

# A Study on Different Data-Analysis Techniques to Detect Fine Motions

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**Abstract:** In this study of different data analysis techniques to detect fine motions, we will be analysing how different techniques are implemented. Also how RADAR can be used instead of cameras in gesture recognition techniques and how SOLI is superior to all the techniques that use camera.

**Keywords:** SOLI, hand gesture techniques, RADAR, gesture sensing.

## I. INTRODUCTION

Gesture recognition techniques for detecting fine motions could be any of the following: facial recognition, eye detection, hand recognition, voice recognition, finger movement recognition, lip movement recognition and so on. This can be applied in application where human actions are taken as input for example: HCI (human Control Interface), lie detection, mobile apps, Robot Control.

All the above techniques use camera to recognize the motions, whereas project SOLI is RADAR based wearable that can be used to control all types of device. This new technology uses only hands and fingers as interface.

RADAR was developed secretly for military use by several nations in the period before and during World War II. The term RADAR an acronym for Radio Detection And Ranging or Radio Direction And Ranging.

The modern uses of RADAR are highly diverse, including air and terrestrial traffic control, RADAR astronomy, air-defence systems, antimissile systems, marine RADARs to locate landmarks and other ships, aircraft anti-collision systems, ocean surveillance systems, outer space surveillance and rendezvous systems, meteorological precipitation monitoring, altimetry and flight control systems, guided missile target locating systems, ground-penetrating RADAR for geological observations, and range-controlled RADAR for public health surveillance. High tech RADAR systems are associated with digital signal processing, machine learning and are capable of extracting useful information from very high noise levels. Here we discuss how the RADAR can be used in gesture recognition.

## II. ANALYSIS

We are discussing here different techniques used for gesture recognition.

A face recognition system is a computer application capable of identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a face database. By using this technique, it yields an accuracy rate of 80%.

Since voice input is a useful interface in mobile environments, there is an increasing development of mobile devices incorporating automatic speech recognition (ASR) techniques. However, noise is a very serious problem for voice recognition. By using such techniques to recognise the voice, today it is successful up to an accuracy rate of 80% Iris recognition uses video camera technology with subtle near infrared illumination to acquire images of the detail-rich, intricate structures of the iris which are visible externally. Digital templates encoded from these patterns by mathematical and statistical algorithms allow the identification of an individual or someone pretending to be that individual. Databases of enrolled templates are searched by matcher engines at speeds measured in the millions of templates per second per (single-core) CPU, and with remarkably low false match rates. This type of techniques provides 90% accuracy.

In Human Computer Interaction (HCI), gesture based interface gives a new direction towards the creation of a natural and user friendly environment. Recently in HCI, the detection of finger and finger types has received growing attention in applications like sign language, vision based finger guessing games and in applications related to real-time systems and virtual reality and recognizing pointing gestures in the context of human-robot interaction. This type of finger movement techniques gives an accuracy of 86 % recognition.

Hand gesture has been one of the most common and natural communication media among human being. Hand



gesture recognition research has gained a lot of attentions because of its applications for interactive human-machine interface and virtual environments. There are two categories in this technique: glove – based method which requires the users to wear a device and other technique is vision – based method. Generally hand recognition technique gives an accuracy of 95%.

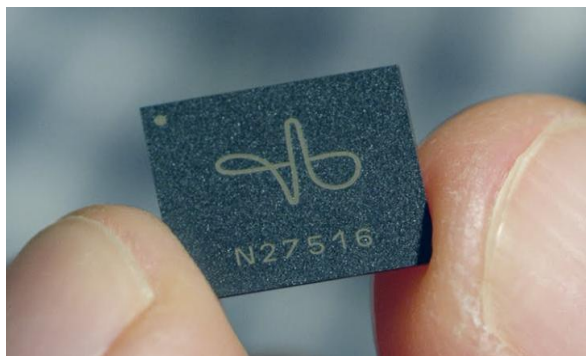
RADAR is an object-detection system that uses radio waves to determine the range, angle, or velocity of objects. It can be used to detect aircraft, ships, spacecraft, guided missiles, motor vehicles, weather formations, and terrain. A RADAR system consists of a transmitter producing electromagnetic waves in the radio or microwaves domain, a transmitting antenna, a receiving antenna (often the same antenna is used for transmitting and receiving) and a receiver and processor to determine properties of the object(s). Radio waves (pulsed or continuous) from the transmitter reflect off the object and return to the receiver, giving information about the object's location and speed.

