Insights on infant drinking behavior from a smart bottle sleeve

Christian Tiemann, Lena Jaschke, Renée Otte, Łucja Segaar, Lili-Marjan Boelens-Brockhuis, Kees Wouters
Philips Research, High Tech Campus, Eindhoven, The Netherlands

PHILIPS

Introduction

Infant feeding is a complex process and important for a healthy growth. The monitoring of bottle feedings can provide valuable information on infant drinking behavior and its development over time. This objective information can help parents and professionals to better understand feeding patterns, and yield insights into whether the infant is actively drinking, an appropriate teat is used, the infant is satisfied, tired, or gulping, etc. Therefore, we aimed to develop an algorithm that can translate data measured with a smart sleeve into relevant objective information on infant drinking behavior.

Methods

Data was collected using a smart sleeve attached to a baby bottle during feedings. A total of 906 feedings of 7 healthy term infants (age range between 2 and 12 weeks) was collected during a home-placement test. The smart sleeve prototype contains sensors to measure linear accelerations and rotational velocities in three directions. These signals are processed to remove gravity-induced offsets, and to calculate the total acceleration magnitude of the sleeve. The algorithm is based on adaptive filters to extract relevant movements and classify different drinking conditions.
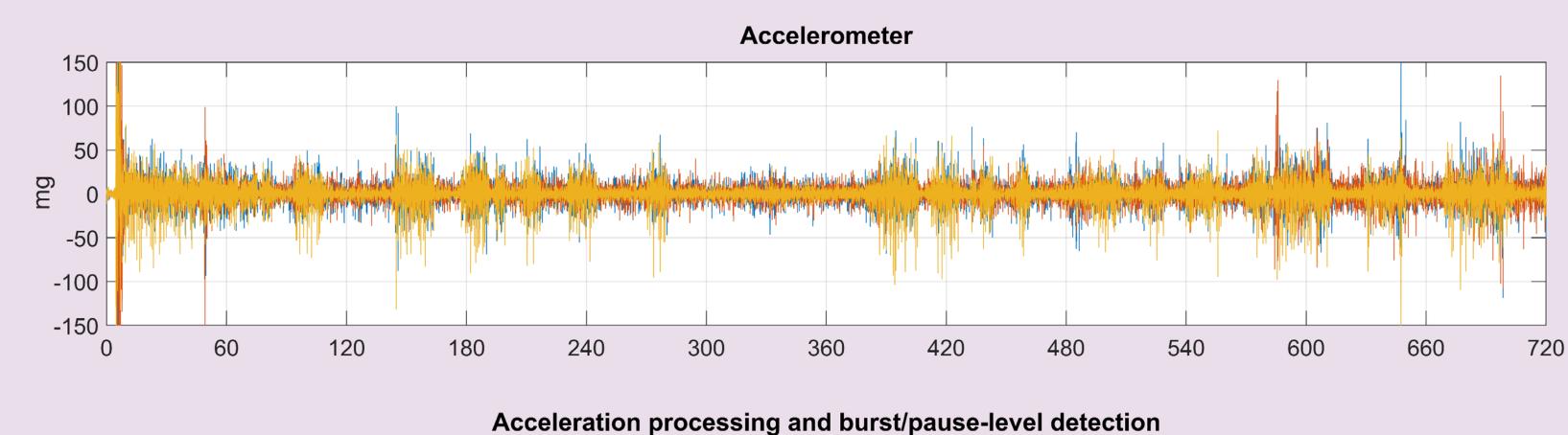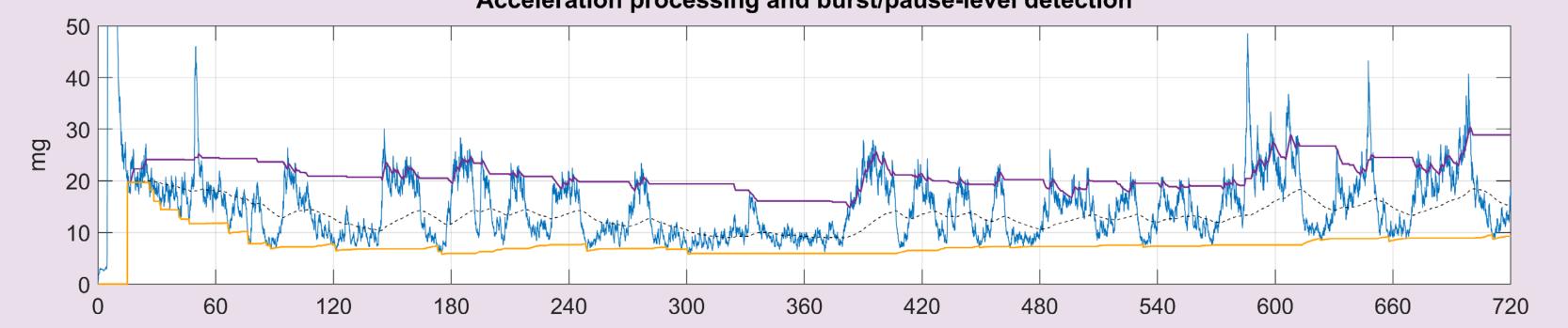
Results

