

Introduction

Typical Filter Types in Recommendation

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Journal

- **Current challenges and visions in music recommender systems research**

- **Name of the Journal : International Journal of Multimedia Information Retrieval**
- **Number of Quotations : 125**
- ***Web of Science* Core Collection : Science Citation Index Expanded (SCIE)**
- **Impact Factor : 3.429**
- **Date of Publication : April 2018**

- **Main Idea**

- MRS research is still facing substantial challenges. In particular when it comes to build, incorporate, and evaluate recommendation strategies that integrate information beyond simple user–item interactions or content-based descriptors, but dig deep into the very essence of listener needs, preferences, and intentions, MRS research becomes a big endeavor and related publications quite sparse. Researchers first identify and shed light on what we believe are the most pressing challenges MRS research is facing, from both academic and industry perspectives. They review the state of the art toward solving these challenges and discuss its limitations. Second, they detail possible future directions and visions they contemplate for the further evolution of the field. The article should therefore serve two purposes: giving the interested reader an overview of current challenges in MRS research and providing guidance for young researchers by identifying interesting, yet under-researched, directions in the field.

- **Future Improvement**

- While personality characteristics of humans are a predictable and stable measure that shapes human behaviors, emotions are short-term affective responses to a particular stimulus. Both have been shown to influence music tastes and user requirements for MRS.
- Most of the existing music recommender systems make recommendations solely based on a set of user-specific and item-specific signals. However, in real-world scenarios, many other signals are available. These additional signals (e.g., location, time of the day, activity, weather, mood, day of the week) can be further used to improve the recommendation performance.

Journal

- **Music Recommendation Using Content and Context Information Mining**

- **Name of the Journal** : IEEE Intelligent Systems
- **Number of Quotations** : 203
- **Web of Science Core Collection** : Science Citation Index Expanded (SCIE)
- **Impact Factor** : 3.210
- **Date of Publication** : 18 March 2010

- **Main Idea**

- The Ubiquitous Music Recommender (uMender) tackles the music recommendation problem by mining musical content and context information. For musical content, researchers propose a two-stage clustering approach that identifies each music item's perceptual patterns, which consist of acoustical and temporal features hidden in music. Considering such patterns, a user's listening interest in music items can be captured more precisely. For context information, they have designed a novel solution for capturing a user's preferences under various context conditions. Instead of computing the correlation coefficients of user ratings, as in traditional methods, we group users under similar context conditions to find implicit, more applicable perceptual patterns. Through integrated mining of both context information and musical content, uMender provides appropriate, ubiquitous music recommendations. On the basis of the CF principle, uMender groups users with similar contexts, implying similar interests in music. Then, uMender identifies relevant music items that match both the user's listening interests and the current context.

- **Future Improvement**

- They will investigate more dimensions of contextual information to improve the recommender's quality.
- They hope to adopt perceptual patterns to enhance content-based retrieval.
- They intend to apply the integrated mining of context information and multimedia content to other multimedia applications.

Journal

- **On Effective Location-Aware Music Recommendation**

- **Name of the Journal : ACM Transactions on Information Systems**
- **Number of Quotations : 94**
- ***Web of Science* Core Collection : Science Citation Index Expanded (SCIE)**
- **Impact Factor : 2.889**
- **Date of Publication : April 2016**

- **Main Idea**

- Researchers present a novel venue-aware music recommender system called VenueMusic to effectively identify suitable songs for various types of popular venues in our daily lives. Toward this goal, a Location-aware Topic Model (LTM) is proposed to (i) mine the common features of songs that are suitable for a venue type in a latent semantic space and (ii) represent songs and venue types in the shared latent space, in which songs and venue types can be directly matched. It is worth mentioning that to discover meaningful latent topics with the LTM, a Music Concept Sequence Generation (MCSG) scheme is designed to extract effective semantic representations for songs. The comparisons with state-of-the-art music recommender systems demonstrate the superior performance of VenueMusic system on recommendation accuracy by associating venue and music contents using a latent semantic space. This work is a pioneering study on the development of a venue-aware music recommender system. The results show the importance of considering the influence of venue types in the development of context-aware music recommender systems.

