Fraunhofer IMS

Embedded Gesture Training and Detection

Customized on your Systems without Connection to Cloud

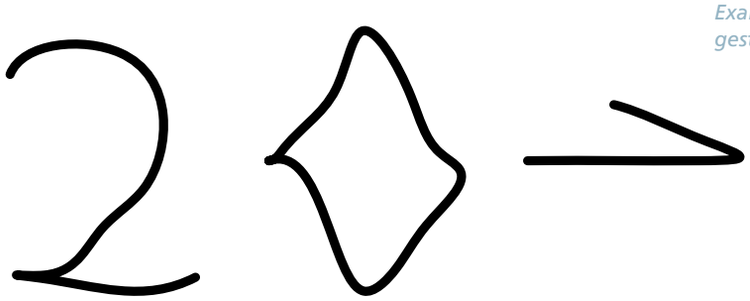
Intuitive methods are increasingly preferred instead of using computer keyboards or touchscreens to control machines or computers in real-life situations. Fraunhofer IMS presents a customizable AI based gesture recognition that exploits the motions of e.g., your head, hand, or foot. It can be trained directly on the embedded system without any cloud connection.

Personalizable AI

Our research on personalizable artificial intelligence (AI) at Fraunhofer IMS offers adaptations and optimizations of devices to their user by means of training. The AI software framework AIfES sets the technical base for this with its ability to use and even train artificial neural networks (ANN) on microcontrollers.

The AIfES development team has used our previous gesture recognition demonstrator as a basis to show the potential of personalizable AI. This demonstrator has already been presented at trade fairs and a video demonstrating the functionalities is available on the AIfES YouTube channel. **Scan the QR-code to check it out.**

Examples of intelligent gesture drawing



Gesture 1: Digit 2 | Gesture 2: Diamond | Gesture 3: Arrow Right

Choose natural gestures that suit your application

Your applications can be as simple as a remote control or as complex as augmented reality scenarios. Choose natural gestures that suit your application, teach your gestures, and connect your application to each one of them.

You are free to use any 2-D or 3-D gestures. This way, applications can be controlled intuitively with gestures that the user personally prefers. **See below, what we can do for you with our Embedded Gesture system.**

Low Performance Hardware

We port to your preferred microcontroller system. The WIO Terminal is used for the demo implementation. For gesture recognition, we only use the acceleration data of the **integrated 3-axis MEMS accelerometer (IMU)**. **User guidance** during training and detection is given **via the built-in display, and user input uses the provided buttons**.

Gesture Training

The demonstrator starts up in learning mode. In this mode, users are guided through the training sequence, where they can record training data for up to ten gestures. The number of gestures that can be trained is only limited by the memory of the microcontroller. Each gesture should be repeated about four times to ensure training success. After each executed gesture, the raw data is processed and only the necessary features are temporarily stored as training data. The special feature extraction algorithm was developed by the AIfES team and allows an **enormous data reduction**. These features form the later inputs for the very compact ANN. After all desired gestures have been performed, AIfES computes the necessary network structure, creates the matching ANN at runtime and trains it from scratch. The network structure depends on the number of gestures because each gesture forms a class and this class is represented by an output neuron of the ANN. After training, the learning success in terms of learning error is output for experts to the display and can be examined.

Gesture Detection

After training, the demonstrator is in inference mode to recognize gestures. The index number of the recognized gesture is output to the display of our demonstrator, but can trigger any other action on display-less devices. The **recognition of a gesture needs about 20-100 ms** on the used hardware. This depends on the extent of the gesture. A demo video of this demonstrator will also soon be available on the AIfES YouTube channel.

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