Measuring Self-Esteem with Passive Sensing

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SocWeB

CBA
Figure: Maslow’s Hierarchy of Needs
Sensors Everywhere
The average smartphone has at least 10 sensors. Here are the most common.

- **Camera**
  What would you do without your selfies?

- **Proximity Sensor**
  This is what keeps you from accidentally pressing buttons with your cheek during calls!

- **Pedometer**
  More and more phones are including a fitness element. Experts recommend 10,000 steps a day.

- **Light Sensor**
  Have you ever turned your phone on in the dark and had it been too bright? Your light sensor may have been malfunctioning.

- **Magnetometer**
  The magnetometer measures the strength of the magnetic field around the device to determine what direction it is moving.

- **Accelerometer**
  Have you ever wondered how your phone knows which way you are holding it to display vertically vs. horizontally? The accelerometer is the answer!

- **Thermometer**
  If you’ve ever left your phone out in the sun you’ve most likely seen it turn off due to heat. The thermometer is useful to monitor internal operating temperature.

- **Gyroscope**
  If you like taking non-blurry photos you have the gyroscope to thank. It helps to correct for camera shake.

- **Fingerprint Sensor**
  The new fingerprint sensor adds an extra layer of security to your phone.

- **Microphone**
  The oldest sensor on any phone. Microphones make it possible for others to hear what you are saying.
Can we automatically and scalably predict self-esteem using passive sensing modalities available on commodity devices?
Study and Dataset
Study and Dataset

CampusLife

51 Participants

- Smartphone
- Social Media
- Surveys

By leveraging passive sensors, this study aims at predicting well-being of students.
Prediction Methodology

**Ground-truth**
- EMA-based surveys of self-esteem
- Physical, Social, and Appearance self-esteem

**Statistical Modeling**
- Features: Passive sensing data (calls, text, conversational frequencies, physical activities)
- Regression
## Results

<table>
<thead>
<tr>
<th>Model</th>
<th>Performance</th>
<th></th>
<th>Social</th>
<th></th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$R^2$</td>
<td>$r$</td>
<td>SMAPE</td>
<td>$R^2$</td>
<td>$r$</td>
</tr>
<tr>
<td>GBR</td>
<td>0.46</td>
<td>0.42**</td>
<td>8.61</td>
<td>0.83</td>
<td>0.77***</td>
</tr>
</tbody>
</table>

![Graphs showing predicted vs. actual performance, social, and appearance SE](image-url)
### Feature Importance

<table>
<thead>
<tr>
<th>Features</th>
<th>Performance</th>
<th>Social</th>
<th>Appearance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calls</td>
<td>0.29***</td>
<td>0.28***</td>
<td>0.26***</td>
</tr>
<tr>
<td>Texts</td>
<td>0.27***</td>
<td>0.11***</td>
<td>0.31***</td>
</tr>
<tr>
<td>Conversations</td>
<td>0.21***</td>
<td>0.25***</td>
<td>0.15***</td>
</tr>
<tr>
<td>Phy. Activity</td>
<td>0.23***</td>
<td>0.37***</td>
<td>0.28***</td>
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Takeaways

• Passively sensed data can measure self-esteem.

• Wellbeing in situated communities

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