so called latent factors from the data.

# Ideas and Methods to build Smart Music Recommender System

- Collaborative Filtering:

Item-based

Idea: songs that are often listened by the same user tend to be similar and are more likely to be listened together in future by some other user.
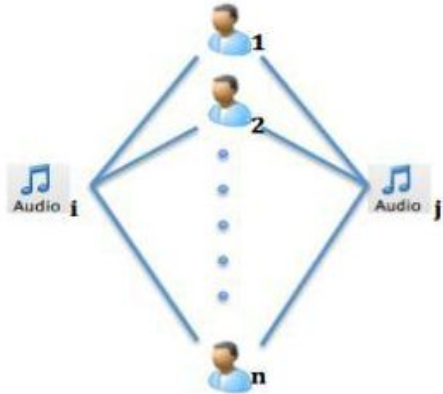
User-based

Idea: users who listen to the same songs in the past tend to have similar interests and will probably listen to the same songs in future.
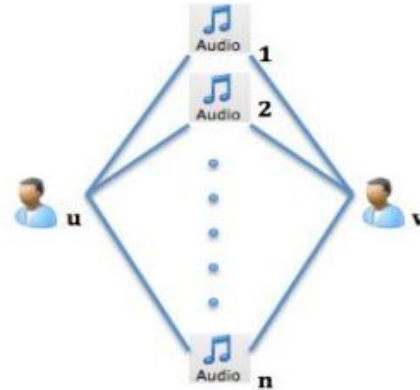
Some Other Ideas and Challenges related to Music Recommender System

- Ideas:
  - Try to include ML into training techniques for the collaborative and content based Modelling.
- Challenges:
  - Evaluation Metric:
    - How to evaluate different Models with a Mathematical Evaluation Technique:
      - Need for the Evaluation Metric for other Models.
      - Methods are given in a Research Paper for Music Recommender System which needed to be Studied.
    - We can later use it to compare different proposed Models for the Music Recommender System and decide which algorithm is best for this recommendation purposes.

Thank You! Any Suggestions are Welcome!