- **Future Improvement**

- They plan to evaluate the system using larger and more complex datasets.
- It will be interesting to integrate broader venue types into the system and take other kinds of personal context information like age or gender into consideration.
- Another novel research direction is to extend the current system to other kinds of media data (e.g., video and text) and support different music search-related applications (e.g., ranking/reranking and personalization).
- Music choice can be influenced greatly by the events and activities they involve.

Journal

- **Global and country-specific mainstreamness measures: Definitions, analysis, and usage for improving personalized music recommendation systems**
 - **Name of the Journal : Plos one**
 - **Number of Quotations : 11**
 - **Web of Science Core Collection : Science Citation Index Expanded (SCIE)**
 - **Impact Factor : 2.740**
 - **Date of Publication : June 7, 2019**
- **Main Idea**
 - First, assuming that there is a difference between the global music mainstream and a country-specific one, they define the measures at two levels: relating a listener's music preferences to the global music preferences of all users, or to music preferences of the user's country. Second, they perform in-depth quantitative and qualitative studies of music mainstream in that they analyze differences between countries in terms of their level of mainstreamness analyzing these with a mixed-methods approach, and investigate differences between countries in terms of listening preferences related to popular music artists. Third, they demonstrate the applicability of their study results to improve music recommendation systems. To this end, they conduct rating prediction experiments using the proposed 6 mainstreamness measures: defined by a distribution-based or rank-based approach, defined on a global level or on a country level, and for artist play counts or artist listener counts.
- **Future Improvement**
 - Using the proposed measurements, the target user's mainstreamness levels have to be computed and, considering the other users' mainstreamness levels, the target user has to be assigned to the corresponding user set for each of the mainstreamness approaches.
 - The recommendation approach that perform best for the mainstreamness measure - user set pair has to be identified and applied. Taking an even more fine-tuned approach, depending on a user's country and the corresponding country profile, the corresponding most appropriate measure and/or algorithm may be adopted for the recommendation task.
 - Future work should expand the perspective on cultural aspects.

Journal

- **Sound and Music Recommendation with Knowledge Graphs**

- **Name of the Journal : ACM Transactions on Intelligent Systems and Technology**
- **Number of Quotations : 82**
- ***Web of Science* Core Collection : Science Citation Index Expanded (SCIE)**
- **Impact Factor : 2.672**
- **Date of Publication : October 2016**

- **Main Idea**

- Researchers describe how to create and exploit a knowledge graph to supply a hybrid recommendation engine with information that builds on top of a collections of documents describing musical and sound items. Tags and textual descriptions are exploited to extract and link entities to external graphs such as WordNet and DBpedia, which are in turn used to semantically enrich the initial data. Two explicit graph feature mappings are formulated to obtain meaningful item feature representations able to catch the knowledge embedded in the graph. Those content features are further combined with additional collaborative information deriving from implicit user feedback. An extensive evaluation on historical data is performed over two different datasets: a dataset of sounds composed of tags, textual descriptions, and user's download information gathered from Freesound.org and a dataset of songs that mixes song textual descriptions with tags and user's listening habits extracted from Songfacts.com and Last.fm, respectively.

- **Future Improvement**

- Without considering the collaborative information, the accuracy drops significantly. In addition, when considering only collaborative features accuracy performances are comparable with respect to hybrid feature combination variants. Finally, they see that the semantic expansion of tags and terms do not improve consistently accuracy with respect to the usage of pure keywords and tags combined with collaborative information
- When using only keyword or tag-based representations, the system is able to retrieve only those few items with an exact keyword/tag match with those liked by the user. Thus, the system is unable to widely explore the item space to find those items which are semantically related to the ones liked by the user.

Conference

- **Deep content-based music recommendation**

- **Name of the Conference(Abbrev.) : Advanced in Neural Information Processing Systems 26 (NIPS)**
- **Rank(Source) of the Conference : A(ERA)**
- **Number of Quotations : 997**
- **Date of Publication : NIPS 2013**
- **Conference Year : 1987 -**

- **Main Idea**

- Researchers propose to use a latent factor model for recommendation, and predict the latent factors from music audio when they cannot be obtained from usage data. They compare a traditional approach using a bag-of-words representation of the audio signals with deep convolutional neural networks, and evaluate the predictions quantitatively and qualitatively on the Million Song Dataset. They show that using predicted latent factors produces sensible recommendations, despite the fact that there is a large semantic gap between the characteristics of a song that affect user preference and the corresponding audio signal. They also show that recent advances in deep learning translate very well to the music recommendation setting, with deep convolutional neural networks significantly outperforming the traditional approach.

