1. Goal and Challenges

**Our goal:** Generate personalized sleep therapy music
Automatically induce therapeutic properties into arbitrary user-selected music.

**Two challenges:**
- What musical features contribute to therapeutic effects of sleep music?
- How to bring such therapeutic sleep features into user-selected music?

2. Motivation

Sleep disorders are influencing a lot of people and have a strong causal link to major lifestyle diseases. Sleep therapy can be a promising solution to sleep problems.

3. Sleep therapy approaches need improvement

Current issues of music used for sleep therapy:
- Little scalability
- Music fatigue
- Rarely consider individual music preference

4. Overview of our approach

5. Feature analysis using k-means clustering

Which features perform the best to distinguish sleep music from the other music?

<table>
<thead>
<tr>
<th>Musical Feature</th>
<th>Adjusted Rand Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>All 34 musical features</td>
<td>0.115</td>
</tr>
<tr>
<td>Only articulation and energy features</td>
<td>-0.063</td>
</tr>
<tr>
<td>Only MFCC features</td>
<td>0.096</td>
</tr>
<tr>
<td>Only rhythm features</td>
<td>0.112</td>
</tr>
<tr>
<td>Only spectral rolloff features</td>
<td>0.761</td>
</tr>
<tr>
<td>Only spectral flatness features</td>
<td>0.037</td>
</tr>
</tbody>
</table>

- Spectral roll-off features perform the best to distinguish sleep music from the other music.

- **Take-away:** Sleep music is mostly characterized by its spectrum-related features, such as bass, treble, overall pitch profile, etc.

6. SleepGAN and evaluation

Evaluation shows:
Our SleepGAN model makes arbitrary music more similar to sleep music than CycleGAN does.

7. Future work

Model generalization to untrained music styles
Clinical evaluations
Extension to other mental problems