Analyzing the Potential of Microblogs for Spatio-Temporal Popularity Estimation of Music Artists

Markus Schedl

Department of Computational Perception
Johannes Kepler University (JKU)
Linz, Austria
Typical Application Scenarios of MIR

- personalized Web radio
- automatic playlist generation
- intelligent user interfaces
Motivation

Goal: Determine **artist popularity** on the level of individual countries.

Although music charts do exist…

…they suffer from various shortcomings.
Motivation (II)

Drawbacks of traditional charts, such as the "Billboard Hot 100":
- not available for all countries (or not publicly accessible)
- cover only certain channels of music distribution/consumption
- bias towards record sales / radio plays
- heavy distortions caused by (illegal) music sharing channels
- inhomogeneity between countries (in terms of channels) if data available

→ Look into microblogging activity to derive a measure of artist popularity
Research Questions

To which extent are microblogs used to communicate music listening activity? Are there differences between different countries of the world?

Is it possible to derive a spatio-temporal music popularity measure from microblogging activity?
Data Acquisition

preprocessing:
extract major cities of the world (>500,000 inhabitants) from World Gazetteer and geolocate them → [city, country, long., lat.]

- search for twitter posts including #nowplaying
  around the cities' coordinates (up to 1,500 posts per city)
- aggregate posts for each country
- calculate term frequency of each artist name within a country's posts
  (artist names extracted from most popular last.fm artists)

data acquisition took place from May to September 2010
Statistics and Evaluation

Distribution of music-related tweets around the world (absolute numbers)

- USA: 56.59%
- UK: 8.09%
- Brazil: 6.73%
- Canada: 4.36%
- Australia: 2.63%
- Indonesia: 2.34%
- Germany: 1.58%
- Japan: 1.47%
- Netherlands: 1.10%
- India: 0.97%
- Mexico: 0.90%
- Singapore: 0.88%

Mark Evans. *Exploring the Use of Twitter Around the World.*
http://blog.sysomos.com/2010/01/14/exploring-the-use-of-twitter-around-the-world (access: July 2011)
Statistics and Evaluation

Distribution of music-related tweets around the world (relative to no. of inhabitants)

- Netherlands
- Chile
- United States of America
- Indonesia
- Venezuela
- Japan
- Jamaica
- Brazil
- Mexico
- Dominican Republic
- United Kingdom
- South Korea

SWM @ IJCAI 07/2011
Microblogs for Spatio-Temporal Popularity Estimation of Music Artists

Markus Schedl
markus.schedl@jku.at | http://www.cp.jku.at/people/schedl

Statistics and Evaluation (II)

Comparison between \textit{twitter} and \textit{last.fm} data:

ground truth:
weekly charts by \textit{last.fm} for “metros” (for only 84 out of 790 data available)

analysis on different scopes: day-to-day (D2D), city-to-city (C2C), overall

quality measures: precision, recall, F1 measure, overlap

\[
\text{pre}c_{t,l} = \frac{|A_{t,l}^{tw} \cap A_{t,l}^{fm}|}{|A_{t,l}^{tw}|}
\]

\[
\text{rec}_{t,l} = \frac{|A_{t,l}^{tw} \cap A_{t,l}^{fm}|}{|A_{t,l}^{fm}|}
\]

\[
F_1 = \frac{2 \cdot \text{pre}c \cdot \text{rec}}{\text{pre}c + \text{rec}}
\]

\[
\text{overlap}_{t,l} = \frac{|A_{t,l}^{tw} \cap A_{t,l}^{fm}|}{\max\left(|A_{t,l}^{tw}|, |A_{t,l}^{fm}|\right)}
\]
Statistics and Evaluation (II)

Comparison between \textit{twitter} and \textit{last.fm} data:

<table>
<thead>
<tr>
<th>Property</th>
<th>D2D</th>
<th>C2C</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. number of artists in Twitter posts</td>
<td>21.97</td>
<td>410.49</td>
<td>2.490</td>
</tr>
<tr>
<td>Avg. number of artists in \textit{last.fm} charts</td>
<td>37.49</td>
<td>79.94</td>
<td>1.534</td>
</tr>
<tr>
<td>Avg. precision on \textit{last.fm} charts (%)</td>
<td>11.16</td>
<td>12.70</td>
<td>51.68</td>
</tr>
<tr>
<td>Avg. recall on \textit{last.fm} charts (%)</td>
<td>6.36</td>
<td>51.80</td>
<td>83.90</td>
</tr>
<tr>
<td>Avg. $F_1$-measure on \textit{last.fm} charts (%)</td>
<td>8.10</td>
<td>20.39</td>
<td>63.96</td>
</tr>
<tr>
<td>Avg. overlap between Twitter posts and \textit{last.fm} charts (%)</td>
<td>4.43</td>
<td>11.05</td>
<td>51.68</td>
</tr>
</tbody>
</table>

- almost no temporal correspondence between predictions
- ignoring time, modest recall between countries
Statistics and Evaluation (II)

Comparison between *twitter* and *last.fm* data:

Differences between cities?

\[\sigma_{\text{prec}} = 6.78\]
\[\sigma_{\text{rec}} = 24.03\]
Conclusions

- *twitter* used to different extent to communicate music listening activity (although corresponding to overall *twitter* usage)
- more data available on *twitter* than what is offered by *last.fm*’s API
- little overlap between different data sources

Future Work
- hybrid approaches that combine different data sources
- methods to account for different quantity and quality of information
- charts for subgroups of artists (e.g., different genres)
- charts on track level
Thank you!