The data were used to develop an algorithm to assess parameters related to drinking behavior. Depending on the quality of the data, the drinking behavior can be analyzed at different levels of detail.

Based on motion data measured by the smart sleeve the algorithm can perform real-time analysis defining if the infant is drinking or pausing, and if there are interruptions or movements induced by the parent (e.g. taking the bottle out of the mouth of the infant).

In many cases it was also possible to extract burst-pause cycles from the data. This provides the opportunity to estimate parameters such as the burst- and pause duration and their ratio, which can be informative for assessing aspects of feeding success. In several infants, especially the younger ones, the sucking frequency could also be determined.
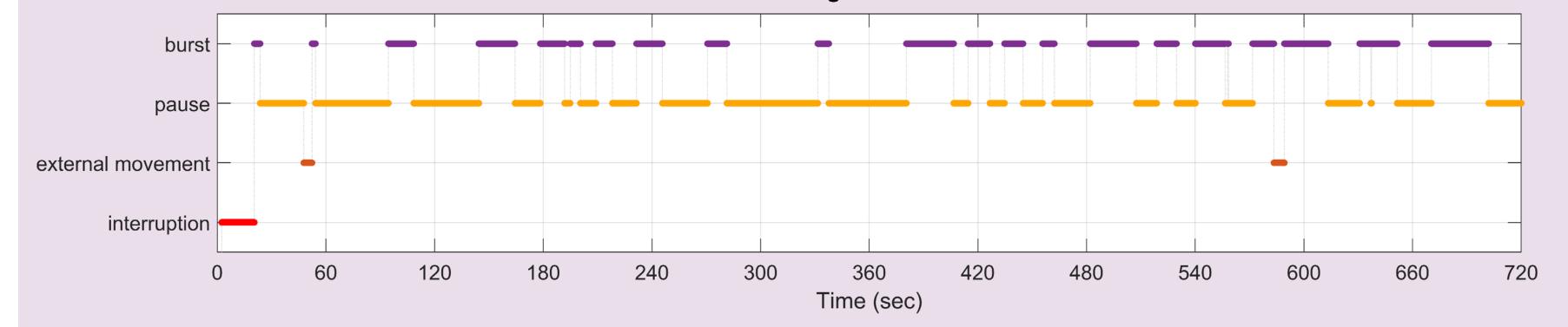

Conclusions

We showed that information collected with a smart bottle sleeve can be used to extract several parameters of infant drinking behavior. Research is ongoing to validate (e.g., via video recordings) and extend the algorithm, and to explore opportunities for providing valuable feedback to parents or health care professionals on infant drinking behavior.

PHILIPS