Ubiquitous and Mobile Computing

CS 528: *StudentLife: Assessing Mental Health, Academic Performance and Behavioral Trends of College Studnets using Smartphones*

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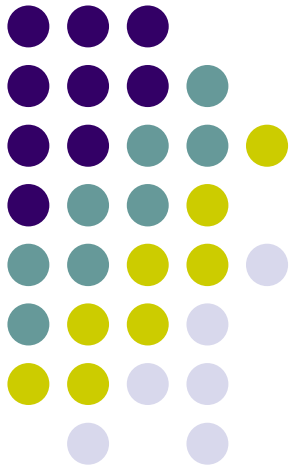
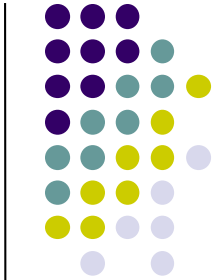


StudentLife: Assessing Mental Health, Academic Performance and Behavioral Trends of College Studnets using Smartphones

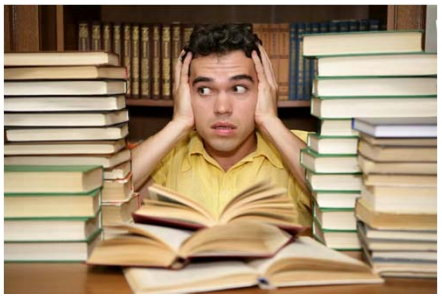


- Motivation
- Related Work
- Methodology
- Dataset
- Result
- Conclusions‼

Motivation

- why do students burnout, drop classes, do poorly, drop out of college when others excel?
- what is the impact of stress, mood, workload, sociability, sleep and mental health on academic performance?
- Is there a set of behavioral trends or signature?

Stress hidden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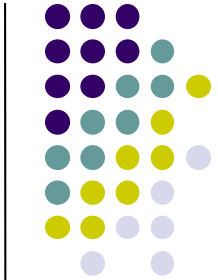

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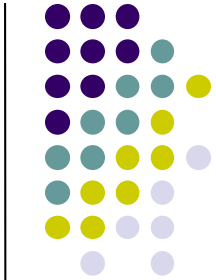
Related Work: using smartphone sensing to infer human health



- Patient health:

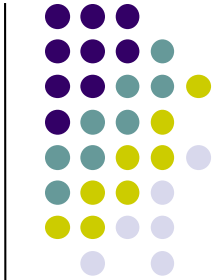
- M. Rabbi: use wearable sensors to study the physical /mental well-being of a group of 8 seniors living in a retirement community. The first to find correlations with depression and continuous sensing data.
- M. Frost, J. E. Bardram: use self-assessment and sensor data from smartphone to study patients' mood. They find that self-reported activity, stress, sleep and phone usage are strongly correlated with self-reported mood.

- Student Health and performances :

- M. T. Trockel: study the effect of behaviors (*i.e.*, social support, sleep habits, working hours) on grade points based on 200 students. It uses survey data manually entered by users to assess health and performance.
- J. I. Watanabe: uses wearable sensors to study the correlation between students interactions with each other during break times and scholastic performance.

- Little work on correlations of sensing data / mental health
- No work has used smartphone sensing to study student health / performance

New about this work:



- Use smartphone sensing to assess mental health, academic performance, behavioral trends.
- identify strong correlation between automatic sensing data and a broad set of well-known mental well- being measures.
- observe trends in the sensing data.

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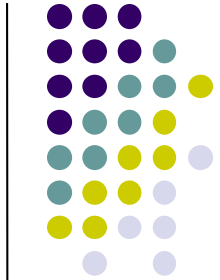

