# A GESTURE BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES

LITERATURE SURVEY

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# 1.HAND GESTURE RECOGNITION:

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Hand gesture recognition system received great attention in the recent few years because of it manifoldness applications and the ability to interact with machine efficiently through human computer interaction. In this paper a survey of recent hand gesture recognition systems is presented. Key issues of hand gesture recognition system are presented with challenges of gesture system. Review methods of recent postures and gestures recognition system presented as well. The essential aim of building hand gesture recognition system is to create a natural interaction between human and computer where the recognized gestures can be used for controlling a robotor conveying meaningful information.How to form the resulted hand gestures to be understood and well interpreted by the computer considered as the problem of gesture interaction.Human computer interaction (HCI) also named Man-Machine Interaction (MMI) refers to the relation between the human and the computer or more precisely the machine, and since the machine is insignificant without suitable utilize by the human.

There are two main characteristics should be deemed when designing a HCI system as mentioned in functionality and usability. System functionality referred to the set of functions or services that the system equips to the users ,while system usability referred to the level and scope that the system can operate and perform specific user purposes efficiently. The system that attains a suitable balance between these concepts considered as influential performance and powerful system .Gestures used for communicating between human and machines as well as between people using sign language. Gestures can be static (posture or certain pose) which require less computational complexity or dynamic (sequence of postures) which are more complex but suitable for real time environments.

Different methods have been proposed for acquiring information necessary for recognition gestures system . Some methods used additional hardware devices such as data glove devices and color markers to easily extract comprehensive description of gesture features . Other methods based on the appearance of the hand using the skin color to segment the hand and extract necessary features , these methods considered easy, natural and less cost comparing with methods mentioned before .Some recent reviews explained gesture recognition system applications and its growing importance in our life especially for Human computer Interaction HCI, Robot control, games,and surveillance, using

different tools and algorithms.This work demonstrates the advancement of the gesture recognition systems, with the discussion of different stages required to build a complete system with less erroneous using different algorithms. The paper organization is as follows: the following section explains key issues of hand gesture recognition system which are segmentation, features extraction, and recognition,applications of gesture recognition,gesture challenges.

## 2.HAND GESTURE METHODS AND APPLICATIONS:

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Authors: Lazzat Zulpukharkyzy Zholshiyeva, Tamara Kokenovna Zhukabayeva, Sherzod Turaev, Meruyert Aimambetovna Berdiyeva, Dina Tokhtasynovna Jambulova,

Automatic Hand Gesture Recognition has become more important in recent years. Due to an increasing number of the deaf and hearing impaired, the use of a variety of non-contact-based applications and devices has also been increased. With the development of modern technology, it also plays a key role in the human-computer interaction systems. Sign language is the main instrument of communication among the deaf, the hearing impaired and the non-verbal. However, there are barriers for these groups in their daily interaction with people who do not understand any sign language. The recent studies in algorithm analysis and computer vision have led to the development of innovative efficient and accurate gesture recognition methods. Since HGR is the basis for sign language analysis, this paper is devoted to conducting the literary survey of hand gesture detection and recognition methods and algorithms, existing sign languages and their applications. The results of this paper can be summarized as following: artificial neural networks, which use advanced methods and algorithms for hand gesture detection and recognition, is the most useful classifier for the recognition of Kazakh Sign Language. In this paper, about 70 references published from 2012 to 2021 were reviewed for identifying common methods for hand gesture recognition.

Sign Language (SL) is the main language used by people with hearing and speech impairments, as well as a means of non-verbal communication to express their thoughts and emotions. However, for people with physical disabilities, it is extremely difficult to understand, thus, translators need to be trained with SL for communication in all areas. The demand for interpretation services has been increased recently. Most qualified translators realize communications between deaf and hard hearing people. This communication is supported by Gesture

Recognition. It is defined as movement of human body or limbs, such as hands, fingers.

