# Spotify Recommender Systems – Research Notes

## 1. Abstract

Spotify uses a hybrid recommendation system combining collaborative filtering, natural language processing, and audio signal analysis. The system powers features like Discover Weekly, Daily Mix, and Radio.

## 2. Key Techniques Used by Spotify

• Collaborative Filtering (ALS, Matrix Factorization): Learns from user–item interaction patterns.

• Content-Based Filtering: Uses audio features (tempo, key, loudness) + lyrics/textual data.

• Natural Language Processing: Spotify’s Annoy/Word2Vec for playlist/track similarity.

• Contextual Signals: Time of day, device type, activity (e.g., running, studying).

• Bandits & Exploration: Balances exploitation (songs you’ll like) with exploration (new songs).

## 3. Important Papers & Blogs

• Hu, Koren, Volinsky – Collaborative Filtering for Implicit Feedback Datasets (2008).

• Spotify Engineering Blog – The Evolution of Recommender Systems at Spotify.

• Annoy: Approximate Nearest Neighbors Oh Yeah – open-source library by Spotify.

• MIT Tech Review – Discover Weekly: How Machine Learning Finds Your New Music.

## 4. Applications in Spotify

• Discover Weekly → Personalized weekly playlist.

• Daily Mix → Blends familiar + new tracks.

• Release Radar → Recommends new songs from favorite artists.

• Blend → Shared playlists between friends.

## 5. Key Takeaways

• Spotify doesn’t rely on just one model → it’s hybrid + context-aware.

• Embeddings (Word2Vec, BERT) are heavily used for text + audio similarity.

• Large-scale serving requires efficient approximate nearest neighbor search (Annoy, Faiss).

## 6. References

• Spotify Engineering Blog – https://engineering.atspotify.com

• MIT Tech Review – “How Discover Weekly Works”

• Research Papers – Collaborative Filtering for Implicit Feedback Datasets (2008).