Schizophrenia is a long-term mental health problem affecting approximately 1% of the general population. It is characterized by repeated psychotic relapse, with up to 82% of patients relapsing within 5 years from their initial psychotic episode. Social functioning is a common measure to monitor the risk of psychotic relapse. Monitoring of social functioning usually relies on infrequent clinic visits, limiting the capacity to detect sudden changes. Routinely collected GPS data from smartphones introduce novel opportunities to implement real-time monitoring of out-of-home activities that are related to social functioning.

Background

- Schizophrenia is a long-term mental health problem affecting approximately 1% of the general population.
- It is characterized by repeated psychotic relapse, with up to 82% of patients relapsing within 5 years from their initial psychotic episode.
- Social functioning is a common measure to monitor the risk of psychotic relapse.
- Monitoring of social functioning usually relies on infrequent clinic visits, limiting the capacity to detect sudden changes.
- Routinely collected GPS data from smartphones introduce novel opportunities to implement real-time monitoring of out-of-home activities that are related to social functioning.

Aim

To explore to what extent out-of-home activities can be assessed from geolocation data, routinely and passively collected with smartphones in schizophrenic patients.

Methods

Step 1: We conducted a five-day pilot study with schizophrenic patients. Participants used a smartphone to continuously record their GPS location, and completed a paper-based social functioning diary (SFD) to register out-of-home activities.

Step 3: We used the density-based algorithm and the time-based algorithm to detect geolocations visited by a person.

Step 4: We applied a modified k-means clustering algorithm to identify the coordinates of places visited from geolocations visited.

Step 5: We used a series of heuristic rules and combined information from web services (i.e., Google Place API, GeoNames) and the OpenStreetMap (OSM) platform to identify the real world place associated to each place visited.

Step 6: We inferred the activities that patients performed in a real world place with the use of a taxonomy.

Results

Table 1: Five patients participated in our pilot study.

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Total number of days</th>
<th>Total number of hours</th>
<th>Total number of SFD activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>20</td>
<td>396.6</td>
<td>35</td>
</tr>
<tr>
<td>Mean (sd)</td>
<td>4 (1)</td>
<td>79.3 (30.6)</td>
<td>7 (2.9)</td>
</tr>
<tr>
<td>Range</td>
<td>3 - 5</td>
<td>36.8 - 109.9</td>
<td>3 - 11</td>
</tr>
</tbody>
</table>

Table 2: We assessed performance with Recall and Precision.

<table>
<thead>
<tr>
<th>Algorithm</th>
<th>Recall</th>
<th>Precision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time-based</td>
<td>0.600 (0.163)</td>
<td>0.909 (0.096)</td>
</tr>
<tr>
<td>Density-based</td>
<td>0.714 (0.168)</td>
<td>0.714 (0.157)</td>
</tr>
</tbody>
</table>

Conclusion

- This study has demonstrated the feasibility to assess out-of-home activities from geolocation data that is routinely collected with smartphones.
- This provides novel opportunities to prevent relapse in schizophrenic patients.
- In the future, more sophisticated analytical methods will be investigated to obtain better performance.