- **Future Improvement**

- Even though a lot of characteristics of songs that affect user preference cannot be predicted from audio signals, the resulting recommendations seem to be sensible. They can conclude that predicting latent factors from music audio is a viable method for recommending new and unpopular music.
- They suspect that using a ranking loss approach may suffer from the problem(i.e. popular songs will have an unfair advantage).

Conference

- **Music recommendation by unified hypergraph: combining social media information and music content**
 - **Name of the Conference(Abbrev.)** : Proceedings of the 18th ACM Multimedia Conference on Multimedia (Multimedia)
 - **Rank(Source) of the Conference** : A1(Qualis)
 - **Number of Quotations** : 666
 - **Date of Publication** : MM 2010
 - **Conference Year** : 1993 -
- **Main Idea**
 - Researchers propose a novel music recommendation algorithm by using both multiple kinds of social media information and music acoustic-based content. Instead of graph, they use hypergraph to model the various objects and relations, and consider music recommendation as a ranking problem on this hypergraph. While an edge of an ordinary graph connects only two objects, a hyper edge represents a set of objects. In this way, hypergraph can be naturally used to model high order relations.
- **Future Improvement**
 - MRH can also be used for recommender systems in other kinds of social media communities, such as movies and pictures. In this work, they treat all types of social relations equally. However, in practical applications, different types of relations may have different importance.
 - Their approach is not limited to music track recommendation. They can exploit it in different applications, such as friend recommendation and personalized tag recommendation.

Conference

- **Music Recommendation from Song Sets**

- **Name of the Conference(Abbrev.) : International Conference on Music Information (ISMIR)**
- **Rank(Source) of the Conference : A1(Qualis)**
- **Number of Quotations : 166**
- **Date of Publication : ISMIR 2004**
- **Conference Year : 2000 -**

- **Main Idea**

- Researchers motivate the problem of music recommendation based solely on acoustics from groups of related songs or 'song sets'. They propose four solutions which can be used with any acoustic-based similarity measure. They first builds a model for each song set and recommends new songs according to their distance from this model. The next three approaches recommend songs according to the average, median and minimum distance to songs in the song set.

- **Future Improvement**

- Future work will focus on the use of other acoustic distance measures, particularly those incorporating rhythmic information, and learning which sounds in the song set perceptually distinguish it from the rest of audio space.
- They will also consider recommending groups of songs. As described, they hope to conduct this research on a larger, more varied collection of song sets with greater feedback from users.

Conference

- **Context-aware mobile music recommendation for daily activities**

- Name of the Conference(Abbrev.) : Proceedings of the 20th ACM International Conference on Multimedia (Multimedia)
- Rank(Source) of the Conference : A1(Qualis)
- Number of Quotations : 216
- Date of Publication : MM 2012
- Conference Year : 1993 –

- **Main Idea**

- Given the popularity of mobile music devices with rich sensing and wireless communication capabilities, researchers present in this paper a novel approach to employ contextual information collected with mobile devices for satisfying users' short-term music playing needs. They present a probabilistic model to integrate contextual information with music content analysis to offer music recommendation for daily activities, and they present a prototype implementation of the model. Finally, they present evaluation results demonstrating good accuracy and usability of the model and prototype.

- **Future Improvement**

- They are currently improving the user experience of the system.
- They also are exploring the integration of context awareness with collaborative filtering to provide even more accurate recommendations.
- They should consider not only activities, but also other features(e.g., weathers or locations).

