WPI

StudentSADD:
Rapid Mobile Depression and Suicidal Ideation Screening of College Students during the Coronavirus Pandemic

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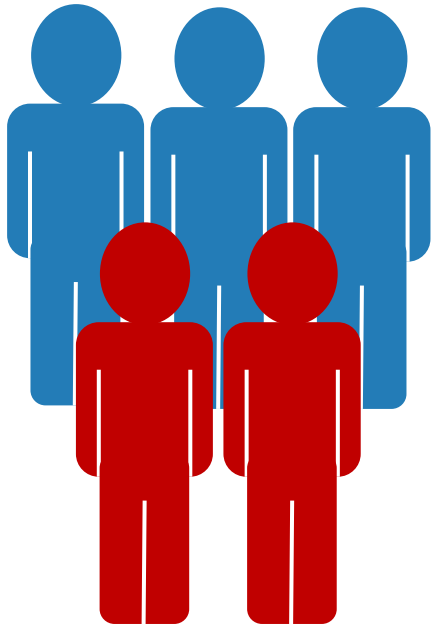
ACM IMWUT 6(2) & UbiComp 2022

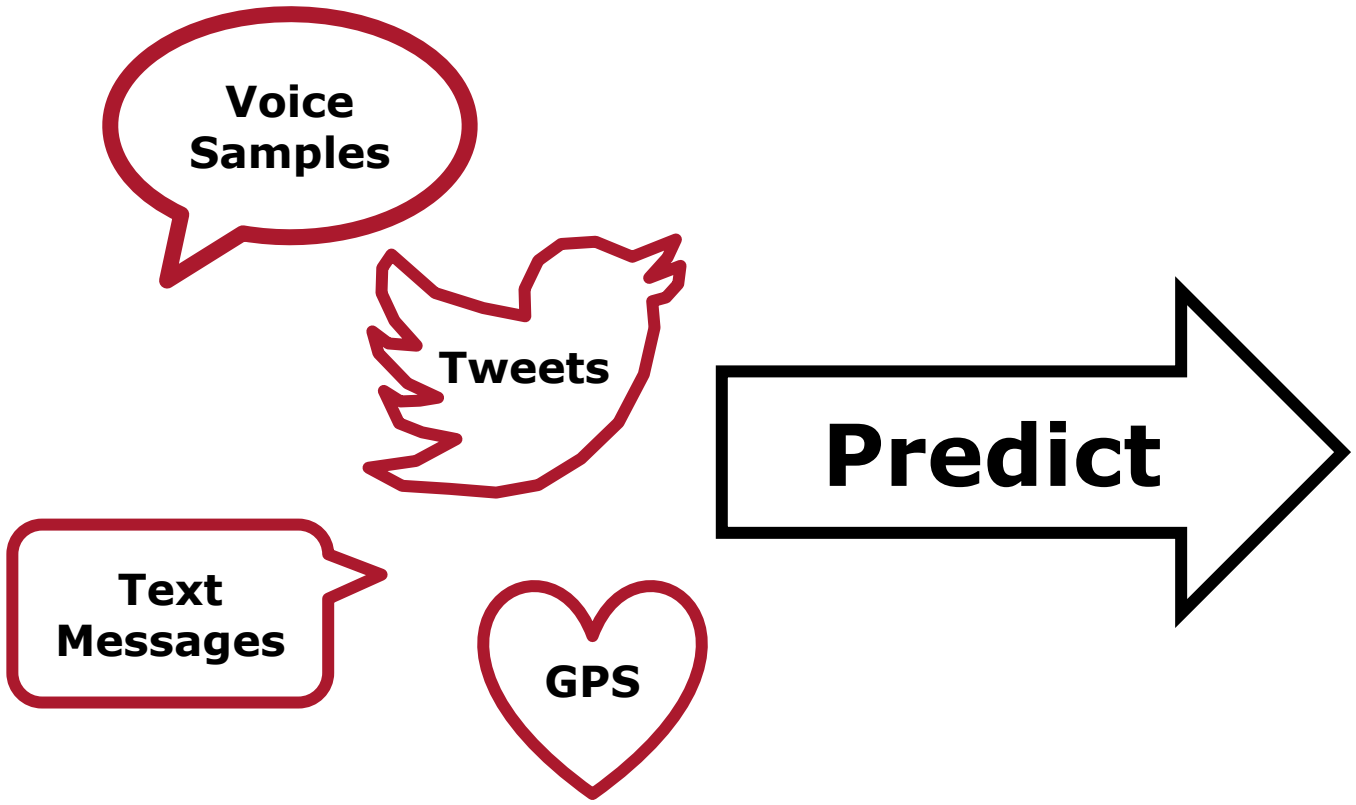
Mental Illnesses are Prevalent and Costly