Project SOLI

Project Soli is a RADAR based wearable that can be used to control all kinds of devices. It is a gesture based system that can track micro motions or small movements like pressing a button, moving finger, moving slider or turning a knob, making fist etc.so project soli wants to make your hands and fingers the only user interface you will ever need to interact with the technology, even without the need to touch anything to control it.



It has pushed the processing power of the electronics to do the sensing part. We can shrink the interrogator and put in the tiny chip. It is reliable, there is nothing to break, no moving parts, no lenses, no piece of sand in the board



Waves on the radio frequency spectrum are emitted at a target by the chip. The panel then receives the reflected waves, which are transferred to a component that interprets the differences between them. Even subtle change detecting in returning waves can be translated into commands for an electronic device.

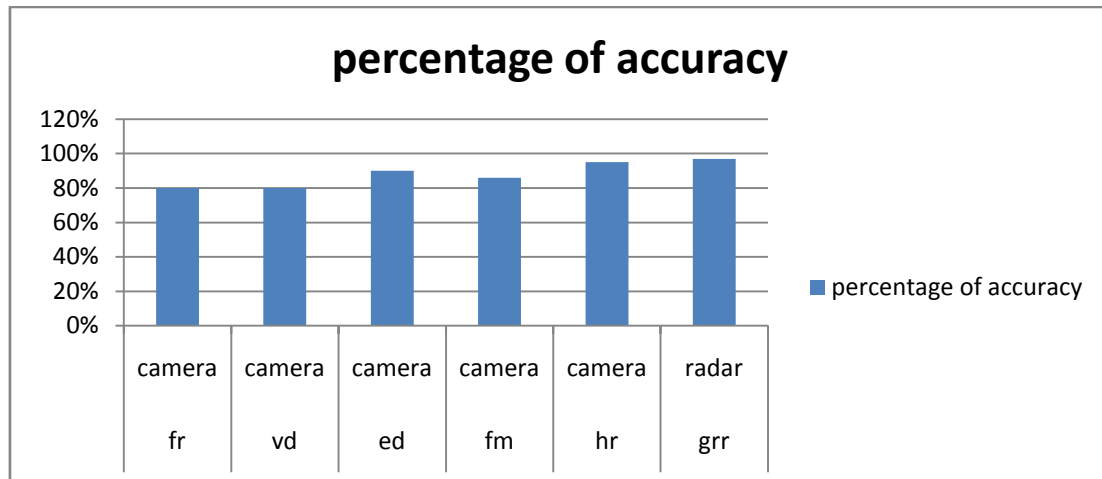
After comparing and analysing the level of accuracy and technique oriented in different analysis technique we get the following readings of different techniques with respect to different level of accuracy.

It uses radio frequency spectrum which is used to track human hand. The RADARs have been used for tracking micro motions, twitches of human hand. Thus the RADAR hardware is turned into a gesture sensor. The ability to interpret so much from one RADAR signal is because of the full gesture recognition pipeline are designed to extract specific information from this one RADAR signal that we receive at a high rate from strange signals. It interprets human in tenth grade or his some unique properties when compared to cameras. For example: it has very high accuracy which means that we can sense the tiniest motions. Since there is certain archetype of control like a volume knob or physical slider volume it needs a virtual tool that could be imagined between thumb and index finger.

recognition techniques	techniques	method using	percentage of accuracy
facial recognition	fr	camera	80%
voice detection	vd	camera	80%
eye detection	ed	camera	90%
finger movement recognition	fm	camera	86%
hand recognition	hr	camera	95%
gesture recognition using RADAR	grr	RADAR	97%



Graph indicating the accuracy level



### III. CONCLUSION

After comparing and analysing the level of accuracy of facial recognition as 80%, eye detection as 90%, voice detection as 80%, finger movement recognition as 86%, hand recognition as 95% using camera. And found that gesture recognition using RADAR is above 95%.

Hence we conclude that so far, project SOLI, the new technology is the best way to recognize human actions. And there could be chances of including other parts of the body or actions of the body as the user interface to interact with the technology.

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