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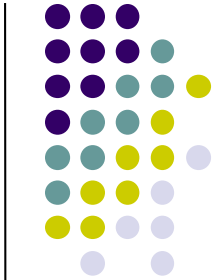
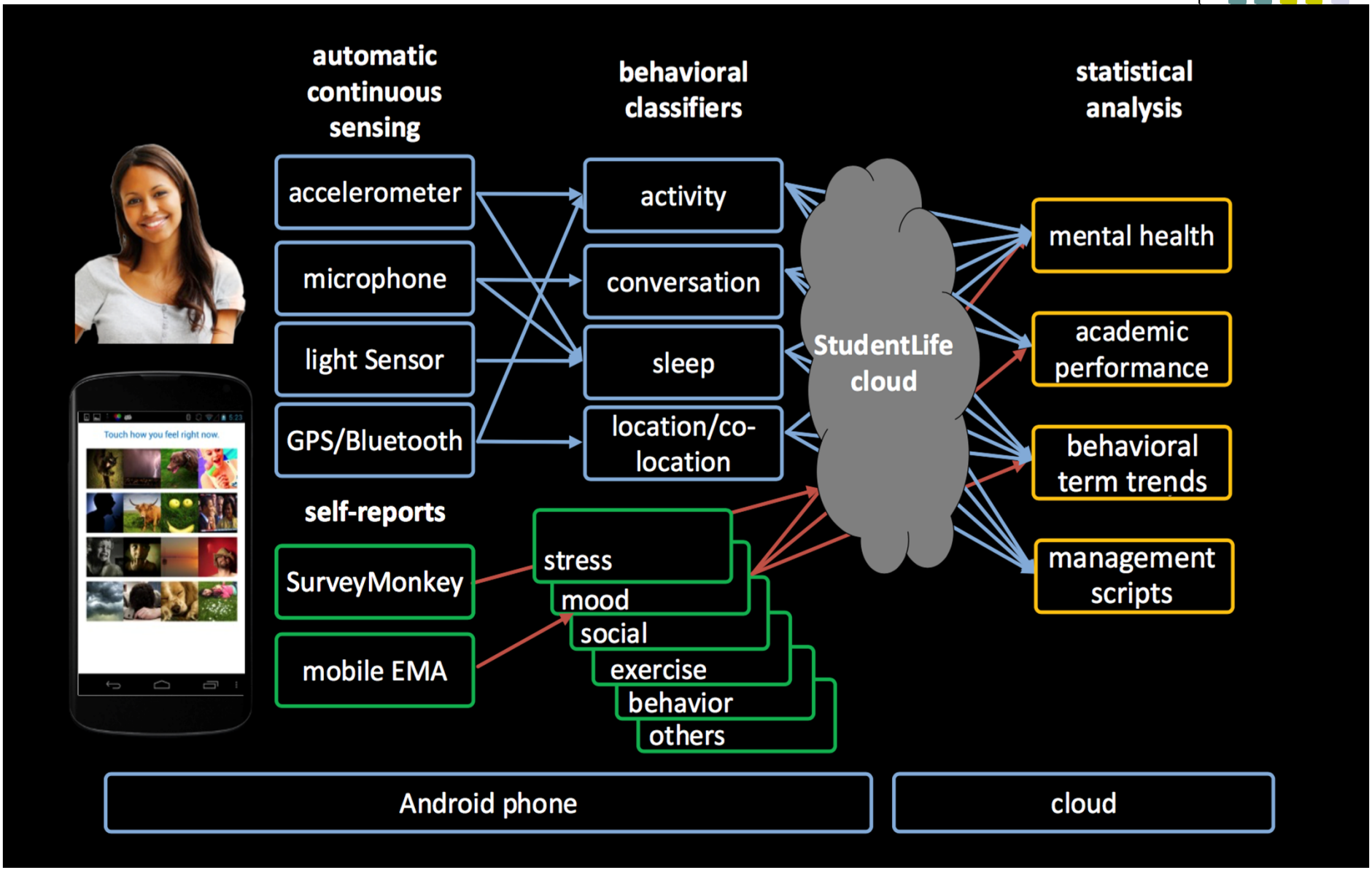
Methodology: study design