Hand gestures also play an important role in the exchange of information between people and computers. In the last decade, this area has attracted the attention of many researchers. Because automated HGR is important for the following reasons: the growth of deaf and hearing-impaired people, the expanded use of applications and non-contact devices. The automatization of human-computer interaction (HCI) is important for information exchange. HGR is a major problem in society, but it is not an easy task, because the hands are naturally deformable objects. A person can easily recognize the shape of the hands by the eyes, but for computer, everything is different, and the main problem is the correct classification of HG by computer.

The purpose of this paper is to provide a comparative overview of recent research, which examines methods, algorithms, and classification of hand gestures supported by various technologies. The paper discusses various types of approaches: based on vision-based and non-vision approaches intended to recognize them. Main contributions of the paper are (1) a comparative review of recent studies aimed at the recognition and classification of hand gestures; (2) overview of existing sign languages and applications; (3) Kazakh sign language overview.

The remaining part of paper is organized as follows: Explains the motivation of the research and the use of HGR,provides a comparative overview of existing modern HGL techniques, discusses current SLs and their applications. Section V demonstrates the results, and the conclusion and future work are presented.

## 3.HAND GESTURE RECOGNITION SYSTEMS:

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Authors: Arpita Ray Sarkar, G. Sanyal, S. Majumder

Gesture was the first mode of communication for the primitive cave men. Later on human civilization has developed the verbal communication very well. But still nonverbal communication has not lost its weightage. Such non – verbal communication are being used not only for the physically challenged people, but also for different applications in diversified areas, such as aviation, surveying, music direction etc. It is the best method to interact with the computer without using other peripheral devices, such as keyboard, mouse. Researchers around the

world are actively engaged in development of robust and efficient gesture recognition system, more specially, hand gesture recognition system for various applications. The major steps associated with the hand gesture recognition system are; data acquisition, gesture modeling, feature extraction and hand gesture recognition. There are several sub-steps and methodologies associated with the above steps. Different researchers have followed different algorithm or sometimes have devised their own algorithm. The current research work reviews the work carried out in last twenty years and a brief comparison has been performed to analyze the difficulties encountered by these systems, as well as the limitation. Finally the desired characteristics of a robust and efficient hand gesture recognition system have been described.

Gesture is a form of non-verbal communication using various body parts, mostly hand and face. Gesture is the oldest method of communication in human. Primitive men used to communicate the information of food/ prey for hunting, source of water, information about their enemy, request for help etc. within themselves through gestures. Still gestures are used widely for different applications on different domains. This includes human-robot interaction, sign language recognition, interactive games, vision-based augmented reality etc. Another major application of gestures is found in the aviation industry for placing the aircraft in the defined bay after landing, for making the passengers aware about the safety features by the airhostess. For communication by the people at a visible, but not audible distance (surveyors) and by the physically challenged people (mainly the deaf and dumb) gesture is the only method. Posture is another term often confused with gesture. Posture refers to only a single image corresponding to a single command (such as stop), where as a sequence of postures is called gesture (such as move the screen to left or right). Sometimes they are also called static (posture) and dynamic gesture (gesture). Posture is simple and needs less computational power, but gesture (i.e. dynamic) is complex and suitable for real environments. Though sometimes face and other body parts are used along with single hand or double hands, hand gesture is most popular for different applications. A few of them are discussed below.

With the advancement of human civilization, the difficulty of interpersonal communication, not only in terms of language, but also in terms of communication between common people and hearing impaired people is gradually being abolished. If development of sign language is the first step, then development of hand recognition system using computer vision is the second step. Several works have been carried out worldwide using Artificial Intelligence for different sign languages. Human-robot interaction is another area where hand gesture recognition has been successfully used. The use of keyboard and mouse is limited to 2D world, but the controlling of a robot should be in 3D space. Hand gesture is most suitable for such purposes. However for robot control only a few

simple commands are being used, such as the hand signal ‘one’ refers to ‘move forward’, ‘five’ refers to ‘stop’ and so on. Similarly, for 3D CAD modeling inputs are provided by hand gestures. The 3-draw technology developed by MIT , is a pen embedded in polhemus device to track the position and orientation of the pen in 3D. A 3D space sensor is embedded in a flat palette that represents the plane of the object. The CAD model is moved synchronously with the user’s gesture and objects can thus be rotated and translated in order to view them from all sides as they are being created and altered.