Conference

- **A music recommendation system based on music data grouping and user interests**

- **Name of the Conference(Abbrev.) : Proceedings of the 10th ACM International Conference on Information and Knowledge Management (CIKM)**
- **Rank(Source) of the Conference : A(ERA)**
- **Number of Quotations : 212**
- **Date of Publication : CIKM 2001**
- **Conference Year : 1992 -**

- **Main Idea**

- In this paper, researchers design the Music Recommendation System (MRS) to provide a personalized service of music recommendation. The music objects of MIDI format are first analyzed. For each polyphonic music object, the representative track is first determined, and then six features are extracted from this track. According to the features, the music objects are properly grouped. For users, the access histories are analyzed to derive user interests. The content-based, collaborative and statistics-based recommendation methods are proposed, which are based on the favorite degrees of the users to the music groups. A series of experiments are carried out to show that our approach is feasible. When a new music object is inserted in the database of the MRS, it goes through two function blocks, i.e., track selector and feature extractor. According to the extracted features, the incoming music object is properly assigned to certain music group by the classifier function block.

- **Future Improvement**

- They will research into the summarization of music objects.
- Other features and recommendation methods will be also investigated.

Conference

- **Exploiting Music Play Sequence for Music Recommendation**

- **Name of the Conference(Abbrv.)** : International Joint Conference on Artificial Intelligence (IJCAI)
- **Rank(Source) of the Conference** : A(ERA), A1(Qualis)
- **Number of Quotations** : 47
- **Date of Publication** : IJCAI 2017
- **Conference Year** : 1969 –

- **Main Idea**

- To explore the effects of music play sequence on developing effective personalized music recommender systems, researchers propose to use word embedding techniques in music play sequences to estimate the similarity between songs. The learned similarity is then embedded into matrix factorization to boost the latent feature learning and discovery. Furthermore, the proposed method only considers the k-nearest songs (e.g. k= 5) in the learning process and thus avoids the increase of time complexity. Experimental results on two public datasets demonstrate that our methods could significantly improve the performance on both rating prediction and top-n recommendation tasks.

- **Future Improvement**

- More number of latent factors leads to better representation capability and more accurate prediction. Thus, with the increasing of the number of factors in matrix factorization, the performance of all the methods is improved. In the meantime, it also increases the time complexity and the risk of overfitting.

Conference

- **A Music Recommendation System Based on Acoustic Features and User Personalities**

- Name of the Conference(Abbrev.) : Pacific-Asia Conference on Knowledge Discovery (PAKDD)
- Rank(Source) of the Conference : A(ERA)
- Number of Quotations : 14
- Date of Publication : PAKDD 2016
- Conference Year : 1997 –

- **Main Idea**

- In this study, researchers proposed a hybrid approach to provide personalized music recommendations. This is achieved by extracting audio features of songs and integrating these features and user personalities for context-aware recommendation using the state-of-the-art support vector machines (SVM). The system is based on SVM model, which is faster than traditional recommendation algorithms and can solve matrix sparse and cold start problems. By using the audio features and user personalities information, this model can take content and context information, rather than only user ratings, into consideration.

- **Future Improvement**

- Future research would collect more data to test whether the model still performs well with large data sets to overcome the disadvantage of using limited scale of datasets.
- Additional context features such as time and location will also be conserved to improve the model.

Conference

- **Improving Music Recommendation Using Distributed Representation**

- **Name of the Conference(Abbrev.) : Companion: Proceedings of the 25th International Conference Companion on World Wide Web (WWW)**
- **Rank(Source) of the Conference : A(ERA), A1(Qualis)**
- **Number of Quotations : 12**
- **Date of Publication : WWW 2016**
- **Conference Year : 1994 -**

- **Main Idea**

- In this paper, a music recommendation approach based on distributed representation is presented. The proposed approach firstly learns the distributed representations of music pieces and acquires users' preferences from listening records. Then, it recommends appropriate music pieces whose distributed representations are in accordance with target users' preferences. Experiments on a real world dataset demonstrate that the proposed approach outperforms the state-of-the-art methods.

- **Future Improvement**

- Researchers plan to combine the distributed representation with more advanced recommendation techniques, to further improve the performance.
- They will try to evaluate their approach by online experiments.