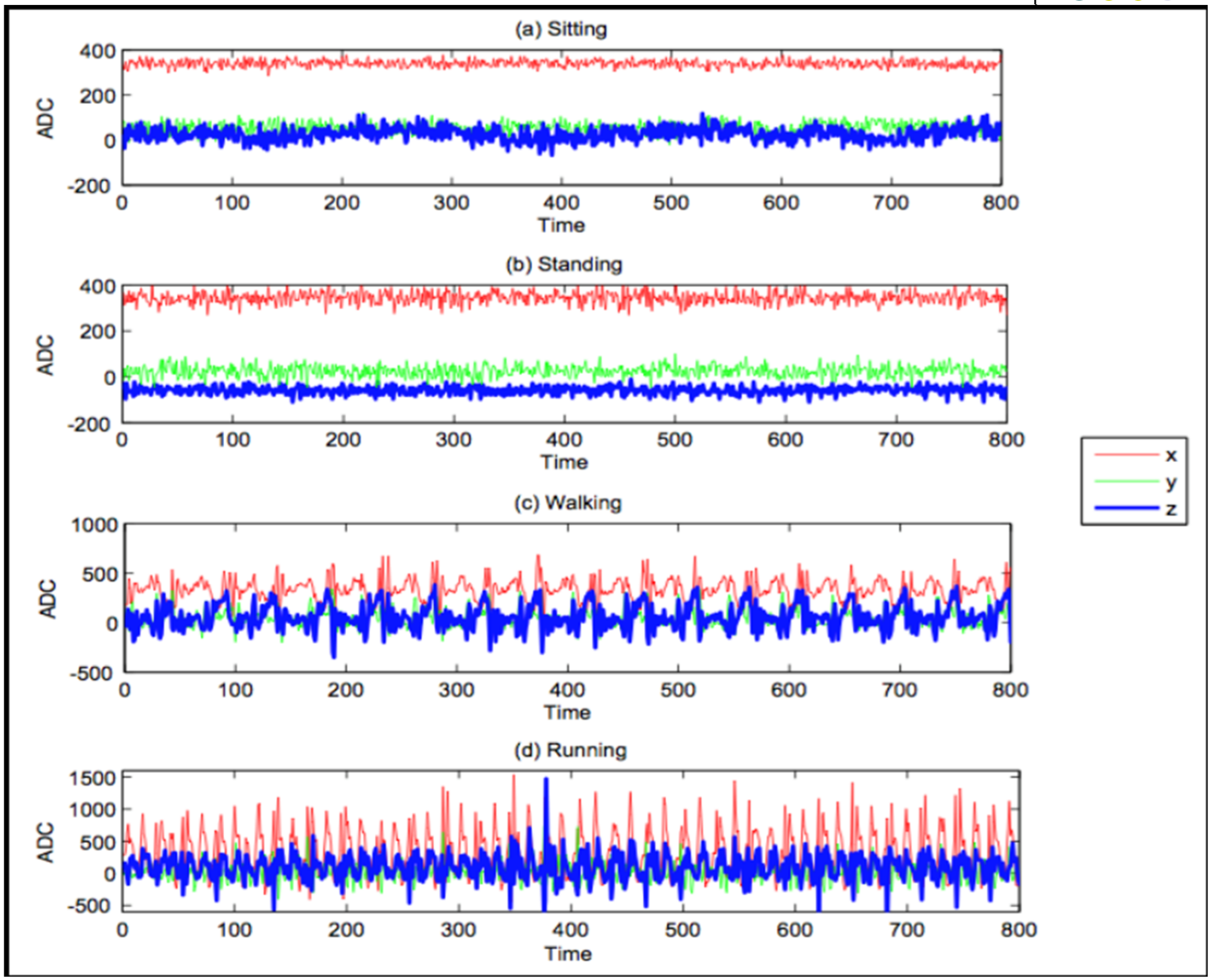
- 48 students over 10 week Spring 2013 term
- 10 female, 38 male
- 30 undergraduates, 18 graduates
- 8 seniors, 14 juniors, 6 sophomores, 2 freshmen, 3 Ph.D students, 1 second-year Masters student, and 13 first-year Masters students
- 23 Caucasians, 23 Asians and 2 African-Americans.