Other applications include Virtual Reality for communication media systems; for controlling Television device to turn the TV on or off or changing the volume ; 3D gaming . Different researchers are using different algorithms and features for the recognition. As mentioned, some of them are working in 2D and some of them are suitable for 3D environment. So these advancements in the field of hand gesture recognition need a complete review and also the different techniques used need to be analyzed.

The present work reviews a numbers of researches on hand gesture recognition systems along with the different steps of the recognition systems. A comparative study of all these works will provide the direction for work by the beginners as well as brief description of the steps associated with hand gesture recognition system.

## 4. A GESTURE BASED TOOL FOR STERILE BROWSING OF RADIOLOGY IMAGES:

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Authors: Juan P.Wachs,Helman I.Stern,Yael Edan,Michael Gillam,John Handler,Craig Feied,Mark Smith

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.

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.

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.

# 5.GESTURE-CONTROLLED IMAGE SYSTEM POSITIONING FOR MINIMALLY INVASIVE INTERVENTIONS:

Published:2021

Authors: Benjamin Fritsch*, Thomas Hoffmann, André Mewes and Georg Rose

This work examines how a touchless interaction concept contributes to an efficient, direct, and sterile interaction workflow during CT-guided interventions. Two hand gesture sets were designed specifically under consideration of the clinical workflow and the hardware capabilities. These were used to change the position of an X-Ray tube and detector of a CT scanner without breaking sterility and are compared regarding usability and performance in a user study with 10 users. 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.

The number of percutaneous interventions is increasing due to the demographic change. Patients are older and more people get cancer. Especially older and multi-morbid patients often cannot be cured with invasive surgery, i.e. by resection of the lesion. With the help of imaging devices, such as CT scanners, the radiologist brings energy applicators into the tumour region with high precision percutaneously. However, most CT systems were developed as diagnostic devices and thus lack assistance and interaction concepts essential for the interventional workflow. Especially for flat panel CT's to acquire images to visualize the instrument and risk structure locations, the radiologist must position the X-Ray tube and the detector to the dedicated angle for the radiography. Observations revealed that the current workflow is not optimal, due to sterility issues that arise with the use of haptic buttons or touchscreens covered with a sterile drape . A lot of research effort has been done in interaction with visualization and controlling of medical image viewers or registration of images. Wachs et al developed a visionbased hand gesture system to control medical image viewer. Shen et al.developed a hand gesture interaction and visualization for CT volume dataset using a Leap Motion Controller (LMC, San Francisco, California, United States). However, during interventions, controlling imaging devices is a frequent task that still shows a need for application specific sterile interaction concepts.

In this work a gesture interaction concept that translates touchless hand gestures into commands for special-purpose radiography imaging and a graphical user interface (GUI) for visualization purposes is presented. With the help of this system, the interventionalist is capable to position X-Ray tube and detector to a dedicated angle without leaving the sterile area and without breaking sterility. This should improve the workflow of image-guided interventions and, consequently, save time and costs and improve the outcome of treated patients. The proposed interaction concepts were evaluated in a user study with 10 participants regarding error rate, task completion time, and usability.

To tackle the challenges of image-guided interventions listed above a hand gesture interaction concept was designed. Additionally, a GUI was developed to get live feedback of the current and the configured angle. The gestures were detected with a stereo infrared optical tracking system, the LMC.

The proposed interaction concept consists of two gesture sets. Each set includes three phases: Activation, Continuation and Confirmation. Activating the gesture system prevents the user from performing unwanted commands. Especially during interventions, the system must not execute unintended commands. Therefore, the activation gesture unlocks the gantry control. The configured angle must be confirmed by performing the confirmation gesture visualized . Both interaction sets can be activated by performing a fist gesture, which is easy to detect and, at the same time, easy to distinguish from other occasional movements performed by the radiologist.