DOI: 10.1002/alz.041241

BIOMARKERS

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Hourly, daily, weekly or monthly? Choosing the right data granularity for analysis of digital biomarker trajectories

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Abstract

Background: The use of digital biomarker data provides the opportunity for frequent functional and cognitive assessments that were not previously available. Digital biomarker data are often collected in the form of time stamped data, which requires processing for interpretable applications in health care research. In general, time stamped data can be averaged, or condensed, into daily, weekly, or even monthly time intervals, which are referred to as time granularities. Data with fine time granularity can improve the fit of a model and increase signal strength, but it can also require more computational time and storage for analysis. There are no published guidelines explaining how to determine the best time granularity. We aim to provide a guideline to find a balance between computational efficiency and integrity of the data when analyzing longitudinal trajectories based on high frequency digital biomarker data in dementia research. We also provide a real-world example to show how the guidelines can be applied.

Methods: There are four important factors of data that we need to investigate when determining appropriate granularity: (i) duration of follow-up, (ii) variables of interest in analysis, (iii) pattern detection, and (iv) signal to noise ratio (SNR). Follow-up time helps determine the highest reduction of time granularity that is feasible for the data. Variables of interest may only be available at certain time granularities. For pattern detection, clinical information about biological patterns will help determine time granularity. SNR uses variability in the data to determine how likely a signal will be detected during trajectory analysis.

Result: These factors are applied to an example involving walking speed derived from a longitudinal cohort study, the Intelligent Systems for Assessing Aging Change study (ISAAC). The data have been collected at the Oregon Center for Aging and Technology (ORCATECH) at the Oregon Health and Science University.

Conclusion: We highlighted common challenges researchers face when analyzing digital biomarkers and how we can use the guideline in selecting an appropriate time granularity before conducting analyses. The guideline will help improve scientific rigor in digital biomarker analyses.