



THE USE OF SMARTPHONE DATA IN SYMPTOM IDENTIFICATION FOR PATIENTS WITH CANCER

Cancer patients experience physical and psychological challenges resulting from either the disease or the toxic effects of cancer treatments. Early detection and prediction of symptom onset or exacerbation can significantly enhance patient outcomes by preventing disease progression and maintaining their quality of life, while remote monitoring has emerged as a crucial tool in comprehensive care of cancer patients.

THE AIM:

To explore the possibility of using smartphone data in patients' behavior analysis and questionnaire data in symptoms assessment.

DATA FOR ANALYSIS:

- 108 patients with different types of cancer.
- Data streams from smartphone sensors to describe the activity and sociability: accelerometer, GPS and power state.
- European Organization for Research and Treatment of Cancer Core Quality of Life questionnaire.

ANALYSIS PROCESS:

GPS data:

- Distance from home (km)
- Average speed of movement (km/h)

Power state data:

- Screen time ratio

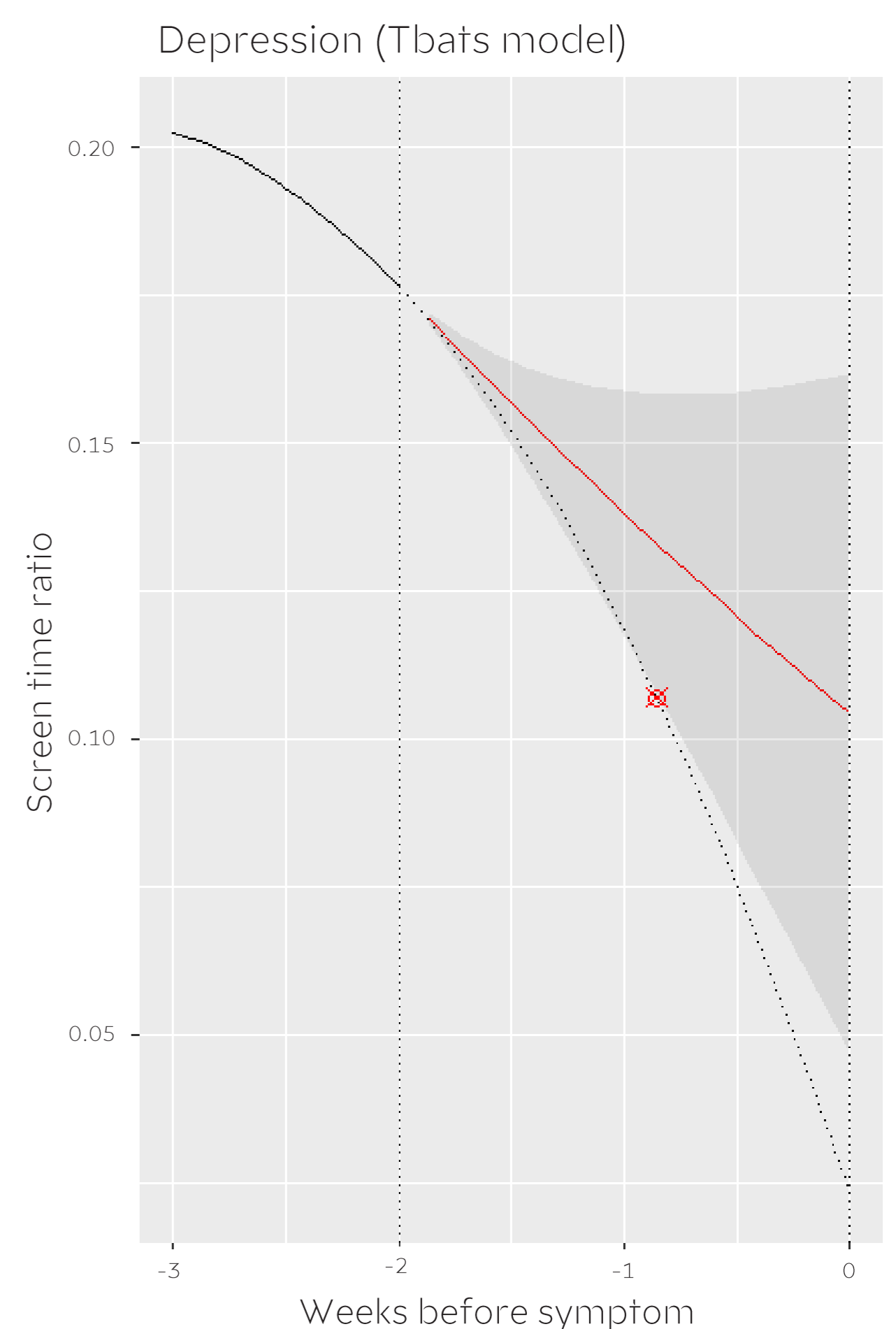
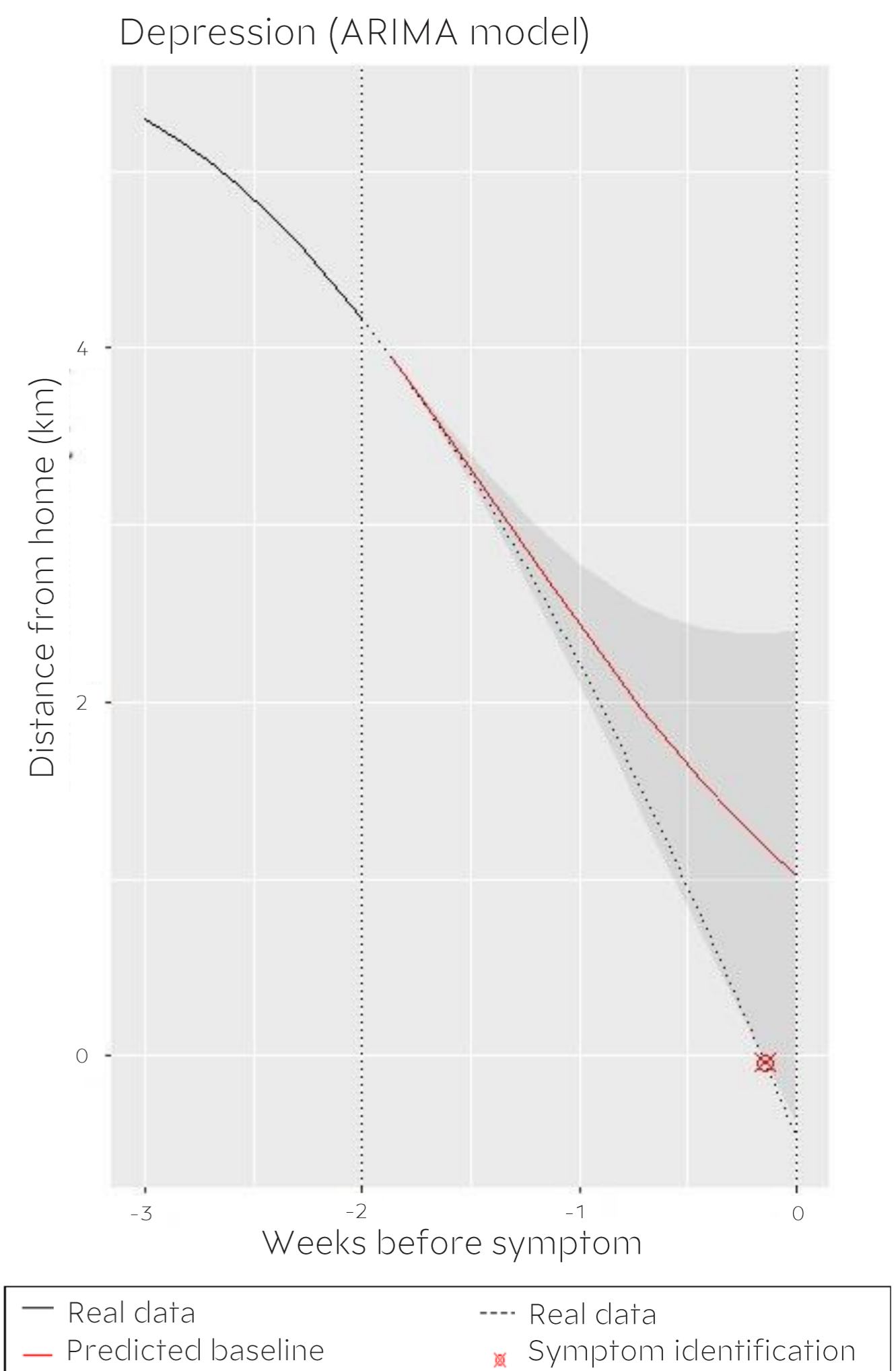
1. Characteristics which are related to the symptoms were identified while the values of the sensors data were decreasing (increasing) a few days before the worsening of symptoms.
2. Different time series models (ARIMA, Holt Winter method, TBATS, LSTM, GRNN) were used to predict the baseline of activity and sociability for upcoming two weeks.
3. The analysis to indicate whether the actual values deviated from the predicted trajectory was performed with 95% CI.