Methodology: sensing system

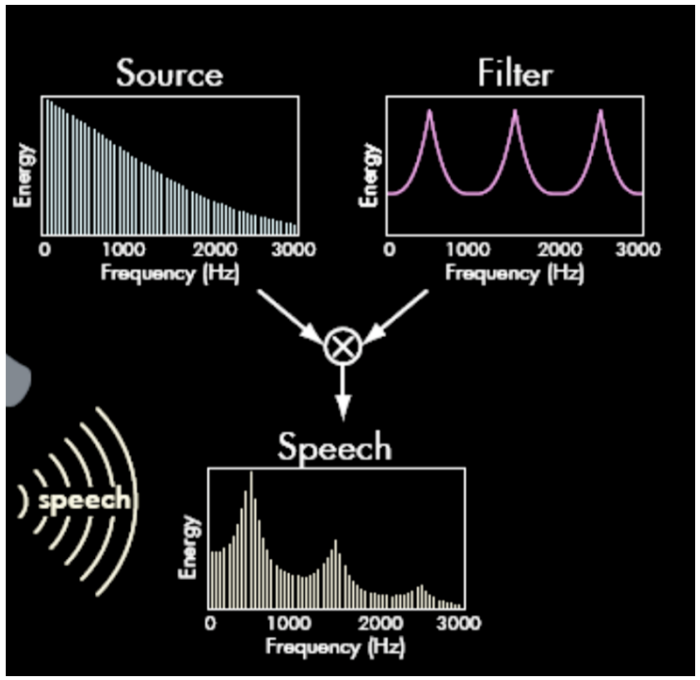


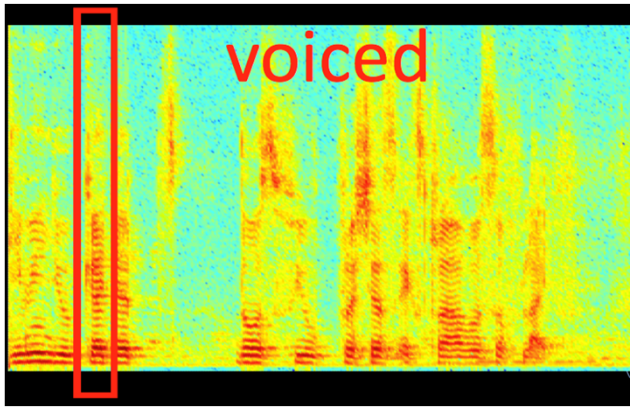
Methodology: classifiers ---- Activity

- ✓ Sitting
- ✓ Standing
- ✓ Walking
- ✓ running



Methodology: classifiers --- Conversation





Audio Classifier

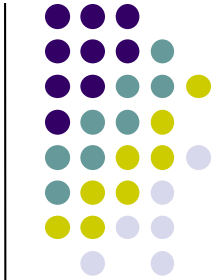
Conversation Classifier

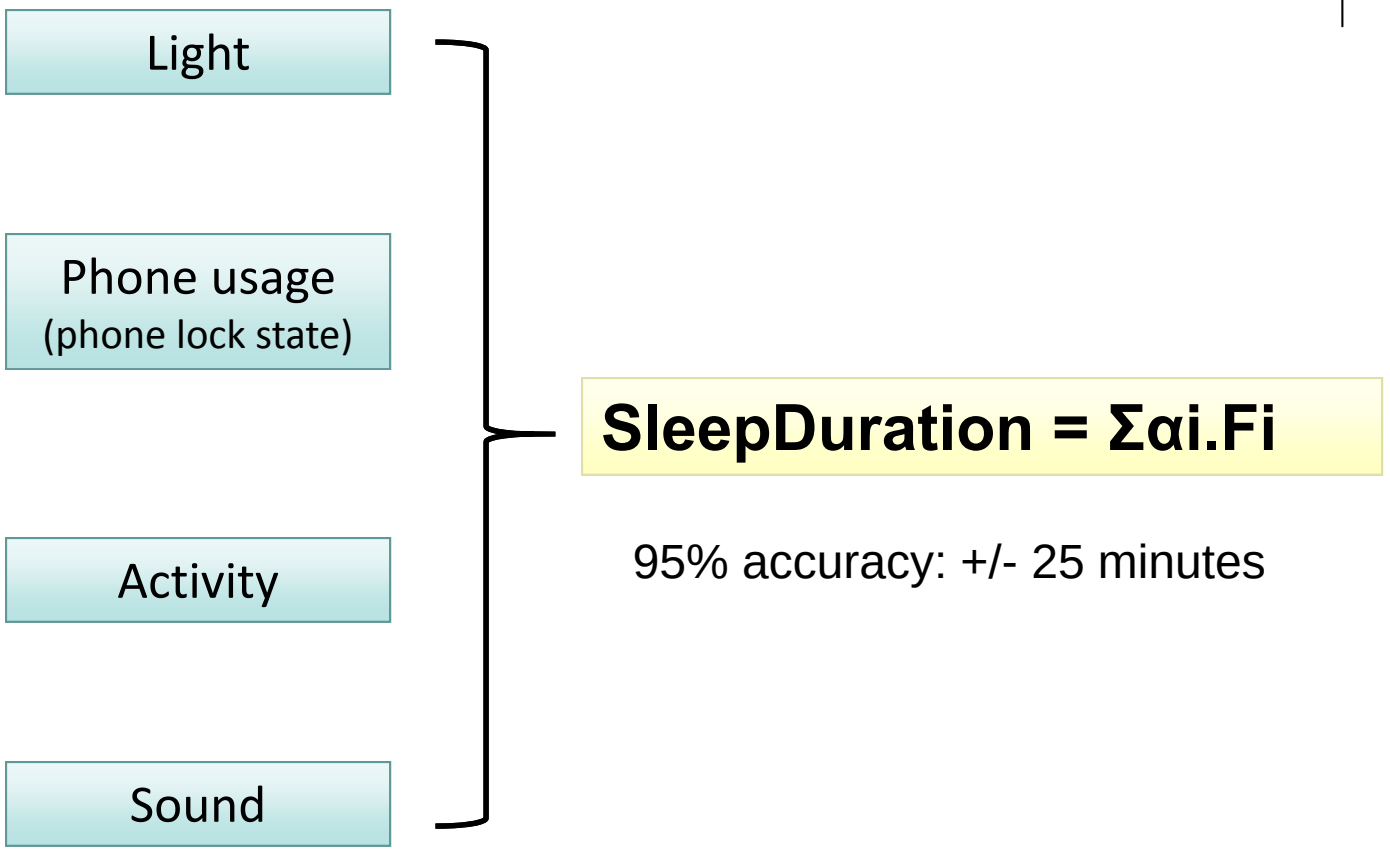
Around Conversation:

oNumber of Conversation

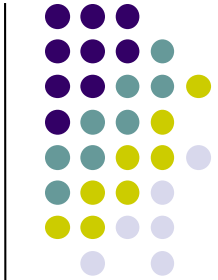
oConversation Duration

Methodology: classifiers --- Sleep





StudentLife DataSet



Automatic sensing :

52.6GB of sensing inferences over a 10 week period

data included :