Conference

- **Music recommendation via heterogeneous information graph embedding**

- **Name of the Conference(Abbrv.)** : IEEE International Joint Conference on Neural Networks (IJCNN)
- **Rank(Source) of the Conference** : A(ERA), A2(Qualis)
- **Number of Quotations** : 10
- **Date of Publication** : IJCNN 2017
- **Conference Year** : 1990 -

- **Main Idea**

- Researchers study the problem of personalized music recommendation that takes different kinds of auxiliary information into consideration. To achieve this goal, a Heterogeneous Information Graph (HIG) is first constructed to encode different kinds of heterogeneous information, including the interactions between users and music pieces, music playing sequences, and the metadata of music pieces. Based on HIG, a Heterogeneous Information Graph Embedding method (HIGE) is proposed to learn the latent low-dimensional representations of music pieces. Then, they further develop a context-aware music recommendation method. Extensive experiments have been conducted on real-world datasets to compare the proposed method with other state-of-the-art recommendation methods. The results demonstrate that the proposed method significantly outperforms those baselines, especially on sparse datasets.

- **Future Improvement**

- Researchers plan to adopt advanced recommending techniques, such as deep learning, to further improve the performance. In addition, they will explore if users' satisfaction can be increased by online experiments.

Conference

- **Leveraging multi-dimensional user models for personalized next-track music recommendation**
 - **Name of the Conference(Abbrev.)** : Proceedings of the Symposium on Applied Computing (SAC)
 - **Rank(Source) of the Conference** : B(ERA), A1(Qualis)
 - **Number of Quotations** : 25
 - **Date of Publication** : SAC 2017
 - **Conference Year** : 1986 –
- **Main Idea**
 - Existing approaches to this "next-track music recommendation" problem often focus solely on the user's recent listening behavior or current situational context and do not consider long-term preferences. In this work, researchers explore the value of including different types of information that reflect long-term preferences into the playlist generation process. Although empirical evaluations show that the most recently played tracks should generally govern the next-track selection process, considering long-term preferences can help to improve the quality of the playlists in different dimensions.
- **Future Improvement**
 - Conducting user studies to evaluate our approaches with respect to the perceived quality of the next-track recommendations and general user satisfaction is part of our ongoing work.

Conference

- **Explicit Modelling of the Implicit Short Term User Preferences for Music Recommendation**

- **Name of the Conference(Abbrev.)** : European Conference on Information Retrieval (ECIR)
- **Rank(Source) of the Conference** : B(ERA), A2(Qualis)
- **Number of Quotations** : 7
- **Date of Publication** : ECIR 2018
- **Conference Year** : 1979 –

- **Main Idea**

- Researchers try to explicitly model the short term preferences of the user with the help of Last.fm tags of the songs the user has listened to. With a session defined as a period of activity surrounded by periods of inactivity, they introduce the concept of a subsession, which is that part of the session wherein the preference of the user does not change much. They assume the user preference might change within a session and a session might have multiple subsessions. They use their modelling of the user preferences to generate recommendations for the next song the user might listen to.

- **Future Improvement**

- Recommending a set of possible next songs based on the current subsession modelled by the Last.fm tags of the songs user has listened to might ignore other important features like time of the day, location, etc.

Conference

- **New Paths in Music Recommender Systems Research**

- **Name of the Conference(Abbrev.) : Proceedings of 11th ACM Conference on Recommender Systems (RecSys)**
- **Rank(Source) of the Conference : B(ERA), B1(Qualis)**
- **Number of Quotations : 26**
- **Date of Publication : Rec 2017**
- **Conference Year : 2007 -**

- **Main Idea**

- It is increasingly more common for a music listener to simply access music than to purchase and own it in a personal collection. In this scenario, recommendation calls no longer for a one-shot recommendation for the purpose of a track or album purchase, but for a recommendation of a listening experience, comprising a very wide range of challenges, such as sequential recommendation, or conversational and contextual recommendations. Recommendation technologies now impact all actors in the rich and complex music industry ecosystem (listeners, labels, music makers and producers, concert halls, advertisers, etc.). To highlight these developments, researchers focus on three use cases: automatic playlist generation, context aware music recommendation, and recommendation in the creative process of music making.

- **Future Improvement**

- Beside a rich variety of other use cases, such as user-centric MRS (e.g., emotion- and personality-aware), recommending fans to artists, artists to labels, concert venues to performers, or tracks to listener groups, researchers reflect on social implications of music recommendation growth, such as filter bubble, ethics, and influence on popular culture, and on the challenges ahead from both academic and industry perspectives.

