Objective characterisation of activity, sleep, and circadian rhythm patterns using wearables: application to mental health

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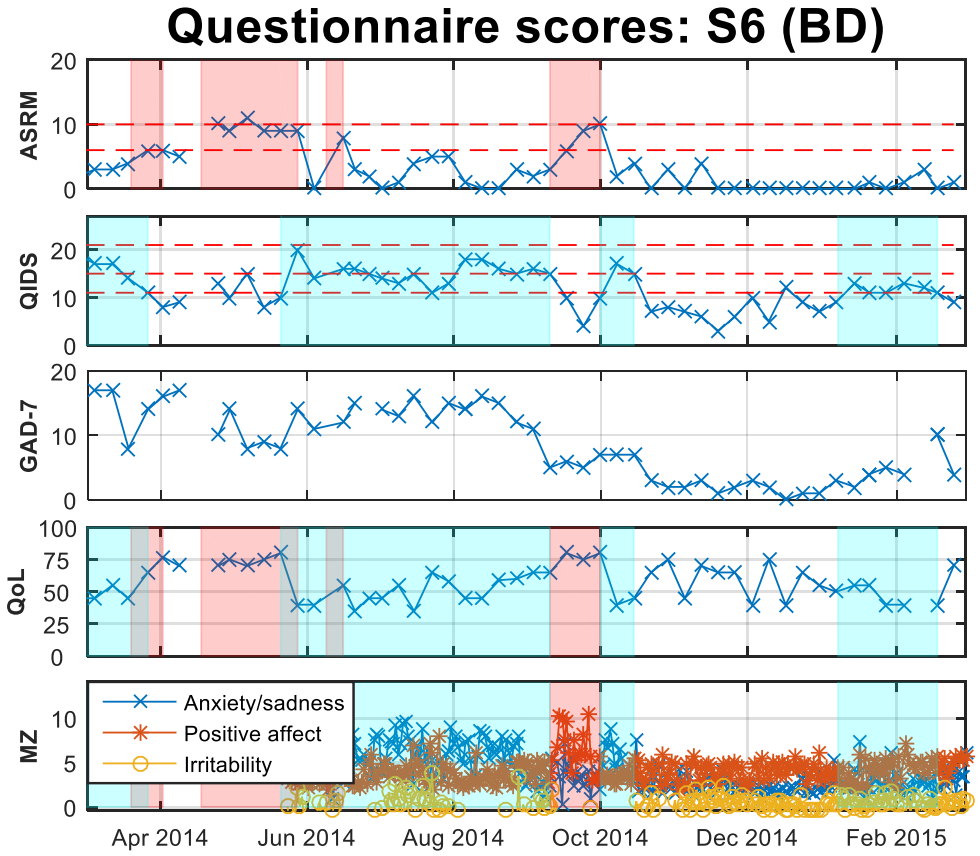
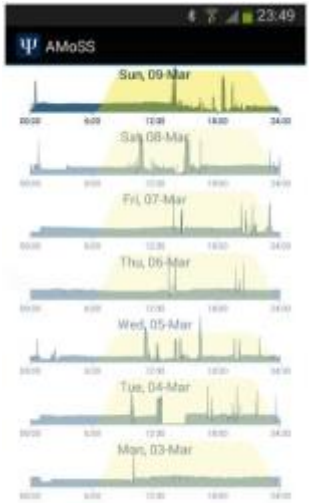
Self-assessment: questionnaires



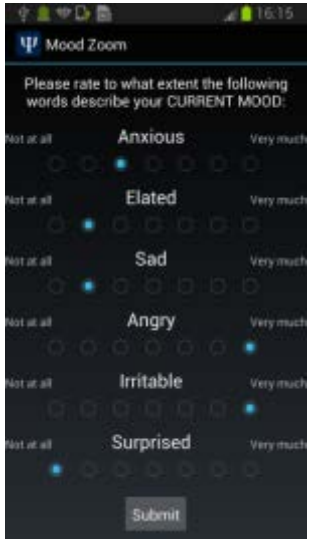
A. Tsanas, et al., **Journal of Affective Disorders**, Vol. 205, pp. 225-233, 2016