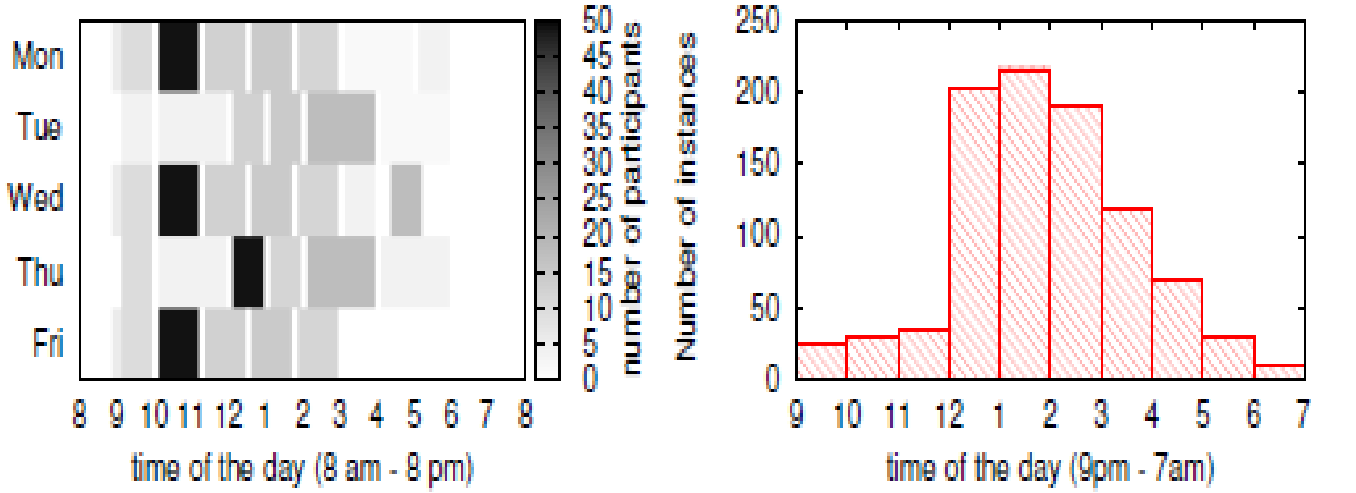
- activity data (type and duration)
- conversation (duration and frequency)
- sleep data (duration and time)
- location

EMA Data:

- 35,295 responses from 48 students over 10 weeks period
- Data was automatically uploaded to the cloud whenever students charged their phones under WiFi
- EMA's were scheduled surveys on stress, mood, sleep, physical activity and behavior.

StudentLife DataSet

- Epochs (time of day)



(a) Meeting time for all classes over the term (b) Sleep onset time distribution for all students over the term

Figure 4. Statistics on class meeting times and sleep onset time (i.e., bedtime).

Survey Instrument Data

There were three types of surveys: Pre, post and during .

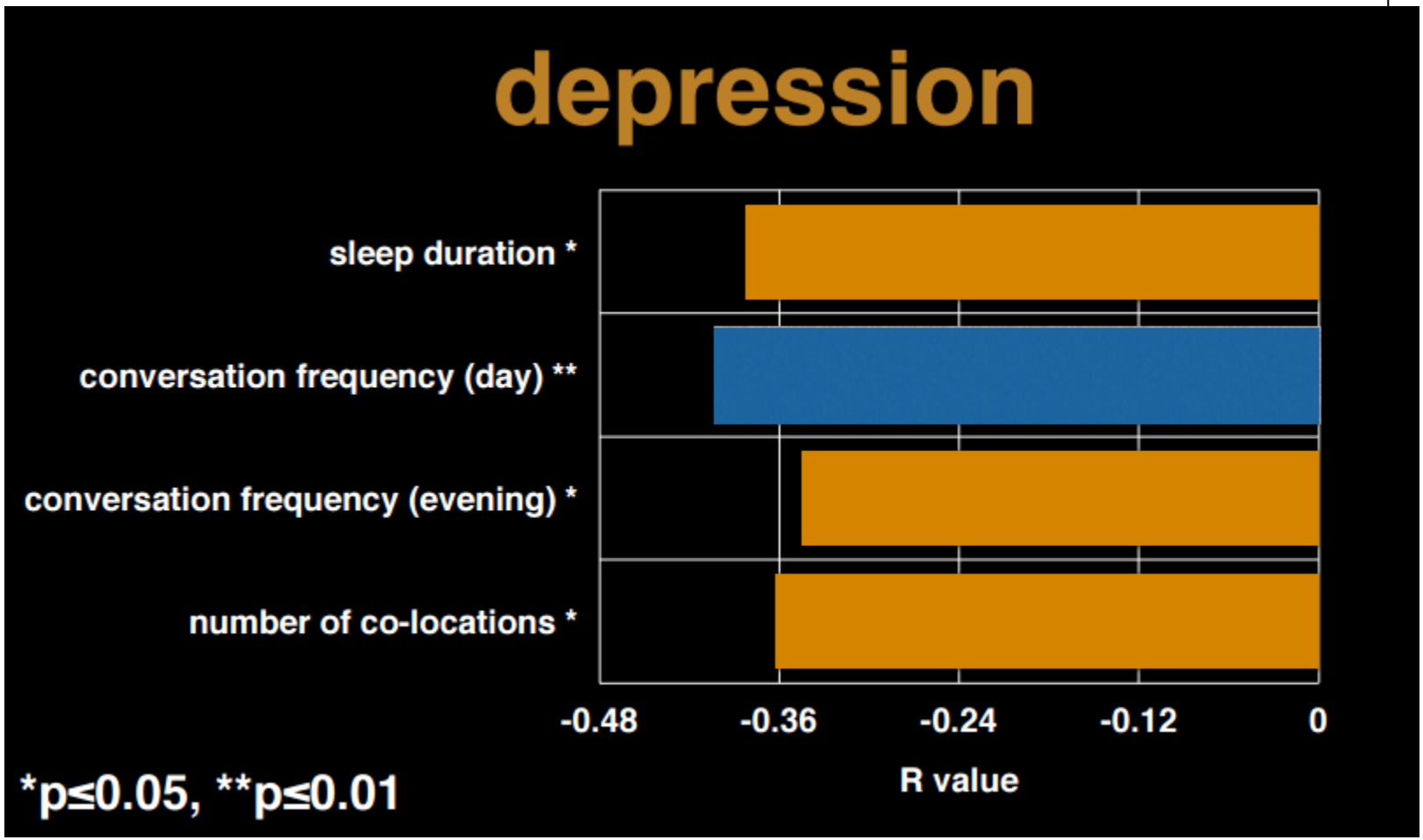
Table 1. Mental well-being surveys.