2 in 5

U.S. **students** screened positive
for depression in fall 2020
(National Healthy Minds Study)



Mental Illness Screening Research Goal



PHQ-9 For Depression Screening

Over the *last 2 weeks*, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. 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	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

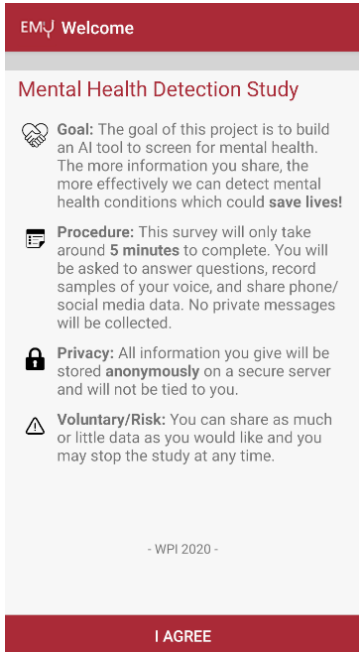
K Kroenke, RL Spitzer, JB Williams, "The PHQ-9: validity of a brief depression severity measure", J of general internal medicine, 2001

Student Suicidal Ideation and Depression Detection (StudentSADD) Dataset

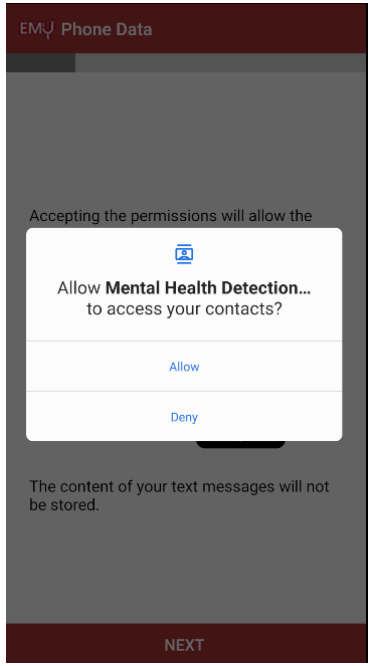
- Goal: A dataset of active digital modalities from students for mental illness screening
- Data: Typed replies, unscripted voice recordings, and scripted voice recordings
- Population: 302 students from various universities
- Collection: First fall semester impacted by COVID-19
- Analysis: Classification of audio and text modalities

