

RADAR-CNS - Research Infrastructure for processing wearable data to improve health

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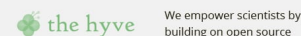
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Leveraging wearable data for better health

Remote Assessment of Disease And Relapse – Central Nervous System (RADAR-CNS) is an innovative collaborative research project to evaluate the potential of wearable devices and smartphone technology to improve the quality of life of patients suffering from epilepsy, multiple sclerosis (MS) and major depression disorder (MDD). As a project in the EU Innovative Medicines Initiative (IMI2) framework, RADAR-CNS is built upon close collaboration of patient organizations, clinical partners, research institutes, pharma and tech industry to develop new strategies for treatment of patients with brain disorders.

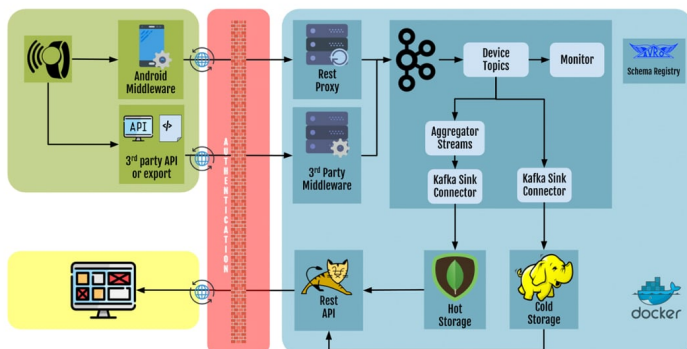
The RADAR-CNS project aims to leverage data from wearable devices and smartphones to generate a continuous, objective view of the patient to enable prediction and prevention of relapse.

Infrastructure for wearable data processing

We envision an open source infrastructure to capture, process, manage and analyse data from wearable devices, which will allow integration with data from multiple sources like clinical and -omics data. Key components of the end-to-end system encompasses technology allowing:

- Data collection
- Real time streaming
- Storage of raw and aggregated data
- Feedback for patients and clinicians via UI Dashboard
- API allowing third party access
- Data Analytics
- Integration into clinical records

Sustainability and Scalability are essential for the development of the RADAR platform. Therefore, we build a generic platform, which will not be limited to brain disorder applications, but will be applicable for subsequent RADAR projects and allow integration of additional data streams from new devices or different applications.



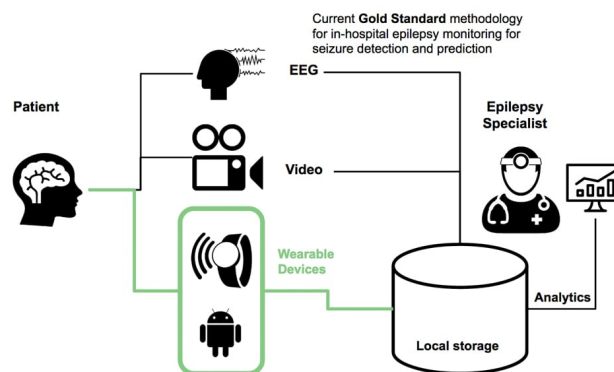
▲ Figure 1: Platform schema with technology stack. Data is collected from wearable sensors (green box), schematized with AVRO and processed with Apache Kafka (top blue box). Both raw data and aggregated data are stored in Hadoop and MongoDB, respectively (bottom blue box). The data can be retrieved through a REST API for visualization and advanced analysis (yellow box).

Epilepsy pilot study

Goal of the pilot study is the evaluation of wearable device data for passive remote monitoring of patients in an hospital epilepsy monitoring unit (EMU).

We developed an Android application, which captures wearable data via a bluetooth connection and streams data to an internal hospital server. Integration of SDKs for multiple wearable devices allows us to investigate and compare the quality of data collected from different devices (e.g., Empatica E4, Pebble 2 and Angel Sensor) as well as device specifications, such as battery life and signal stability/range.

Besides data quality assessment, we will investigate whether data from wearable devices has potential for seizure detection. Parallel video and EEG monitoring in monitoring units of specialized epilepsy centers are used as a Gold Standard for seizure detection evaluation. We will investigate the potential of wearable devices as clinically valuable alternatives to complement or even replace hospital-based technologies; a prerequisite for ambulatory passive remote monitoring of patients in their home environment.



▲ Figure 2: Setup for epilepsy pilot study, enabling A) investigation of data quality from tested wearable devices and B) comparison of clinical information from new data streams to gold standard methods (EEG and Video).

We need you!

To facilitate and support an active open source community around the RADAR platform, source code and comprehensive documentation of applications and infrastructure components will be shared and made publically available under an open source license. This approach allows users to build and integrate additional applications for different devices or to develop innovative analytics tools based on the API and the data streams collected from the wearable devices.

We are welcoming any feedback on the RADAR platform, study setups and prototypes. We are especially looking for input from clinicians interested in using the platform, as well as patients with epilepsy, MS or MDD who are interested in participation in clinical trials.

We need you! Get in touch: radar-cns.org/contact
Contribute: github.com/RADAR-CNS / radar-cns.org/participate

RADAR-CNS receives funding from the Innovative Medicines Initiative 2 Joint Undertaking under grant agreement No 115902. This Joint Undertaking receives support from the European Union's Horizon 2020 research and innovation programme and EFPIA.