survey	measure
patient health questionnaire (PHQ-9) [26]	depression level
perceived stress scale (PSS) [17]	stress level
flourishing scale [19]	flourishing level
UCLA loneliness scale [36]	loneliness level

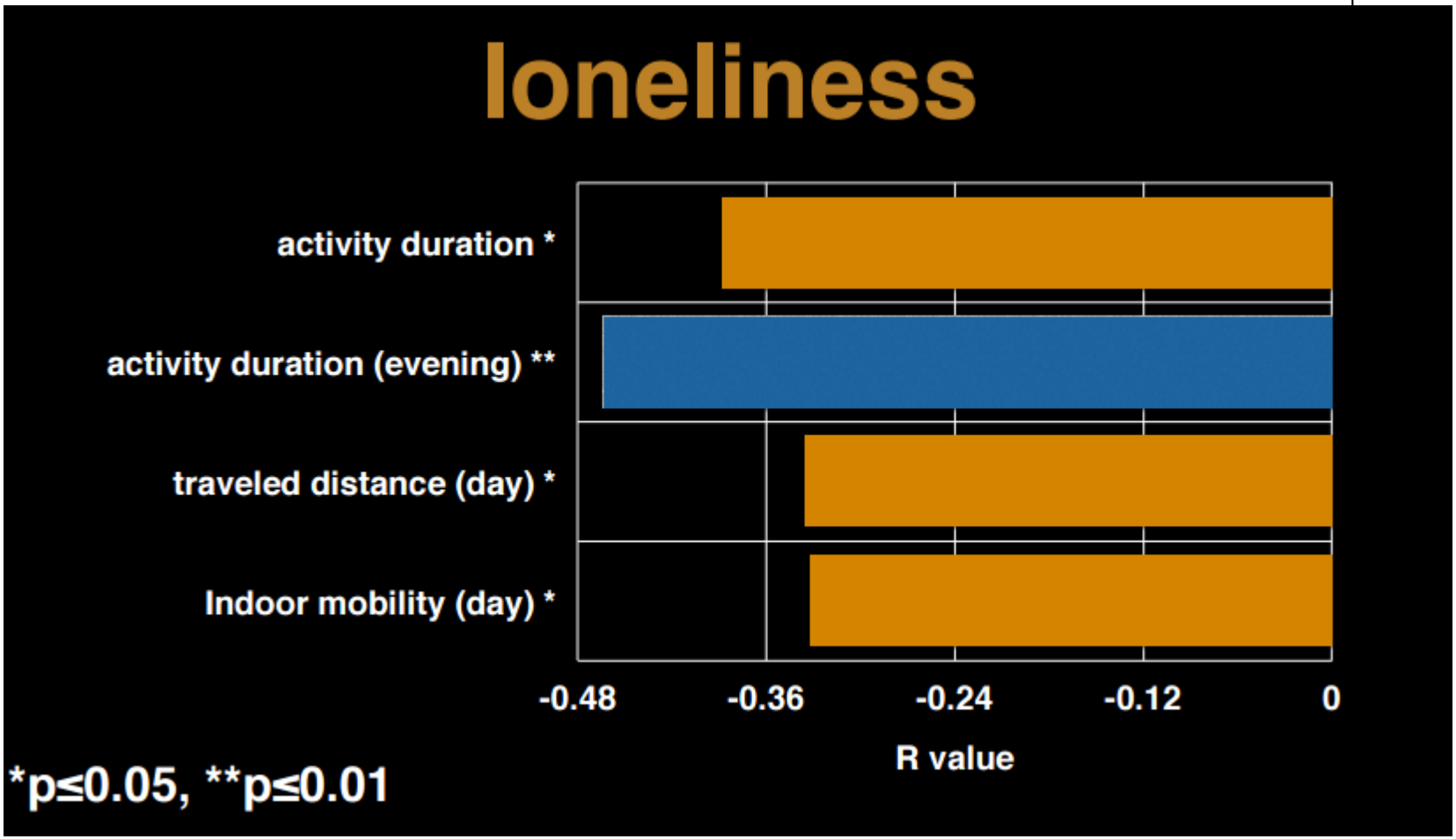
Table 2. PHQ-9 depression scale interpretation and pre-post class outcomes.