StudentSADD Data Collection

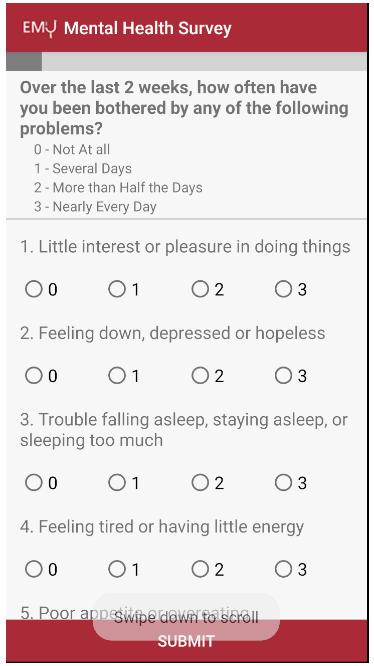
Study Info



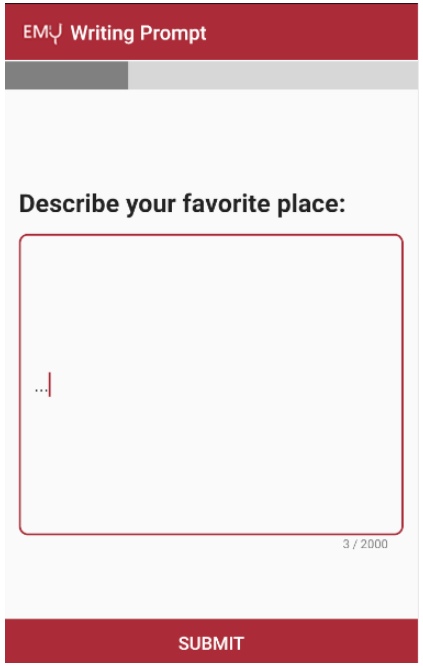
Upload Data



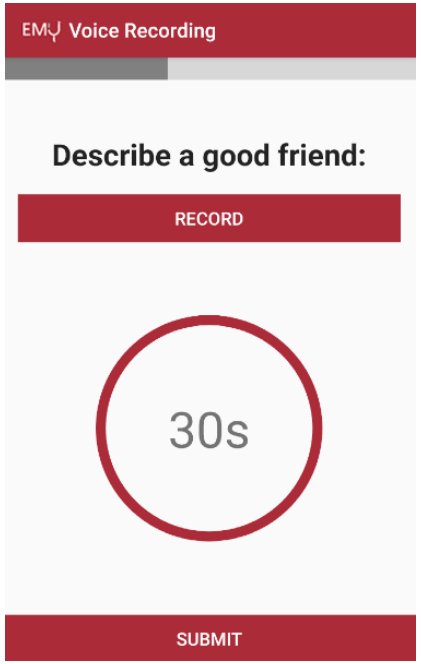
Depression Survey



Text Prompt



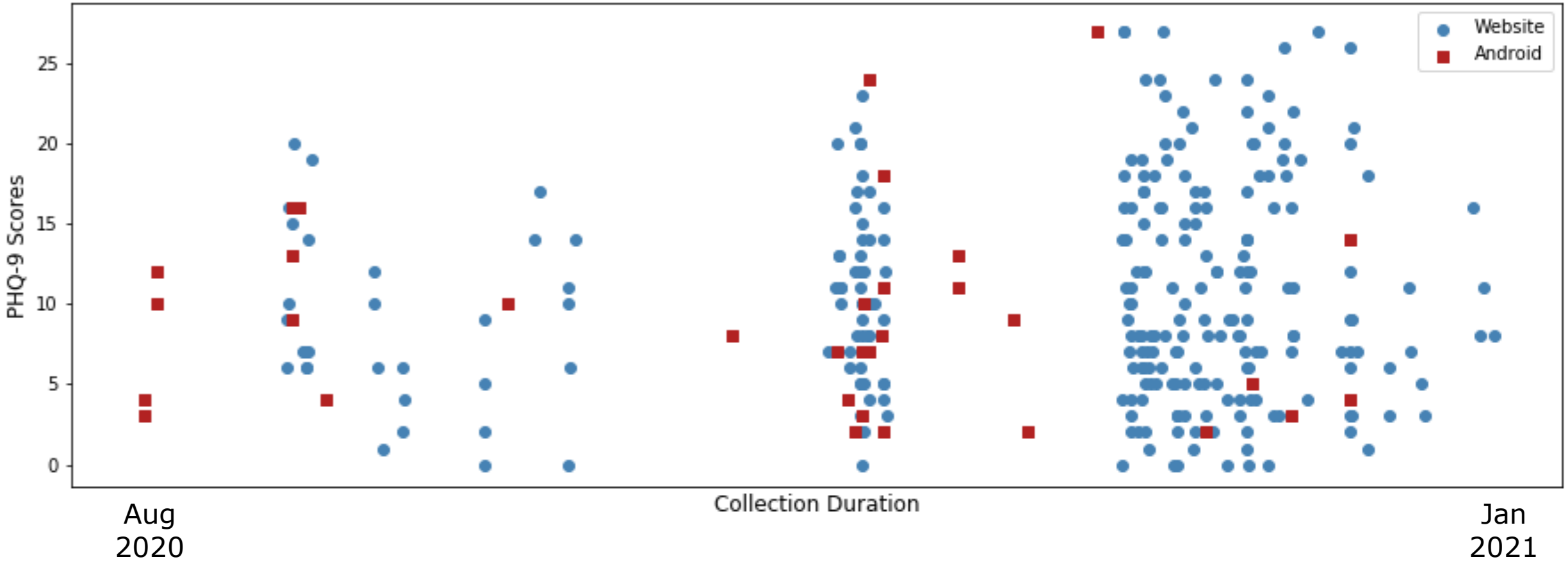
Unscripted Audio



Scripted Audio

Mental illness labels for the data

302 StudentSADD Participants



StudentSADD Data Shared

Almost half of the students screened positive for depression

	Shared	Depressed	Ideation
All	302 (100.0%)	142 (47.0%)	80 (26.5%)
Demographics	295 (97.7%)	139 (47.1%)	79 (26.8%)
Text Prompt	298 (98.7%)	141 (47.3%)	80 (26.9%)
Unscripted Audio	200 (66.2%)	90 (45.0%)	44 (22.0%)
Scripted Audio	194 (64.2%)	89 (45.9%)	44 (22.7%)
Unscripted Voice	110 (55.0%)	44 (40.0%)	22 (20.0%)
Scripted Voice	115 (59.3%)	45 (39.1%)	22 (19.1%)
Has Twitter	47 (27.5%)	21 (44.7%)	13 (27.7%)
Username	16 (34.0%)	5 (31.3%)	4 (25.0%)
GPS	21 (63.6%)	7 (33.3%)	2 (9.5%)
Calendar/Contacts	11 (33.3%)	5 (45.5%)	0 (0.0%)
Call/Text Logs	10 (30.3%)	5 (50.0%)	0 (0.0%)

