Digital Health - Connected Healthcare
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Bachelor Project Winter 2021

Sensor-based Nursing Activity App

Nurses are obliged to document their nursing activities. Within the framework of the nursing documentation, the measures planned and carried out in the nursing process, further observations, particularities, and changes are documented systematically, comprehensively, and as completely as possible in writing. In particular basic nursing, including all activities that ensure primary care for the patient, contains physical differentiable movement sequences. These care services include help and support with regular and recurring tasks in everyday life, such as oral care, blood collection, washing, personal hygiene, nutrition, toileting, and mobility in the patient's own home.

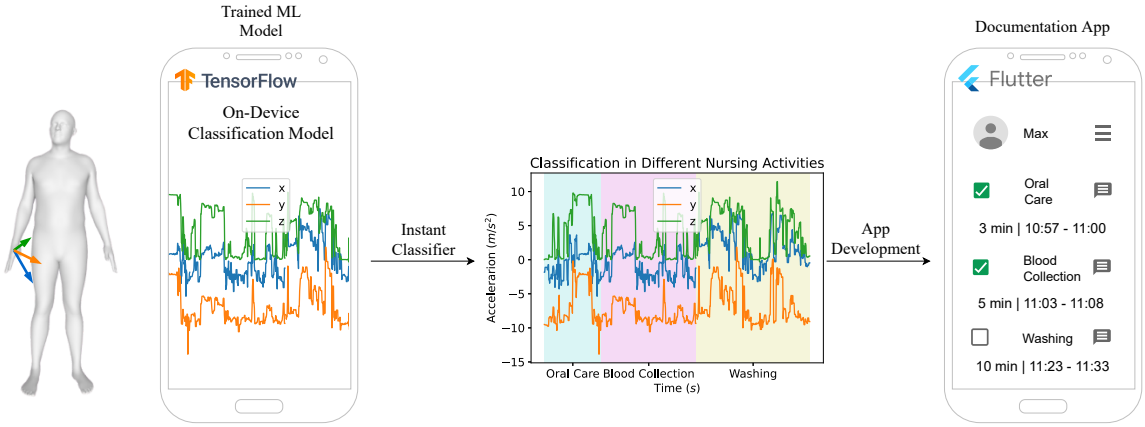

Figure 1: Real-time activity recognition framework from left to right: Sensor data is transferred to a mobile phone during nursing activities, which is capable of on-device inference with ML. Real-time classification results are used to show the type and duration of activities for nursing documentation in an app.

Thus, the goal of this bachelor project is to develop a documentation app that includes different data engineering steps. Documentation and planning of patients' treatment can be very extensive and time-consuming [2]. It comprises up to 30% of the working time, which can be reduced by using machine learning (ML) models. The

recognition and data mining of nursing activities can lead to a better understanding and improvements in medical care, and it can help prevent unnecessary and excessive work.

In that regard, the project's objectives are as follows:

1. Development of a mobile app that automatically recognizes nursing activities.
2. Evaluation and improvement of an ML model to classify the different nursing movement patterns.

Methodology

Sensor-based activity recognition integrates the emerging field of sensor networks with novel data mining and ML techniques to model a wide range of human activities [3]. Accelerometers and angular rate sensors provide sufficient data and computational power to enable activity recognition. However, due to the inherent noisiness of the input data, this is a challenging task. Especially, the inflection pattern of nursing activities are more complex [1]. Therefore, a set of operations aimed at creating interfaces and mechanisms for information flow and access is necessary. As shown in Figure 1, where sensor data is collected, this project involves data transfer; data pre-processing; on-device, real-time classification of different activities; and the development of a mobile app for nursing documentation.

This project will touch different programming languages and technologies like Python, Tensorflow Lite[1] to enable on-device machine learning, and Flutter[2]/React Native[3] to build a mobile application that can access the TensorFlow Lite interpreter and perform inference.

Requirements and Expectations

This is an interdisciplinary project with a broad spectrum in the field of digital health. Specifically, it comprises different topics like nursing documentation, IMU-based data pre-processing, ML/DL, and cross-platform app development. Therefore we expect the following from you:

- Fun/enjoyment/motivation to develop an app to relieve the burden on caregivers
- Willingness to learn new things
- Willingness to work in a team and do independent research
- Interest in latest developments

[1] https://www.tensorflow.org/lite
[2] https://flutter.dev/
[3] https://reactnative.dev/

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References

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[2] Statistisches Bundesamt. Erfüllungsaufwand im Bereich Pflege.

[3] Nishkam Ravi et al. Activity Recognition from Accelerometer Data. In *Proceedings of the 17th Conference on Innovative Applications of Artificial Intelligence - Volume 3*, IAAI'05, page 1541–1546. AAAI Press, 2005.