RESULTS:

- Characteristics with more than 30% of patients having decreased (increased) activity and sociability were chosen to describe the symptoms.

The association of decreased (increased) activity and sociability and the symptoms		
Variable		Number of patients with decreased (increased) activity and sociability
Depression	Screen time ratio	7 out of 23 (30.43%)
	Distance from home	17 out of 23 (73.91%)
Fatigue	Screen time ratio	32 out of 55 (58.18%)
	Distance from home	24 out of 55 (43.64%)
	Average speed of movement	24 out of 55 (43.64%)
Vomiting	Screen time ratio	5 out of 8 (62.50%)

Symptoms detection from smartphones data				
Variable		Days before determining (mean ± SD)	The number of patients with symptoms detected earlier (%)	Model
Depression	Screen time ratio	8.57 ± 4.47	10 out of 26 (38.47%)	Tbats
	Distance from home	7.67 ± 6.11	7 out of 26 (26.93%)	ARIMA
Fatigue	Screen time ratio	6.71 ± 4.92	12 out of 41 (29.28%)	Tbats
	Distance from home	8.86 ± 2.91	11 out of 25 (44.00%)	GRNN
	Average speed of movement	6.88 ± 4.70	12 out of 41 (29.28%)	Tbats
Vomiting	Screen time ratio	9.33 ± 4.04	3 out of 9 (33.33%)	ARIMA



CARD

CENTRE FOR APPLIED RESEARCH AND DEVELOPMENT

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