Ideation phase

Literature Survey

DATE	**19 oct 2022**
TEAM ID	PNT2022TMID36359
PROJECT NAME	**A Gesture-based Tool for Sterile Browsing of Radiology Images**

A Gesture-based Tool for Sterile Browsing of Radiology Images

Abstract:

The use of doctor-computer interaction devices in the operation room (OR) requires new modalities that support medical imaging manipulation while allowing doctors' hands to remain sterile, supporting their focus of attention, and providing fast response times. This paper presents "*Gestix*," a vision-based hand gesture capture and recognition system that interprets in real-time the user's gestures for navigation and manipulation of images in an electronic medical record (EMR) database. Navigation and other gestures are translated to commands based on their temporal trajectories, through video capture. "*Gestix*" was tested during a brain biopsy procedure. In the in vivo experiment, this interface prevented the surgeon's focus shift and change of location while achieving a rapid intuitive reaction and easy interaction. Data from two usability tests provide insights and implications regarding human-computer interaction based on nonverbal conversational modalities.

Introduction:

Computer information technology is increasingly penetrating into the hospital domain. A major challenge involved in this process is to provide doctors with efficient, intuitive, accurate and safe means of interaction without affecting the quality of their work. Keyboards and pointing devices, such as a mouse, are today's principal method of human—computer interaction. However, the use of computer keyboards and mice by doctors and

nurses in intensive care units (ICUs) is a common method for spreading infections.[1] In this paper, we suggest the use of hand gestures as an alternative to existing interface techniques, offering the major advantage of sterility. Even though voice control also provides sterility, the noise level in the operating room (OR) deems it problematic.[2]

In this work we refer to gestures as a basic form of non-verbal communication made with the hands. Psychological studies showed that young children use gestures to communicate before they learn to talk. Manipulation, as a form of gesticulation, is often used when people speak to each other about some object. Naturalness of expression, non-encumbered interaction, intuitiveness and high sterility are all good reasons to replace the current interface technology (e.g., keyboard, mouse, and joystick) with more natural interfaces.

This paper presents a video-based hand gesture capture and recognition system used to manipulate magnetic resonance images (MRI) within a graphical user interface. A hand gesture vocabulary of commands was selected as being natural in the sense that each gesture is cognitively associated with the notion or command that is meant to represent it. For example, moving the hand left represents a "turn left" command.

The operation of the gesture interface was tested at the Washington Hospital Center in Washington, DC. Two operations were observed in the hospital's neurosurgery department and insights regarding the suitability of a hand gesture system was obtained. To our knowledge, this is the first time that a hand gesture recognition system was successfully implemented in an "in vivo" neurosurgical biopsy. A sterile human—machine interface is of supreme importance because it is the means by which the surgeon controls medical information avoiding contamination of the patient, the OR and the surgeon.

EXISTING SYSTEM:

In recent decades, the social life and information technology have a very close relationship in the twenty-first century. In the future, especially the interfaces of consumer electronics products (e.g. smart phones, games and infota1inment systems) will have more and more functions and be complex.

How to develop a convenient human machine Interface (Human Machine Interaction/Interface, HMI) for each consumer electronics product has become an important issue. The traditional electronic input devices, such as mouse, keyboard, and joystick are still the most common interaction way. However, it does not mean that these devices are the most convenient and natural input devices for most users. Since ancient times, gestures are a major way for communication and interaction between people. People can easily express the idea by gestures before the invention of language. Nowadays, gestures still are naturally used by many people and especially are the most major and nature interaction way for deaf people. In recent years, the gesture control technique has become a new developmental trend for many human- based electronics products. The objective of

this paper is to develop a real time hand gesture recognition system based on adaptive color HSV model and motion history image (MHI). By adaptive skin color model, the effects from lighting, environment, and camera can be greatly reduced, and the robustness of hand gesture recognition could be greatly improved.

Problem Statement:

