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# AI-Powered Radar Sensing for Remote Health Monitoring

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COVID-19 has accelerated many developments related to remote healthcare monitoring. Here, we discuss our cloud-supported privacy-preserving camera-free radar system for non-contact, real-time recognition and monitoring of physical activities, gait, and vital signs. This system has been installed around a number of retirement homes, long-term care homes, and hospital rooms. The proposed system employs standalone Internet of Things (IoT)-based millimeter wave multiple input multiple output frequency modulated continuous wave (MIMO FMCW) radar devices augmented by deep learning models to enable autonomous free-living activity recognition.

To optimize the field of view of these radars, various add-on custom lenses were designed and 3D printed to create custom device packaging. To train deep learning models, we utilize datasets of range-Doppler maps generated from real-life in-home activities. The performance of several deep learning models is evaluated based on accuracy and prediction time, with the gated recurrent network (GRU) model selected for real-time deployment due to its balance of speed and accuracy compared to 2D Convolutional Neural Network Long Short-Term Memory (2D-CNNLSTM) and Long Short-Term Memory (LSTM) models. The overall accuracy of the GRU model for classifying in-home physical activities is better than 93% and the radar system demonstrated better than 90% when it comes to vital sign monitoring. In addition to recognizing and differentiating various activities and walking periods, the cloud-based system also records the subject's activity level over time, including washroom use frequency, sleep/sedentary/active/out-of-home durations, current state, and gait parameters. As we collect more data, we hope that our system can be utilized in predictive warnings at the onset of a plurality of medical conditions.

## References

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