Only 10 students shared call/text logs

Descriptive Analytics of StudentSADD Participants

Website App	269 (89.1%)
Android App	33 (10.9%)
Computer Browser	86 (53.1%)
iPhone Browser	58 (35.8%)
Android Browser	18 (11.1%)

Most students completed the web version of the app

No Treatment	217 (73.6%)
Prior Treatment	78 (26.4%)

A quarter of the students had prior depression treatment

Remote	97 (53.9%)
Hybrid	73 (40.6%)
Not Remote	10 (5.6%)
COVID-19	12 (6.3%)
No/Unknown	168 (88.4%)

Remote students had the lowest rates of depression

StudentSADD Deep Learning Text Results

		Depression		Suicidal Ideation	
Method	Data	F1	Balanced Accuracy	F1	Balanced Accuracy
BERT	Text Reply	0.64 ± 0.01	0.52 ± 0.31	0.45 ± 0.02	0.56 ± 0.02
BERT-LSTM	Text Reply	0.67 ± 0.01	0.57 ± 0.02	0.46 ± 0.05	0.56 ± 0.08
BERT Attention	Text Reply	0.65 ± 0.01	0.53 ± 0.01	0.49 ± 0.00	0.62 ± 0.01
BERT	Transcript	0.51 ± 0.01	0.55 ± 0.04	0.29 ± 0.07	0.58 ± 0.03
BERT-LSTM	Transcript	0.50 ± 0.00	0.50 ± 0.00	0.32 ± 0.12	0.60 ± 0.06
BERT Attention	Transcript	0.51 ± 0.01	0.51 ± 0.00	0.32 ± 0.01	0.59 ± 0.01

StudentSADD Deep Learning Voice Results

		Depression		Suicidal Ideation	
Method	Data	F1	Balanced Accuracy	F1	Balanced Accuracy
VGGish	Unscripted Voice	0.56 ± 0.00	0.63 ± 0.01	0.59 ± 0.08	0.73 ± 0.06
VGGish Attention	Unscripted Voice	0.63 ± 0.01	0.71 ± 0.01	0.46 ± 0.03	0.65 ± 0.01
VGGish	Scripted Voice	0.56 ± 0.01	0.64 ± 0.01	0.44 ± 0.03	0.69 ± 0.04
VGGish Attention	Scripted Voice	0.64 ± 0.02	0.74 ± 0.02	0.50 ± 0.14	0.68 ± 0.06

StudentSADD Deep Learning Multimodal Results

			Depression		Suicidal Ideation	
Method	Data		F1	Balanced Accuracy	F1	Balanced Accuracy
BERT+VGGish	Unscripted	Transcript	0.54 ± 0.02	0.61 ± 0.05	0.39 ± 0.05	0.62 ± 0.02
AudiBERT	Unscripted	Transcript	0.52 ± 0.01	0.55 ± 0.03	0.37 ± 0.03	0.61 ± 0.02
BERT+VGGish	Scripted	Text Reply	0.64 ± 0.02	0.73 ± 0.02	0.20 ± 0.02	0.53 ± 0.02
AudiBERT	Scripted	Text Reply	0.69 ± 0.00	0.78 ± 0.00	0.37 ± 0.03	0.62 ± 0.02

Toto, Tlachac, Rundensteiner, "AudiBERT: A Deep Transfer Learning Multimodal Classification Framework for Depression Screening", CIKM, 2021

Takeaways

1. StudentSADD is a novel dataset collected during COVID-19
2. Students preferred the **website** app on a **computer** browser
3. Students preferred sharing the **active** screening modalities
4. AudiBERT with scripted voice and text prompt was best at depression screening

StudentSADD Text & Feature Availability

StudentSADD

The Student Suicidal Ideation and Depression Detection (StudentSADD) dataset was collected between August 2020 and January 2021 by the 2020 REU team and 2020-2021 MQP team advised by ML Tlachac and Prof. Rundensteiner with assistance from Ermal Toto. The StudentSADD dataset contains text prompts, unscripted voice transcripts, unscripted voice openSMILE features, and scripted voice openSMILE features labeled with demographics and PHQ-9 depression screening scores from over 300 college student participants.

- Paper: https://dl.acm.org/doi/10.1145/3534604
- Data: StudentSADD data access
- Code: StudentSADD code for baseline models

To obtain access to the data please fill the StudentSADD data agreement form and email it to gr-studentsadd@wpi.edu using an email account affiliated with a higher education institution.

Thank You

This work was supported by:

- US Dep. of Education P200A180088
- AFRI Grant 1023720NSF
- Fulbright Foreign Student Program
- Chilean National Agency for Research and Development Scholarship Program
- NSF Small #1910880 & #1815866
- Data Science Department at WPI

Results were obtained in part using an HPC from NSF MRI grant DMS-1337943 to WPI

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