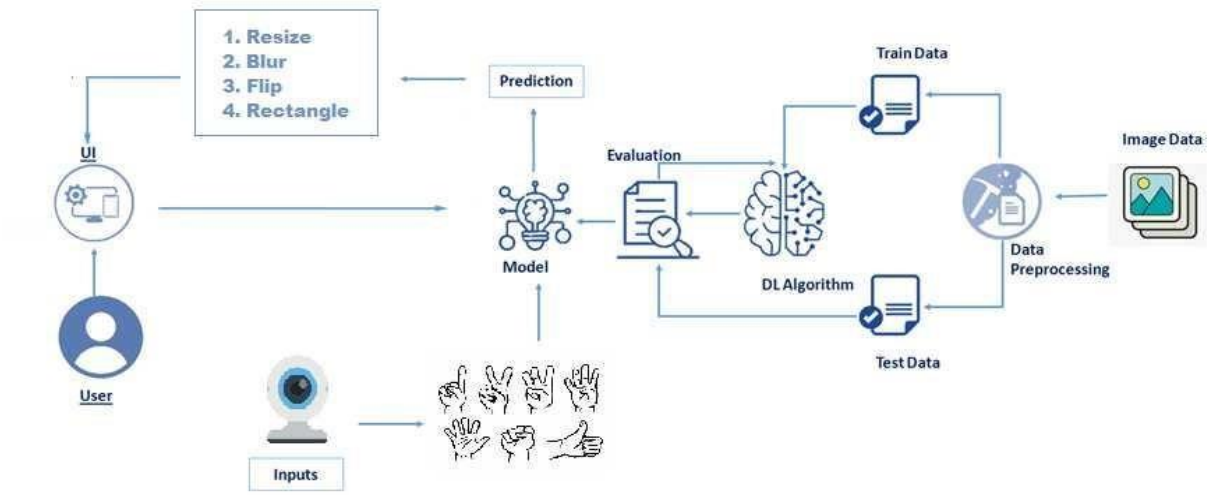
A major challenge involved is to provide Doctors with efficient, intuitive, accurate and safe means of interaction without affecting the quality of their work. However the use of computer keyboards and mouse by doctors in intensive care unit(ICU) is a common mean for spreading infections.We suggest the use of hand gestures in medical field as an alternative to the existing interface techniques by offering maximum level of sterility.

Proposed System:

The interaction with interventional imaging systems within a sterile environment is a challenging task for physicians. Direct physician–machine interaction during an intervention is rather limited because of sterility and workspace restrictions. We propose a method of gesture-controlled projection display that enables a direct and natural physician–machine interaction during computed tomography (CT)-based interventions.

Therefore, a graphical user interface is projected on a radiation shield located in front of the physician. Hand gestures in front of this display are captured and classified using a leap motion controller. We propose a gesture set to control basic functions of intervention software such as gestures for 2D image exploration, 3D object manipulation and selection. Our methods were evaluated in a clinically oriented user study with 12 participants.The results of the performed user study confirm that the display and the underlying interaction concept are accepted by clinical users. The recognition of the gestures is robust, although there is potential for improvements. The gesture training times are less than 10 min, but vary heavily between the participants of the study. The developed gestures are connected logically to the intervention software and intuitive to use. The proposed gesture-controlled projection display counters current thinking, namely it gives the radiologist complete control of the intervention software. It opens new possibilities for direct physician–machine interaction during CT-based interventions most importantly during surgeries carried out in ICU and is well suited to become an integral part of future interventional suites.

Technical Architecture:



Conclusion:

The proposed work will help to eliminate the conventional methods of visualizing images in medical field. It only requires web-camera to capture I/P image. This would lead to a new generation of human computer interaction in which no physical contact with device is needed. Doctors, Nurses or any medical professionals can use the system to operate the computer easily, by using gesture commands.

References:

Schultz M, Gill J, Zubairi S, Huber R, Gordin F. "Bacterial contamination of computer keyboards in a teaching hospital," *Infect Control Hosp. Epidemiol* 2003;4(24):302-303. [PubMed] [Google Scholar]

2. Nishikawa A, Hosoi T, Koara K, Negoro D, Hikita A, Asano S, Kakutani H, Miyazaki F, Sekimoto M, Yasui M, Miyake Y, Takiguchi S, Monden M. "Face MOUSe: A Novel Human-Machine Interface for Controlling the Position of a Laparoscope," *IEEE Trans. on Robotics and Automation* 2003;19(5):825-841. [Google Scholar]

3. Smith KR, Frank KJ, Bucholz RD. "The NeuroStation- a highly accurate, minimally invasive solution to frameless stereotatic neurosurgery," *Comput Med Imaging Graph* 1994;18:247-256. [PubMed] [Google Scholar]

4. Graetzel C, Fong TW, Grange S, Baur C. "A non-contact mouse for surgeon-computer interaction," *Technol Health Care* 2004;12(3):245-257. [PubMed] [Google Scholar]

5. Kuno Y, Murashima T, Shimada N, Shirai Y. "Intelligent Wheelchair Remotely Controlled by Interactive Gestures." *Proceedings of 15th International Conference on Pattern Recognition* 2000;4:672-675. [Google Scholar]

6. Starner T, Auxier J, Ashbrook D, Gandy M. “The Gesture Pendant: A Self-illuminating, Wearable, Infrared Computer Vision System for Home Automation Control and Medical Monitoring” *Fourth Intl. Symp Wearable Comp* 2000:87-94.
7. Wachs JP, Stern HI, Edan Y, et al. “Real-Time Hand Gesture Interface for Browsing Medical Images” *Int. J Intel. Comp. Med. Sci. Image Proc* 2007;1(3):175-185. [Google Scholar]
8. Lewis JR. Psychometric evaluation of an after scenario questionnaire for computer usability studies: The ASQ *SIGCHI Bulletin* 1991;23:78-81. [Google Scholar]