Music Playlist Continuation by Learning from Hand-Curated Examples and Song Features
DLRS Workshop at RecSys’17

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Problem (un)definition

Under the bridge (A)

Metallica - Nothing Else Matters
Weezer - Say It Ain't So
Red Hot Chili Peppers - Under The Bridge
Eels - Novocaine For The Soul
Pixies - Wave of Mutilation (UK Surf Version)
Green Day - Basket Case
Radiohead - Creep (Explicit)
Spacehog - In The Meantime
Alice In Chains - Them Bones
...

Under the bridge (B)

Cake - Rock 'n' Roll Lifestyle
Nirvana - Love Buzz
Red Hot Chili Peppers - Under The Bridge
Big Bad Voodoo Daddy - Mr. Pinstripe Suit
Spice Girls - The Lady Is A Vamp
Our Lady Peace - Clumsy
Elliott Smith - Bled White
PJ Harvey - Down By The Water
Siouxsie And The Banshees - Playground Twist
Bias towards popular songs

Examples from the 8tracks dataset.

Bon Iver - Skinny love (140)
Coldplay - The scientist (47)
Foo Fighters - Everlong (38)

Bon Iver - Team (1)
Coldplay - One I love (1)
Foo Fighters - End over end (1)
Hybrid music playlist continuation

\[
\begin{align*}
\begin{pmatrix}
  x_1 \\
  x_2 \\
  x_3 \\
  \vdots \\
  x_D \\
\end{pmatrix} & \xrightarrow{f(\cdot; \theta)} \begin{pmatrix}
  o_1 \\
  o_2 \\
  o_3 \\
  \vdots \\
  o_{|T|} \\
\end{pmatrix} \xrightarrow{\sigma} \begin{pmatrix}
  \hat{y}_1 \\
  \hat{y}_2 \\
  \hat{y}_3 \\
  \vdots \\
  \hat{y}_{|T|} \\
\end{pmatrix} \sim \begin{pmatrix}
  y_1 \\
  y_2 \\
  y_3 \\
  \vdots \\
  y_{|T|} \\
\end{pmatrix}
\end{align*}
\]

song features \quad network output \quad predicted probabilities \quad target playlists
Hybrid music playlist continuation

playlists

songs

$S_i$
Hybrid music playlist continuation
Study on two playlists datasets

- Compare the proposed approach to Collaborative Filtering (CF)
- Assess multimodal song features

AotM-2011
2715 playlists, 4097 artists, 12355 songs

8tracks
3272 playlists, 5119 artists, 14613 songs
Multimodal song features

audio

tags

logs

<table>
<thead>
<tr>
<th>user</th>
<th>song</th>
<th>count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>11</td>
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<tr>
<td>1</td>
<td>12</td>
<td>4</td>
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<tr>
<td>2</td>
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<td>4</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
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</tbody>
</table>
## Results

### AotM-2011

<table>
<thead>
<tr>
<th>feature</th>
<th>med rank</th>
<th>R@100</th>
</tr>
</thead>
<tbody>
<tr>
<td>audio + tags + logs</td>
<td>860</td>
<td>17.61%</td>
</tr>
<tr>
<td>logs</td>
<td>993</td>
<td>16.32%</td>
</tr>
<tr>
<td>tags</td>
<td>1372</td>
<td>12.99%</td>
</tr>
<tr>
<td>CF</td>
<td>1444</td>
<td>14.56%</td>
</tr>
<tr>
<td>audio</td>
<td>2715</td>
<td>4.85%</td>
</tr>
<tr>
<td>random</td>
<td>6087</td>
<td>0.79%</td>
</tr>
</tbody>
</table>

### 8tracks

<table>
<thead>
<tr>
<th>feature</th>
<th>med rank</th>
<th>R@100</th>
</tr>
</thead>
<tbody>
<tr>
<td>audio + tags + logs</td>
<td>448.5</td>
<td>26.85%</td>
</tr>
<tr>
<td>logs</td>
<td>612.5</td>
<td>23.28%</td>
</tr>
<tr>
<td>tags</td>
<td>935</td>
<td>18.57%</td>
</tr>
<tr>
<td>CF</td>
<td>1000</td>
<td>19.60%</td>
</tr>
<tr>
<td>audio</td>
<td>1985</td>
<td>7.53%</td>
</tr>
<tr>
<td>random</td>
<td>7320</td>
<td>0.66%</td>
</tr>
</tbody>
</table>
Cold-starting rare and out-of-set songs

![Graphs showing med rank and R@100 for AotM-2011 and 8tracks]
Summary

- Flexible and robust hybrid music playlist continuation model
- Competes with CF when sufficient data is available
- Outperforms CF when recommending rare and out-of-set songs
- Different modalities indeed carry complementary song information
- Check it out! [https://github.com/andreuvall/HybridPlaylistContinuation](https://github.com/andreuvall/HybridPlaylistContinuation)

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