depression severity	minimal	minor	moderate	moderately severe	severe
score	1-4	5-9	10-14	15-19	20-27
number of students (pre-survey)	17	15	6	1	1
number of students (post-survey)	19	12	3	2	2

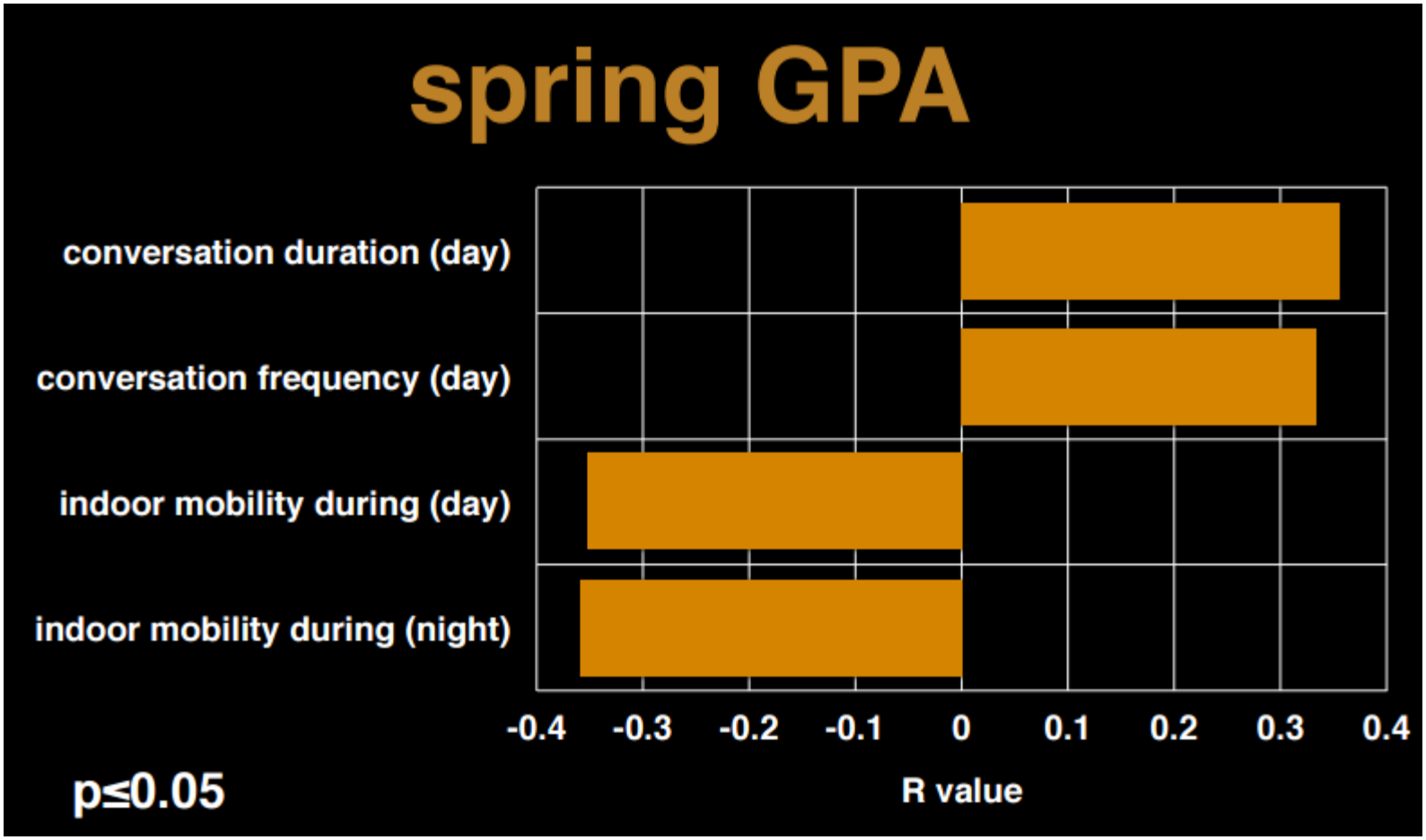
Results


depression
sleep duration *
conversation frequency (day) **
conversation frequency (evening) *
number of co-locations *
-0.48
-0.36
-0.24
-0.12
0
R value
*p≤0.05, **p≤0.01