A. Tsanas, et al., **JMIR Mental Health**, Vol. 4, pp. e15, 2017

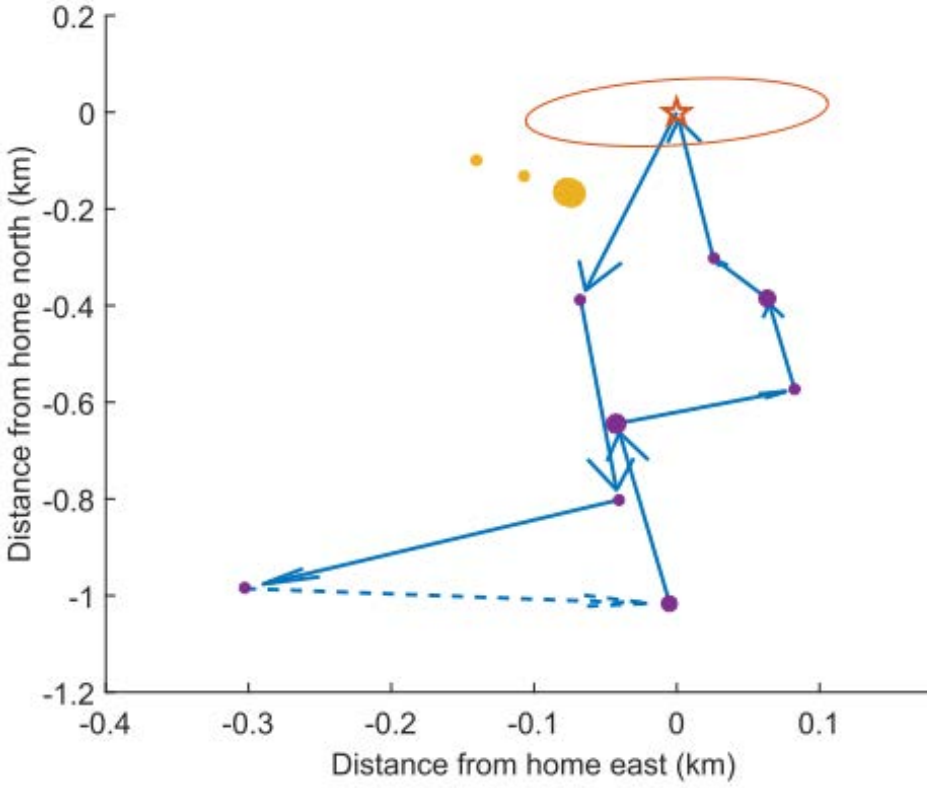
Assessing mental health



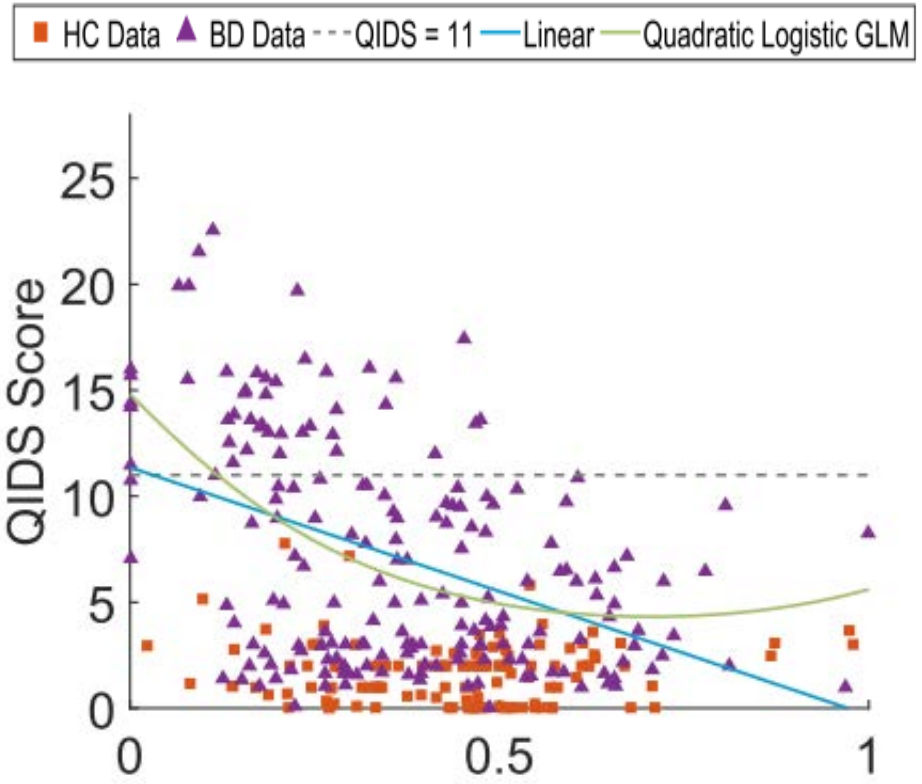
- Continuous personalized monitoring
- Objectively quantify mental health
- Assess treatment effects



