ARTIFICIAL INTELLEGENCE

A GESTURE BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

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A Gesture-based Tool for Sterile Browsing of Radiology Images

Literature Survey

Survey 01

"A gesture-based tool for sterile browsing of radiology images."

- J. Watchs , H. Stern, Y. Edan, M. Gillam, J. Handler, C. Feied, Mark S. Smith
- 2008

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.

Survey 02

"Hand-gesture-based sterile interface for the operating room using contextual cues for the navigation of radiological images."

- M. Jacob, J. Wachs, R. Packer
- 2013

This paper show that the gesture interaction and surgeon behavior analysis can be used to accurately navigate, manipulate and access MRI images, and therefore this modality could replace the use of keyboard and mice-based interfaces.

An image navigation and manipulation task was performed, and the gesture recognition accuracy, false positives and task completion times were computed to evaluate system performance. Experimental results show that gesture interaction and surgeon behavior analysis can be used to accurately navigate, manipulate and access MRI images, and therefore this modality could replace the use of keyboard and micebased interfaces.

Survey 03

"A gesture-controlled projection display for CT-guided interventions."

- A. Mewes, P. Saalfeld, Oleksandr Riabikin, M. Skalej, C. Hansen
- Medicine
- International Journal of Computer Assisted Radiology and Surgery
- 2015

A gesture set to control basic functions of intervention software such as gestures for 2D image exploration, 3D object manipulation and selection and is well suited to become an integral part of future interventional suites.

The developed gestures are connected logically to the intervention software and intuitive to use Conclusions. 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 CTbased interventions and is well suited to become an integral part of future interventional suites.

Survey 04

"Touchless gesture recognition system for imaging controls in sterile environment."

- D. Hsieh
- Medicine

- 2014

It uses a hand-gesture recognition system that gives the user the ability to use one hand to efficiently manipulate medical imaging data and can be easily integrated into existing systems, requires no calibration prior to each usage, and is very low cost.

An experiment was conducted at a local hospital, with 9 radiologists, 3 surgeons, 3 operating room support staff and 1 engineer to validate the adoptability and usability of our plugin tool. From the results, this paper is concluded as thats the participants are receptive to our hand-gesture recognition system as an alternative to using the traditional mouse and keyboard when viewing the imaging or to asking an assistant outside of the sterile field to operate the computer.

Survey 05

"Gesture-controlled image system positioning for minimally invasive interventions."

- Benjamin Fritsch, T. Hoffmann, A. Mewes, G. Rose
- Computer Science
- Current Directions in Biomedical Engineering
- 2021

It turned out that it feels more natural to activate and confirm the system with the same gesture, and it is possible to change the angle of the gantry within 10 seconds average in an experimental setup.

The user study revealed that it is possible to change the angle of the gantry within 10 seconds average in an experimental setup. A straight hand gesture showed higher acceptance than a pistol motivated gesture. Furthermore, the sequences were not optimal and confused the users. It turned out that it feels more natural to activate and confirm the system with the same gesture.

Survey 06

"Intention, Context and Gesture Recognition for Sterile MRI

Navigation in the Operating Room."

- M. Jacob, Christopher Cange, R. Packer, J. Wachs
- Computer Science
- CIARP
- 2012

A sterile, intuitive HCI to navigate MRI images using freehand gestures that incorporates contextual cues and intent of the user to strengthen the gesture recognition process is proposed.

The system incorporates contextual cues and intent of the user to strengthen the gesture recognition process. Experimental results showed that while performing an image navigation task, mean intent recognition accuracy was 98.7% and that the false positive rate of gesture recognition dropped from 20.76% to 2.33% with context integration at similar recognition rates.

Survey 07

"Simulation Interface for Gesture-Based Remote Control of a Surgical Lighting Arm."

- Jean-François Collumeau, Elyse Nespoulous, H. Laurent, Benoit Magnain
- Computer Science
- 2013 IEEE International Conference on Systems, Man, and Cybernetics
- 2013

This paper introduces a simulation of a gesture-based remote control interface intended for ORs, and develops an image processing chain aiming at giving surgeons remote control over OR equipment.

A graphical interface enables the coupling of both processing chain and virtual scene, enabling the user to control the virtual lighting support by performing various hand postures. Functionalities include 3-dimensional displacements, control of the lighting intensity and task-specific pre-programmed movements.

Survey 08

"Gesture-Controlled Image Management for Operating Room: A Randomized Crossover Study to Compare Interaction Using Gestures, Mouse, and Third Person Relaying."

- Rolf Wipfli, V. Dubois-Ferrière, Sylvain Budry, P. Hoffmeyer, C. Lovis
- Psychology
- PloS one
- 2016

Under the premise that mouse cannot be used directly during surgery, gesturecontrolled approaches demonstrate to be superior to oral instructions for image manipulation.

The given gestures could be learned easily and reliability of the tested gesture-control system is good. Conclusion Under the premise that mouse cannot be used directly during surgery, gesture-controlled approaches demonstrate to be superior to oral instructions for image manipulation.

Survey 09

"Touchless interaction with software in interventional radiology and surgery: a systematic literature review."

- A. Mewes, B. Hensen, F. Wacker, C. Hansen
- Medicine
- International Journal of Computer Assisted Radiology and Surgery
- 2016

The main challenges for future research are the improvement and evaluation of usability and intuitiveness of touchless human–computer interaction and the full

integration into productive systems as well as the reduction of necessary interaction steps and further development of hands-free interaction.

Further research is required to cope with current limitations of touchless software interfaces in clinical environments. The main challenges for future research are the improvement and evaluation of usability and intuitiveness of touchless human−computer interaction and the full integration into productive systems as well as the reduction of necessary interaction steps and further development of hands-free interaction.

Survey 10

"Real-Time Hand Gesture Interface for Browsing Medical Images."

- J. Wachs, H. Stern, Y. Edan, M. Gillam, C. Feied, Mark Smithd, J. Handler
- Computer Science
- 2008

A vision-based gesture capture system interprets user's gestures in real-time to manipulate objects in an image visualization environment. A color distribution model of the gamut of colors of the users hand or glove is built at the start of each session resulting in an independent system. The gesture system relies on real-time robust tracking of the user's hand based on a color-motion fusion model. Dynamic navigation gestures are translated to commands based on their relative positions on the screen. Performance evaluation included gesture recognition accuracy, task learning, and rotation accuracy. Fast task learning rates were found with convergence after ten trials. A beta test of a system prototype was conducted during a live brain biopsy operation, where neurosurgeons were able to browse through MRI images of the patient's brain using the sterile hand gesture interface. The surgeons indicated the system was easy to use and fast with high overall satisfaction.

References

01: A gesture-based tool for sterile browsing of radiology images.

02: Hand-gesture-based sterile interface for the operating room using contextual cues for the navigation of radiological images.

03: A gesture-controlled projection display for CT-guided interventions.

04: Touchless gesture recognition system for imaging controls in sterile environment.

05: Gesture-controlled image system positioning for minimally invasive interventions.

06: Intention, Context and Gesture Recognition for Sterile MRI Navigation in the Operating Room.

07: Simulation Interface for Gesture-Based Remote Control of a Surgical Lighting Arm.

08: Gesture-Controlled Image Management for Operating Room: A Randomized Crossover Study to Compare Interaction Using Gestures, Mouse, and Third Person Relaying.

09: Touchless interaction with software in interventional radiology and surgery: a systematic literature review.

10: Real-Time Hand Gesture Interface for Browsing Medical Images.