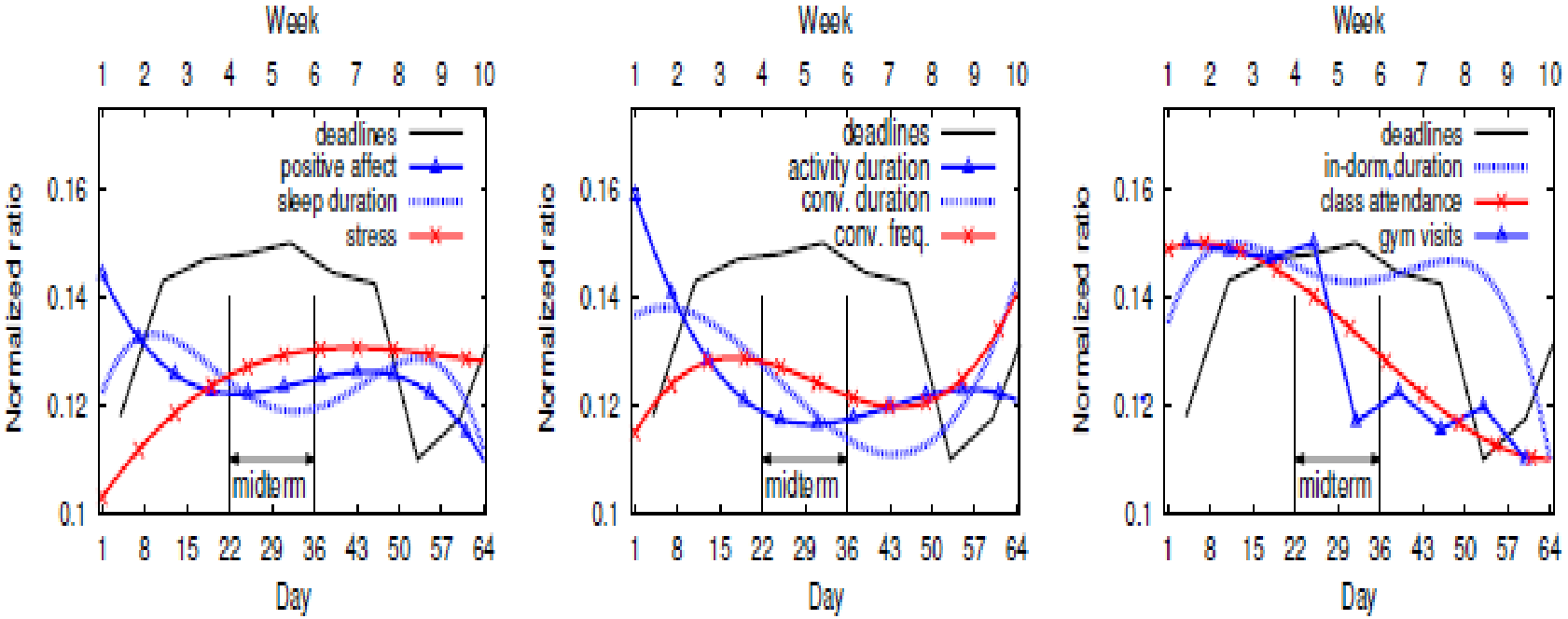
Results


loneliness
activity duration *
activity duration (evening) **
traveled distance (day) *
Indoor mobility (day) *
-0.48
-0.36
-0.24
-0.12
0
R value
*p≤0.05, **p≤0.01

Results


spring GPA
conversation duration (day)
conversation frequency (day)
indoor mobility during (day)
indoor mobility during (night)
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
R value
p≤0.05

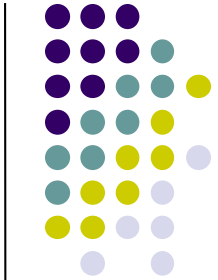
Results



(a) EMA and sleep data (b) Automatic sensing data (c) Location-based data

Figure 5. Dartmouth term lifecycle: collective behavioral trends for all students over the term.

Conclusion



- The project focused on StudentLife sensing system and results from a 10-week deployment.
- A number of insights into behavioral trends, and importantly, correlations between objective sensor data from smartphones and mental well-being and academic performance for a set of students at Dartmouth College were determined.
- This is the first-of-its-kind smartphone sensing system and study . (contribution)
- Their questions revolved around understanding correlation between stress, behavior and grades, in the future they plan to take this work to the University of Texas, Austin.

References

- *Rui Wang, Fanglin Chen, Zhenyu Chen, Tianxing Li, Gabriella Harari, Stefanie Tignor, Xia Zhou, Dror Ben-Zeev, and Andrew T. Campbell. "StudentLife: Assessing Mental Health, Academic Performance and Behavioral Trends of College Students using Smartphones." In Proceedings of the ACM Conference on Ubiquitous Computing. 2014.*
- *http://studentlife.cs.dartmouth.edu/*
- _Rui Wang "StudentLife: *Assessing Mental Health, Academic Performance and Behavioral Trends of College Students using Smartphones", ACM UbiComp, Sept 15, 2014*