Music Recommendation Systems for Listeners with Hearing Loss

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Music Recommendations

- Recommending music the user knows & love vs. new music
- Exploration vs. Exploitation
- For me: I want to hear music I know every time
Familiarity & Preference

• Why do we prefer music we are already familiar with?
• Explains popularity of:
  • Cover songs
  • “oldies” and “throwbacks”
Quality

• How does **audio quality** affect our preference?
• Most of the time... audio is low quality
  • Driving
  • Public spaces: restaurant, bar
  • Listening through laptop/phone speakers
Cochlear Implant

- For people with hearing loss, perceiving high-quality audio is impossible
Cochlear Implant

- Stimulates auditory nerve with a tiny electrode array
- Tuned for speech
- Great for:
  - Rhythms, tempo, meter
- Not great for:
  - Melody, harmony
Cochlear Implant

- Angel Sim Cochlear Implant Simulator
- Note: This is best case scenario
- 32-channel noise vocoded
Audio Examples

- Familiar & Degraded
- Familiar & Intact
- Unfamiliar & Degraded
- Unfamiliar & Intact
Cochlear Implant

• Spectrogram of 8kHz sine sweep through CI simulator:
Study

“IMPACT OF FAMILIARITY ON MUSIC PREFERENCE DURING SIMULATED COCHLEAR-IMPLANT LISTENING” - ISMIR 2018

10 ‘familiar’ songs paired with 10 ‘unfamiliar’ songs:
- Familiar songs from dataset of known widely-familiar songs
- Unfamiliar songs are top songs from other countries

18 participants (ages 19-39, 10 female)
Study

- **Song Choices:**

<table>
<thead>
<tr>
<th>Familiar Songs</th>
<th>Unfamiliar Songs</th>
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</thead>
<tbody>
<tr>
<td>Dancing Queen (ABBA)</td>
<td>Science Fiction (Divinyls)</td>
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<tr>
<td>I Will Survive (Gloria Gaynor)</td>
<td>Tears (The Crocodiles)</td>
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<tr>
<td>We Are the Champions (Queen)</td>
<td>Blue Lady (Hello Sailor)</td>
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<tr>
<td>Hey Jude (The Beatles)</td>
<td>Hello How Are You (The Easybeats)</td>
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<tr>
<td>I Gotta Feeling (Black Eyed Peas)</td>
<td>Don’t Hold Back (The Pobelleez)</td>
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<tr>
<td>Singe Ladies (Beyoncé)</td>
<td>Burn (Jessica Mauboy)</td>
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<tr>
<td>Hotel California (The Eagles)</td>
<td>Carry Me (The Stampeders)</td>
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<tr>
<td>Every Breath You Take (The Police)</td>
<td>High School Confidential (Rough Trade)</td>
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<tr>
<td>I Believe I Can Fly (R. Kelly)</td>
<td>Loyal (Dave Dobbin)</td>
</tr>
<tr>
<td>Imagine (John Lennon)</td>
<td>I Hope I Never Die (Split Enz)</td>
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</tbody>
</table>
Results

• Average preference scores for subjects in the six song-pair conditions.
  • 1. Familiar vs. Unfamiliar
  • 2. Intact vs. Degraded
• Participants listened to two song excerpts & responded with their preferences on a sliding scale: -50–50.
Results

- Preference driven more by audio quality than familiarity.
Results

- If unfamiliar music is enjoyable only when audio quality is high, music recommendation and discovery systems could benefit from considering this.
  - Taking into account listener’s surroundings and audio device?
- For CI users, prior knowledge of a song is especially critical not only for enjoyment, but for basic comprehension of a musical excerpt.
  - Customized recommendations for users with hearing loss?
Thank you!

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