## **SmartGPA: How Smartphones Can Assess and Predict Academic Performance of College Students**

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# performance







## Blackboard





# SAT

















## StudentLife

StudentLife is the first study that uses passive and automatic sensing data from the phones of a class of 48 Dartmout term to assess their mental health (e.g., depression, loneliness, stress), academic performance (grades across all the cumulative GPA) and behavioral trends (e.g., how stress, sleep, visits to the gym, etc. change in response to college assignments, midterms, finals -- as the term progresses).

Much of the stress and strain of student life remains hidden. In reality faculty, student deans, clinicians know little about outside of the classroom. Students might know about their own circumstances and patterns but know little about class student life we develop the first of a kind StudentLife smartphone app and sensing system to automatically infer human students do better than others? Under similar conditions, why do some individuals excel while others fail? Why do students





# we extend studentlife





## class attendance, studying and partying









# semantics of location

**Chinese Language House** 

WFRD

Choate House

ainst

\_ittle Hall

North Hall

El Hajj Malik El Shabazz

Brown Hall

Webster Cottage

Carson Hall

Sherman Library

Baker-Berry Library

Haldeman Center

Dartmouth Beta

DartmouthCollege: Rockefeller Center

Silsby Hall

**Butterfield Hall** 

el Hall

Russell Sage

Moore Psychology Bldg

Byrne II Hall

Native American House

Raven House

Berry

Parker, House

Dartmouth College Sudikoff Lab

-

he Church of Christ at Dartmouth College

Fairchild Hall





## study areas



## activity

### sound







## studying







# attending classes and studying



week







## party places

## sound

### activity co-location





# partying

# partying trends across the term





## party duration



## study duration







### behaviors features



88

83

22

88

88.88

8.88.88

8888

88





## capturing the dynamics of behavior





week











# behavior term slope

### term slope = 0.29

week



# behavior term slope

### term slope = 0.29

9

## midterm

6 8

week

5

# pre/post midterm slope



# post-slope = -0.86midterm

6 5 8 9 7

week

# breakpoint — when students change their behavior to adapt









week

# breakpoint — how to compute



- iteratively select every week as breakpoint
- use one or two linear regressions to fit the data before and after the breakpoint





# breakpoint — how to compute

9

![](_page_25_Picture_3.jpeg)

 use one or two linear regressions to fit the data before and after the breakpoint

![](_page_25_Picture_5.jpeg)

![](_page_26_Figure_1.jpeg)

# breakpoint — how to compute

9

![](_page_26_Picture_3.jpeg)

use one or two linear regressions to fit the data before and after the breakpoint

![](_page_26_Picture_5.jpeg)

![](_page_27_Figure_2.jpeg)

## breakpoint — how to compute

### $MSE_6$

we use Bayes Information Criterion to select the breakpoint

![](_page_28_Picture_0.jpeg)

![](_page_28_Picture_1.jpeg)

![](_page_28_Picture_2.jpeg)

![](_page_28_Picture_3.jpeg)

![](_page_28_Picture_5.jpeg)

## studying, partying and GPA

![](_page_29_Figure_1.jpeg)

study focus - activity

study focus - audio

party duration

-0.45

![](_page_29_Figure_6.jpeg)

**R** value

# studying, partying changes and GPA

pre-midterm class attendance

pre-midterm study duration

after-midterm conversation duration

0

![](_page_30_Figure_5.jpeg)

![](_page_31_Picture_0.jpeg)

![](_page_31_Picture_1.jpeg)

## what models can predict GPA?

![](_page_31_Picture_3.jpeg)

![](_page_31_Picture_4.jpeg)

![](_page_32_Figure_0.jpeg)

## use lasso to regularize training

![](_page_32_Figure_2.jpeg)

leave-one-out cross validation

# se ectec features

## three sensor-based behavioral features

- conversation duration night breakpoint
- conversation duration evening term-slope
- study duration

## three EMA features

- positive affect
- positive affect post-slope
- stress term-slope

one personality

conscientiousness

![](_page_34_Figure_0.jpeg)

absolute error

# prediction performance

goodness of fit: •  $R^2 = 0.559$ • r = 0.81, p < 0.01

our model can distinguish high and **lower performers** 

## MAE = 0.179

0.4 0.5

![](_page_34_Picture_7.jpeg)

![](_page_35_Picture_0.jpeg)

![](_page_36_Picture_0.jpeg)

![](_page_37_Picture_0.jpeg)

## Thanks, I'm done