Geolocation and depression



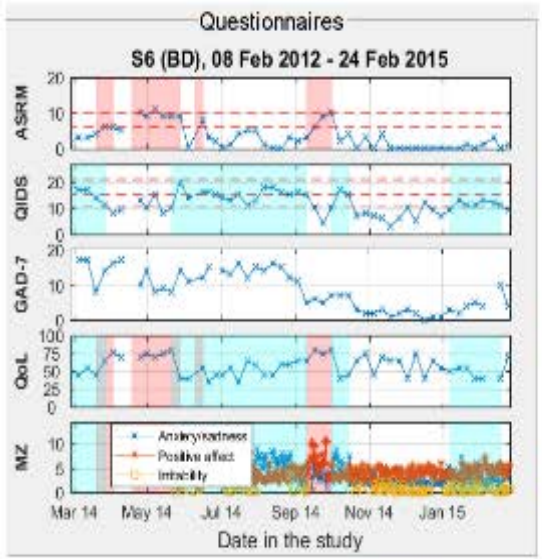
(a) Raw data coordinates with inaccurately recorded noise (weekend

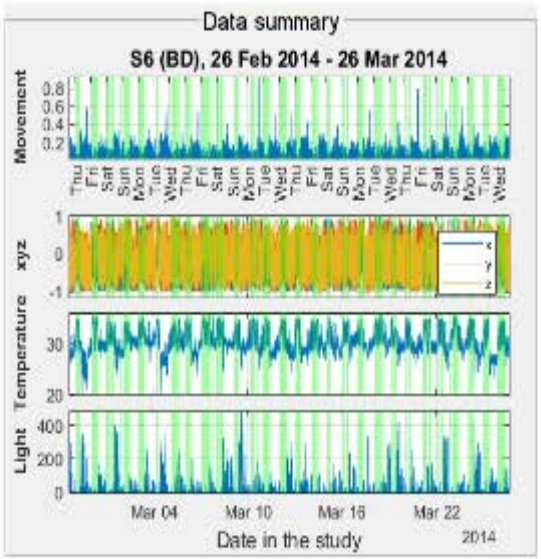


(a) Normalized entropy (weekdays)

N. Palmius, A. Tsanas, et al.: Detecting bipolar depression from geographic location data, **IEEE Transactions on Biomedical Engineering**, 2017 (in press)

My actigraphy toolbox: automating data analysis





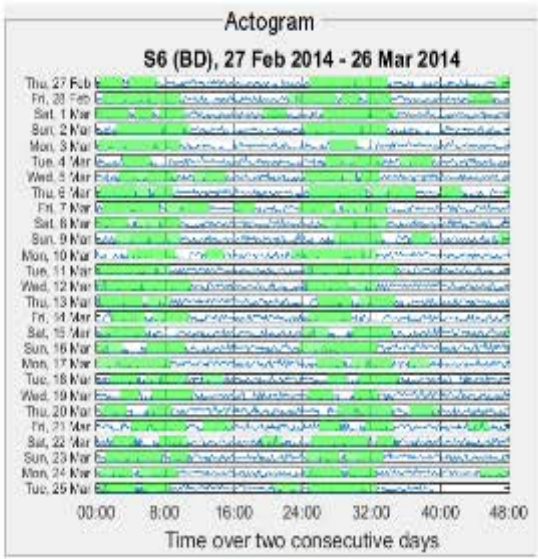
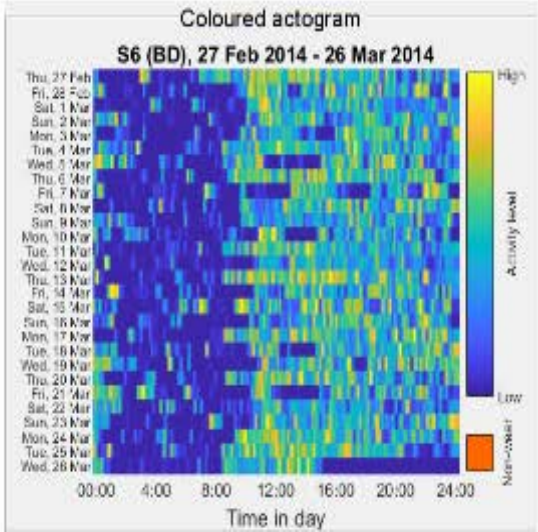


