Assessing Mental Health Issues on College Campuses: Preliminary Findings from a Pilot Study

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1 in 5 adults in the U.S. has mental illness in a year
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1 in 4 college students in the U.S. has mental illness in a year
Based on 19,681 students over 40 schools,

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However, 40% of them did not seek help.
Barriers to Accessing Support

<table>
<thead>
<tr>
<th>Reasons</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stigma</td>
<td>36</td>
</tr>
<tr>
<td>Busy Schedule</td>
<td>34</td>
</tr>
<tr>
<td>Hours of Services</td>
<td>25</td>
</tr>
<tr>
<td>Lack Information</td>
<td>24</td>
</tr>
<tr>
<td>Long Wait</td>
<td>16</td>
</tr>
<tr>
<td>Other</td>
<td>15</td>
</tr>
</tbody>
</table>
Appointment Wait Times

<table>
<thead>
<tr>
<th>Days to wait</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>≥ 5 Days</td>
<td>39</td>
</tr>
<tr>
<td>2~4 Days</td>
<td>20</td>
</tr>
<tr>
<td>1~2 Days</td>
<td>23</td>
</tr>
<tr>
<td>1 Day</td>
<td>18</td>
</tr>
</tbody>
</table>
Ratio of student to psychological counselors is 1900 : 1
A new tool to monitor students’ behavior and assess their mental well-being continuously and unobtrusively is needed.
86% of US college student regularly use a smartphone.
Pilot Study - Smartphone Based Mental Health Assessment Tool

- Conducted in an Ubicomp class in the Spring term (4 months) at Cornell University.

- Cornell health center was involved.

- 22 participants (12 females and 10 males) participated.
Pilot Study - Smartphone Based Mental Health Assessment Tool

- App was run on iOS and Android devices.
- Both self-assessment survey and passive sensing data were collected.
Well-being Survey
Sleep Survey
Photographic Affect Meter (PAM) Survey

Beginning, midterm, end of semester
10:30 AM
10:30 AM
4:30 PM
Photographic Affect Meter (PAM) Survey
Survey Data

Sensor Data

Activity  Call  Audio  Location  Charging
Survey Data - Sleep Duration Over Weekdays and Weekends

The graph shows the sleep duration (in hours) over the course of a week, with data points for each day of the week. The graph indicates a trend where sleep duration is generally lower on weekdays (Monday to Thursday) and higher on weekends (Friday to Sunday). The specific data points are not provided in the image.
Survey Data - Sleep Duration During Study and Exam Period

- Overall
- February break
- Spring break
- Exam
The **low-dimension structures** of students’ sensor data might be indicative of the **underlying pattern** of their daily behavior.
Robust PCA - Method for Recovering Corrupted Low-Rank Matrices

Given high-dimension data $D$, decompose $D$ into $A$ and $E$.

where $D = A + E$.

Low-rank component  Sparse component (gross errors)

Robust PCA - Method for Recovering Corrupted Low-Rank Matrices

Given high-dimension data $D$, decompose $D$ into $A$ and $E$.

$$D = A + E.$$
Robust PCA - Finding Underlying Behavioral Pattern

Given high-dimension data $D$, decompose $D$ into $A$ and $E$.

where $D = A + E$.

Low-rank component
Sparse component (gross errors)

$D$ Raw Sensor Data $A$ Underlying Pattern $E$ Noise
Example - The Raw Sensor Data from One User

Raw Activity Data

#seconds user being active during an hour
Example - The Low-rank Matrix from the User’s Sensor Data

\[
\text{Raw Activity Data} \quad \Rightarrow \quad \text{RPCA} \quad \Rightarrow \quad \text{Underlying Activity Pattern}
\]

Low-rank matrix after decomposition
Example - The Low-rank Matrix from the User’s Sensor Data
Example - The Low-rank Matrix from the User’s Sensor Data
Example - The Low-rank matrix from the User’s Sensor Data
Next Step - Identifying the Change of Behavioral Pattern

Underlying Behavioral Pattern

Activity       Audio       Phone Use

Mental Well-Being GPA
Future Work - Early Intervention

Help students manage their own mental welling and introduce timely mental health service from their caregivers.
Thank you!