Social Media for Mental Health: Opportunities, Challenges, and The Road Ahead

Munmun De Choudhury
Assistant Professor, School of Interactive Computing, Georgia Tech + Faculty Associate, Berkman Center for Internet and Society, Harvard

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Emotion
Social Interactions
Language
Mental health and well-being
Individual

- Diagnosis
- Risk/Early-warning systems
- Support and Psychotherapy
- Interventions and treatment

Population
Behavioral Changes of New Mothers

Blue line represents approximate time of childbirth. The red line represents mothers and the green line represents the background cohort.
Patient Health Questionnaire (PHQ-9)

- the 9-item questionnaire seeks responses over the past two week period
- based directly on the nine diagnostic criteria for major depressive disorder in the DSM-IV (Diagnostic and Statistical Manual Fourth Edition)
- scores on the PHQ-9 range from zero to 27; individuals with scores 15 or above are considered to be moderately severe to severely depressed (Kroenke et al. 2001)

<table>
<thead>
<tr>
<th></th>
<th>Not at all</th>
<th>Several days</th>
<th>More than half the days</th>
<th>Nearly everyday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little interest or pleasure in doing things</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feeling down, depressed, or hopeless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Trouble falling or staying asleep, or sleeping too much</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feeling tired or having little energy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Poor appetite or overeating</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Feeling bad about yourself — or that you are a failure or have let yourself or your family down</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Trouble concentrating on things, such as reading the newspaper or watching television</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

(De Choudhury, Counts, Horvitz, Hoff, CSCW 2014)
Social media depression index

\[ SMDI(t) = \frac{n_d(t) - \mu_d}{\sigma_d} - \frac{n_s(t) - \mu_s}{\sigma_s} \]

standardized difference between frequencies of depression-indicative and standard posts, compared to a period before between \( k \) and \( t-1 \) \((1 \leq k \leq t-1)\)

actual (CDC data)  predicted (SMDI)

least squares regression fit yields correlation of 0.52
Can social media characterize recovery?

(Tamersoy, De Choudhury, Chau, Hypertext 2015)
Can social media characterize recovery?

<table>
<thead>
<tr>
<th>Model</th>
<th>StopSmoking (SS)</th>
<th>StopDrinking (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deviance df χ² p-value</td>
<td>Deviance df χ² p-value</td>
<td></td>
</tr>
<tr>
<td>Null</td>
<td>880.3 0 441.4 &lt; 10⁻⁶</td>
<td>738.9 0 385.4 10⁻³</td>
</tr>
<tr>
<td>Language</td>
<td>438.9 304 461.8 &lt; 10⁻⁷</td>
<td>353.5 309 398.1 10⁻³</td>
</tr>
<tr>
<td>Language + Addiction</td>
<td>418.5 309 461.8 &lt; 10⁻⁷</td>
<td>340.8 309 398.1 10⁻³</td>
</tr>
<tr>
<td>Language + Addiction + Interaction</td>
<td>326.9 357 553.4 &lt; 10⁻⁹</td>
<td>273.2 357 465.7 10⁻⁴</td>
</tr>
</tbody>
</table>

Our findings indicate that linguistic and interaction cues gleaned from activity in SS and SD forums may be used to understand short-term and long-term abstinence tendencies of the users in the testing partitions; for each threshold value, all users with probabilities above that value are labeled as long-term abstainers, or short-term abstainers otherwise. This process also achieves a mean accuracy of 0.85, a mean precision of 0.88, a mean recall of 0.82, and a mean specificity of 0.88. This model also achieves a mean F1 score of 0.86 and 0.85 in SS and SD, respectively.

To evaluate how well our three statistical models distinguish the long-term smoking or drinking abstinence [36], our research can also be carefully designed and developed. However, if successful, systems could raise ethical and privacy concerns, and must therefore be designed and developed. Considering the minimum of the values for SS and SD, this model also achieves the mean F1 scores of 0.86 and 0.85 in SS and SD, respectively.

In general, we observe that the best performing model in both StopSmoking (SS) and StopDrinking (SD) is Language + Addiction + Interaction, which achieves the mean F1 scores of 0.86 and 0.85 in SS and SD, respectively.
Can social media predict relapse?

New approach: Survival analysis + Cox regression model that handles collinearity of *n*-grams

Linguistic cues reveal that “survival” i.e., not experiencing a smoking/drinking relapse on the community is protracted.
Intervention Implications

If you or someone you know is struggling with thoughts of suicide, the Lifeline is here to help: call 1–800–273–8255

If you are experiencing any other type of crisis, consider chatting confidentially with a volunteer trained in crisis intervention at www.imalive.org, or anonymously with a trained active listener from 7 Cups of Tea.

And, if you could use some inspiration and comfort in your dashboard, you should consider following the Lifeline on Tumblr.
Pro eating disorder communities

Disclaimer: some content above are graphic

- These communities promote eating disorders as a legitimate lifestyle
- Extensive self-injury and emotionally vulnerable content
Intervention Implications

Everything okay?
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Go back

View search results
But deviant behavior subverts attempts to intervene

Increasing and more complex lexical variations have emerged since Instagram enforced moderation of pro eating disorder content in 2012.

- anorexic, anorexie, anoressia, anorexi, anorexia, anorexique, anorexica, anorectic, anorexia, anoretic
- eatingdisorders, eatingdisorder, eatingdisoder, eatingdis, eatingdisorderer, eatingdisoreder, eatingdisorde, eatingdisorderrr, eatingdisordered, eating_disorder
- thighgaps, thygap, thighgapp, thigh_gap, thightgap, thyghgap, thighgapppp, thegap, thigap, thigap, thighgapss
- thinspoooo, thynspo, thynspoo, thynspoo, thinspoo, thinspoo, thynspoooo, thinspo, thinspoooooo

(Full text with tables and diagrams is not included here.)
Moderation was followed by increased social engagement

(Chancellor, Pater, Clear, Gilbert, De Choudhury, forthcoming 2015)
• Mental health support is a complex ecosystem online
• Language is extremely valuable and has potential for both diagnosis and intervention
• But many practical, ethical and privacy issues remain to be answered
Thanks!

Questions?

mchoudhu@cc.gatech.edu
@munmun10