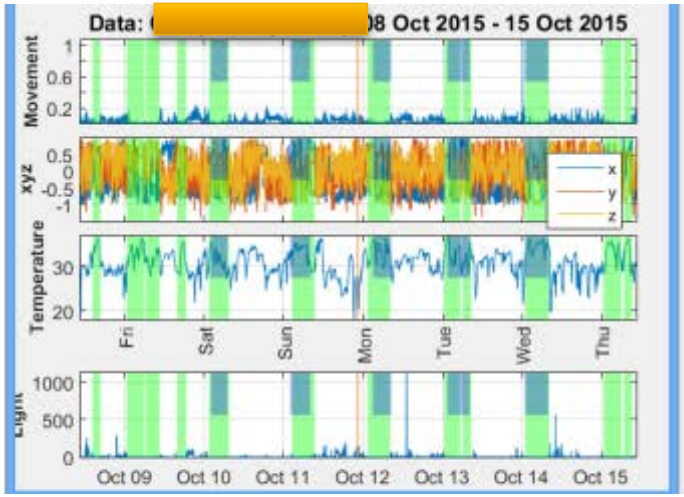
Table summary

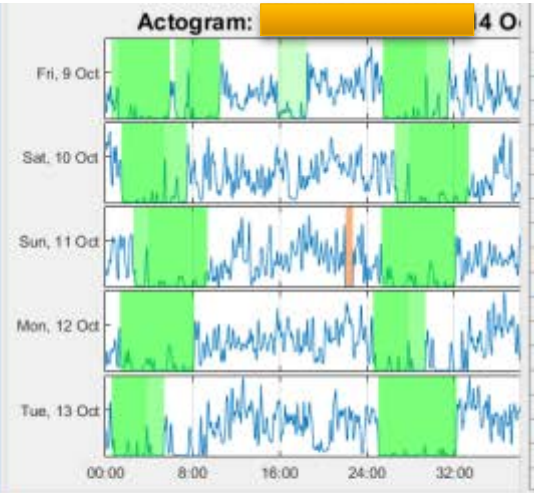
	27 Feb	28 Feb	01 Mar	02 Mar	03 Mar	04 Mar	05 Mar	06 Mar	07 Mar	08 Mar	09 Mar	10 Mar	11 Mar	12 Mar
M10	0.17	0.12	0.15	0.13	0.13	0.16	0.12	0.16	0.11	0.15	0.13	0.11	0.15	0.14
L5	0.01	0.01	0.01	0.00	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
RA	0.88	0.87	0.91	0.94	0.87	0.80	0.75	0.85	0.84	0.91	0.82	0.81	0.87	0.91
IS	0.67	0.52	0.60	0.65	0.60	0.51	0.59	0.66	0.64	0.63	0.51	0.52	0.65	0.63
IV	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.03	0.02	0.02	0.02
Mean activity1	0.11	0.08	0.08	0.09	0.07	0.11	0.08	0.10	0.06	0.09	0.09	0.07	0.09	0.08
Mean Activity2	0.11	0.08	0.07	0.09	0.07	0.11	0.08	0.10	0.06	0.09	0.08	0.07	0.09	0.08
Mean Nocturnal Activity	0.03	0.02	0.04	0.02	0.02	0.01	0.03	0.03	0.03	0.03	0.02	0.02	0.03	0.03
Percent Nocturnal Activity	0.10	0.06	0.18	0.09	0.06	0.01	0.03	0.03	0.15	0.09	0.07	0.04	0.13	0.11
Diurnal Skew	0.08	0.10	0.05	0.09	0.11	0.09	0.11	0.08	0.09	0.08	0.12	0.12	0.08	0.09
Sleep onset	00:13	00:44	22:21	02:16	00:10	03:07	02:35	00:13	00:41	23:35	02:12	03:35	22:36	00:37
Sleep offset	06:59	09:53	10:14	10:54	09:47	06:20	09:24	06:56	13:00	09:44	09:49	09:13	08:35	11:00
Sleep duration	06:41	09:06	11:53	08:38	09:37	03:13	06:48	06:43	12:27	10:08	07:36	05:38	09:59	10:53
Sleep onset phase	NaN	26.00	-143.00	235.00	-126.00	177.00	-32.00	-142.00	28.00	-86.00	157.00	83.00	-299.00	91.00
Sleep offset phase	NaN	171.00	24.00	46.00	-67.00	-207.00	104.00	-20.00	252.00	-204.00	5.00	-36.00	-36.00	145.00
Sleep_activity 5%	0.02	0.03	0.03	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.05	0.03
Sleep_activity 25%	0.04	0.05	0.14	0.09	0.06	0.04	0.03	0.09	0.05	0.08	0.06	0.06	0.15	0.07



