

A Gesture-Based Tool for Sterile Browsing

INTRODUCTION:

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. Through video capture, navigation and other gestures are translated to commands based on their temporal trajectories. "*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.

Existing Solution:

By the early 1990's scientists, surgeons, and other experts were beginning to draw together state-of-the-art technologies to develop comprehensive image-guidance systems for surgery, such as the *StealthStation*. This is a free-hand stereo-tactic pointing device, in which a position is converted into its corresponding location in the image space of a high-performance computer monitor. In a setting like the OR, touch screen displays are often used, and must be sealed to prevent the buildup of contaminants. They should also have smooth surfaces for easy cleaning with common cleaning solutions. These requirements are often overlooked in the busy OR environment.

Disadvantages:

- Surgeons kept their focus of attention between the patient and the surgical point of interest on the touch-screen navigation system.
- Most of the surgery maintained a short distance between the surgeon and the patient.
- The surgeon had to move close to the main control wall to discuss and browse through the patient's MRI images.

Proposed Solution:

A hand gesture system for MRI manipulation in an EMR image database called “*Gestix*” was tested during a brain biopsy surgery. This system is a real-time hand-tracking recognition technique based on color and motion fusion. In an in vivo experiment, this type of interface prevented the surgeon's focus shift and change of location while achieving, rapid intuitive interaction with an EMR image database. In addition to allowing sterile interaction with EMRs, the “*Gestix*” hand gesture interface provides:

- ✓ ease of use—the system allows the surgeon to use his/her hands, their natural work tool.
- ✓ rapid reaction—nonverbal instructions by hand gesture commands are intuitive and fast (In practice, the “*Gestix*” system can process images and track hands at a frame rate of 150 Hz, thus, responding to the surgeon's gesture commands in real-time).
- ✓ an unencumbered interface—the proposed system does not require the surgeon to attach a microphone, use head-mounted (body-contact) sensing devices or use foot pedals.
- ✓ distance control—the hand gestures can be performed up to 5 meters from the camera and still be recognized accurately. The results of two usability tests (contextual and individual interviews) and a satisfaction questionnaire indicated that the “*Gestix*” system provided a versatile method that can be used in the OR to manipulate medical images in real time and in a sterile manner.

Conclusion:

The proposed work will help to eliminate the traditional. It only requires a web camera to capture images. This would lead to a new generation of human-computer interaction in which no physical contact with the device is needed. Anyone can use the system to operate the computer easily, by using gesture commands.