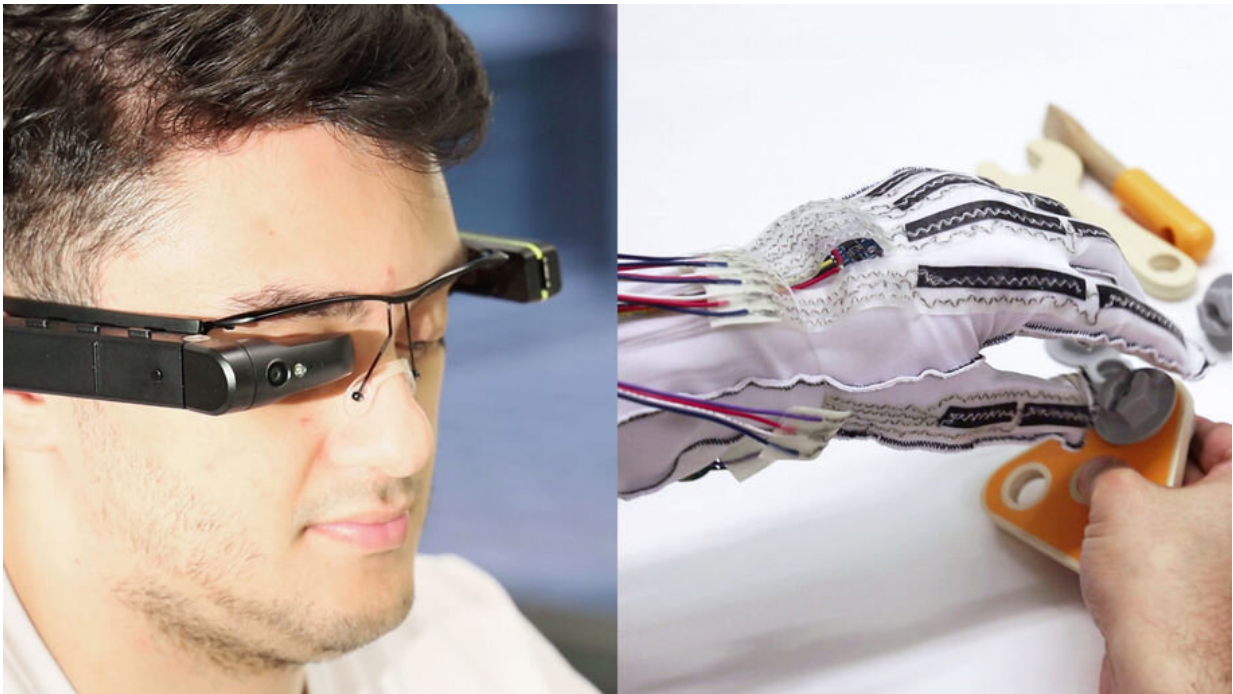


Gesture recognition technology shrinks to micro size

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Sensor-based smart gloves allow the employee to interact in real time with an augmented reality application that can provide visual and haptic feedback.
Credit: Mariela Urria Schiaffino

New resource-efficient gesture recognition can be embedded into smart clothing. Technology developed in collaboration between Aalto University and company HitSeed could be used in manufacturing and healthcare, for example.

The use of augmented reality (AR) applications and wearable electronics is constantly increasing in the industry. For instance, [smart glasses](#) can show an employee real-time instructions on how to assemble a device or help find parts that need service. Smart textiles based on sensor technology, such as smart gloves, can convert physical movements into virtual equivalents and quite literally guide the employee by the hand.

The smart glove must be able to accurately detect hand and finger movements and grip force. This is often done using [deep neural networks](#), machine learning methods that mimic the function of the human brain and traditionally require a lot of computational power. Researchers at Aalto University have collaborated with HitSeed, a company that specializes in intelligent [sensor technology](#), to develop gesture recognition that can be used on even fingertip-sized microcontrollers.

"Usually, sensor data collected by gloves needs to be sent over a network to a computer that processes it and sends the information back. The [deep learning](#)-based gesture recognition algorithms we have developed are so lightweight that they can do the same locally in an [embedded system](#) like smart gloves," says Yu Xiao, a researcher at Aalto University who is the leader of a research group that specializes in wearable systems development.

This means that the devices can be used anywhere, without the need for internet connection or an external computer. The information can be transferred between the smart gloves and AR glasses using the Bluetooth Low Energy network.

The technology could be used in a variety of embedded systems for [sensor data](#) in the future.

"We can apply the developed technology for several measurement types

like keeping separate counts for multiple gestures, for measuring motion improvements in physiotherapy or for detecting the state of multiple machines running based on a vibration or sound spectrum," says HitSeed CTO Pertti Kasanen.

"Smart [sensors](#) and augmented reality and virtual reality applications have endless opportunities in industry, healthcare and education," Xiao says.

The researchers used HitSeed's fingertip-sized Sensor Computer, which supports Google's Tensor Flow Lite software library, to run convolutional neural networks (CNNs) on smart [gloves](#). CNN is a specialized type of neural network which is often used for image classification. A CNN is made up of neurons that have learnable weights and biases. As a next step, the system will be extended to support local execution of long short-term memory (LSTM), which is commonly used for processing entire sequences of data such as speech and video.

The research project received €100,000 seed funding from the European Union's Horizon 2020 ATTRACT project, which supports collaboration between research institutes and companies to develop technologies that change society. Next, researchers will seek partners for research aimed at commercializing the technology.

More information: For more information, see [mobilecloud.aalto.fi/wp-content ... L-Case-Debare-v1.pdf](https://mobilecloud.aalto.fi/wp-content/uploads/2020/10/L-Case-Debare-v1.pdf)

Provided by Aalto University

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