PTSD, before and after treatment

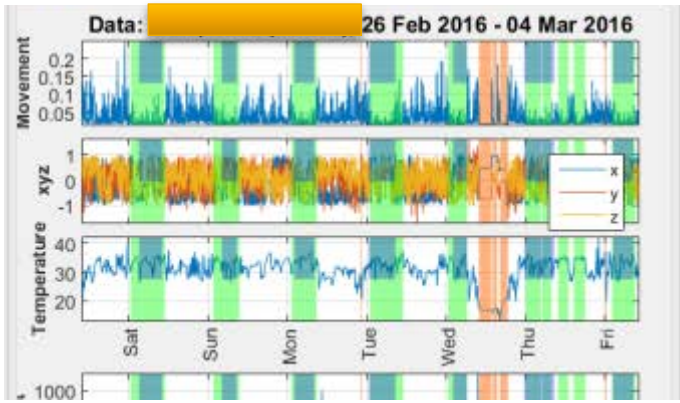
BEFORE

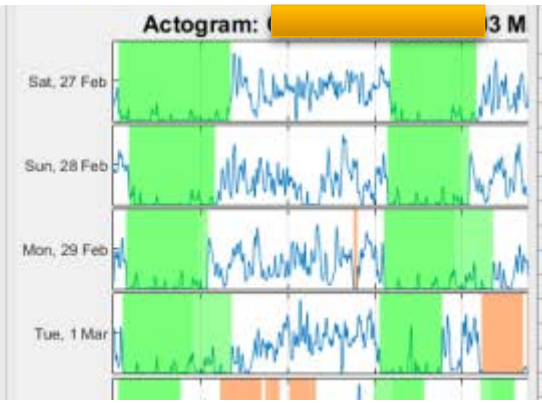




	09 Oct	10 O
M10	0.15	0.16
L5	0.01	0.01
RA	0.86	0.86
IS	0.62	0.59
IV	0.02	0.02
mean activity	5.54	10.0
sleep onset	01:27	02:3
sleep offset	07:28	09:2
sleep duration	06:01	06:4
sleep onset phase	57.00	65.0
sleep offset phase	93.00	113.
sleep_activity 1%	0.73	0.97
sleep_activity 5%	1.57	1.57
sleep_activity 10%	2.27	2.01
sleep_entropy	3.01	3.19
sleep temp zenith	35.50	35.4
sleep temp zenith time	01:55	03:4

AFTER





	27 Feb	28
M10	0.17	0.1
L5	0.01	0.0
RA	0.92	0.9
IS	0.76	0.6
IV	0.01	0.0
mean activity	9.42	6.5
sleep onset	01:24	01:
sleep offset	09:18	08:
sleep duration	07:54	07:
sleep onset phase	58.00	-16.
sleep offset phase	-86.00	-40.
sleep_activity 1%	1.50	1.4
sleep_activity 5%	1.85	1.8
sleep_activity 10%	3.15	2.5