Conference

- Using offline metrics and user behavior analysis to combine multiple systems for music

recommendation

- Name of the Conference(Abbrev.) : Conference on Recommender Systems (RecSys)
- Rank(Source) of the Conference : B(ERA), B1(Qualis)
- Number of Quotations : 5
- Date of Publication : RecSys 2018
- Conference Year : 2007 –

- Main Idea

- Researchers focus on music recommendation and propose a new way to improve recommendations, with respect to a desired metric of choice, by combining multiple systems for each user individually based on their expected performance. Essentially, their approach consists in predicting an expected error that each system will produce for each user based on their previous activity. To this end, they propose to train regression models for different metrics predicting the performance of each system based on a number of features characterizing previous user behavior in the system. They then use different fusion strategies to combine recommendations generated by each system. Following this approach one can optimize the final hybrid system with respect to the desired metric of choice. As a proof of concept, they conduct experiments combining two recommendation systems, a Matrix Factorization model and a popularity-based recommender. They use the data provided by Melon, a Korean music streaming service, to train and evaluate the performance of the systems.

- Future Improvement

- For the future work researchers propose to study alternative ranking fusion or score-fusion methods.
- It is also challenging to estimate the importance of individual user behavior features and compare global features and session features for predicting system performance as well as consider other user behavior features and demographic features.
- Another research possibility is to evaluate robustness of regression models and study the effect of the size of listening behavior data on the quality of predictions.

Conference

- **User Perception of Next-Track Music Recommendations**

- **Name of the Conference(Abbrev.)** : Proceedings of the 25th Conference on User Modeling Adaption and Personalization (UMAP)
- **Rank(Source) of the Conference** : B1(Qualis)
- **Number of Quotations** : 27
- **Date of Publication** : UMAP 2017
- **Conference Year** : 1993 –

- **Main Idea**

- They aim to check the external validity of insights that are obtained through such offline experiments on historical datasets. Our results indicate that manually created playlists can in fact represent a reasonable gold standard, an insight for which no evidence existed in the literature before. Furthermore, their work was able to confirm that considering playlist homogeneity aspects does not only lead to performance improvements in offline experiments – as indicated by past research – but also to a better quality perception by users. However, the observations also revealed that user studies of this type can be easily distorted by item familiarity biases, because the participants tend to evaluate continuation alternatives better when they know the track or the artist.

- **Future Improvement**

- In the music domain, the participants have to invest a considerable amount of time as they are required to listen to a number of tracks during the experiment. In their setup, they therefore limited the number of tracks in the given playlist to four and only provided 30-second previews of the tracks.
- All of the tracks in the experiment were not longer than usual pop songs and each track exhibited limited within-track variation of the tempo or harmonics.
- They limited the number of playlists in the experiment to five in order to end up with a sufficient number of participants per playlist.

Conference

- **A Survey of Music Recommendation Systems and Future Perspectives**

- **Name of the Conference(Abbrev.) : International Symposium on Computer Music Modeling and Retrieval (CMMR)**
- **Rank(Source) of the Conference : B5(Qualis)**
- **Number of Quotations : 172**
- **Date of Publication : CMMR 2012**
- **Conference Year : 2003 –**

- **Main Idea**

- This paper surveys a general framework and state-of-art approaches in recommending music. Due to the relatively poor experience in finding songs in long tail and the powerful emotional meanings in music, two user-centric approaches: context-based model and emotion-based model, have been paid increasing attention. In this paper, three key components in music recommender - user modelling, item profiling, and match algorithms are discussed. Six recommendation models and four potential issues towards user experience, are explained. However, subjective music recommendation system has not been fully investigated. To this end, we propose a motivation-based model using the empirical studies of human behavior, sports education, music psychology.

- **Future Improvement**

- As the users aggregate in the recommender systems, it needs to be able to adapt to new data such as user listening histories and listening behavior to further personalized their music taste.
- Most of the recommender systems are not flexible, because the playlist is ordered by the similarity distance between seed songs. Though the most similar songs are given in order, the theme and mood can be dramatically changed in between. Rather than randomly shuffling, human skipping behavior can be considered for dynamic playlist generation.
- The future research direction will be mainly focused on user centric music recommender systems. A survey among athletes showed practitioners in sport and exercise environments tend to select music in a rather arbitrary manner without full consideration of its motivational characteristics. Therefore, future music recommender should be able to lead the users reasonably choose music.

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