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A Novel Technical Approach for Implementing Static Hand Gesture Recognition

Ramesh M. Kagalkar[1], Dr.Nagaraj H.N[2], Dr. S.V Gumaste[3]

Research scholar, VTU, Belgaum, Karnataka, India[1]

Professor and Director, IITE, Ahmedabad, Gujarath, India[2]

Professor & Head, Computer Engg, R. H. Sapat College of Engineering, Nashik, Maharashtra, India[3]

Abstract: This survey presents a summary of the difficult field of static hand gesture recognition, that primarily consists of the popularity of well-defined signs supported a posture of the hand. Since human beings tend to differ in terms of size and shape the foremost difficult drawback consists of the segmentation and also the correct classification of the information's gathered from the input image, captured byone or additional cameras. The aim of this paper is to indicate that techniques have with success been tested and employed in order to unravel the issues mentioned higher than yielding a strong and reliable static hand gesture recognition system.

Keywords: KSL, Image Capturing, ZM, PZM, HMM.

1. INTRODUCTION

The language (language of individuals with hearing disabilities), as a special communication system utilized by specific teams of individuals in definite things and d raw back areas, is associate attention-grabbing and promising object for linguistics. In several things and cases the language is that the solely doable chance of communication realization. Till recently the language was used solely within context of human communication. However currently with the event and wide implementation of laptop information technology, the problem of translation from signs (Gestures) to regular text language, following its transformation into sound kind while not a personality's translator became a degree of active analysis interest.

Our analysis is dedicated to creation of program and technological computerized applications that will enable considerably improve things regarding language, pa rticularly with in the cases once no different communication is out there. Things once one in every of the communication sides doesn't grasp the language; however the communication is to be effectively conducted. Although a static hand gesture may in theory be any doable posture of a humans hand, typically solely a restricted set of well-defined postures square measure thought about to be employed in the communication. Since similarities between postures with completely different that means tend to lift the amount of wrong detected / undQerstood gestures, and so the error rate. In general, gesture recognition is taken into account as a really difficult field since natural environments tend to be rather unsuitable for gesture recognition, because of dangerous illumination, non-uniform backgrounds, and so on. The various publications of the recent years show that static hand gesture recognition remains field of active analysis, whereas several of them attempt to face the antecedently mention discus so as to enhance the performance and quality of existing technologies. There exist manyfurther devices(e.g. information gloves), that sq uare measure accustomed solve the antecedently mentioned issues by providing a additional precise capturing of the hand data.

However, this report refers solely to camera primarily based static hand gesture recognition. A doable application of static hand gesture recognition is that the machine assisted communication victimization the Kannada Sign Language (KSL) so as to permit the communication between KSL- and non-ASL-speakers. one more application involves the management of shopper physics, like TVs, Hi Fi-systems, DVD/CD players and then on. A user may so use some management gestures so as to modify them kannada state or on, modification the radio or TV show or to pick out some show or music. combos of gestures may even be accustomed perform additional advanced tasks, like programing the recording of one's favorite TV-show.

This report aims to convey an outline of the technologies and ways accustomed acknowledge static hand posture recognition. Successive section summarizes the essential principles of static hand gesture recognition and shows the technologies that square measure used for all the various tasks, conjointly discussing the benefits and downsides of every technology. In section three some applications squaremeasure bestowed, whereas section fou r covers the discussion. The last section contains the conclusions.

2. GESTURE RECOGNITION PROCESS

There 2 basic approaches in static gesture recognition, as represented in [1];

1. The topdown approach, wherever a antecedently created model of collected data concerning hand configurations is rendered to some feature within

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the image co- ordinates. Examination the chance of the rendered image with the real gesture image is then accustomed decide whether or not the gesture of the real image corresponds to the rendered one.

2. The bottom-up approach, it extracts options features from input image and stored in data base, the given input image is compare with data base image where the results is based on similar measurement.

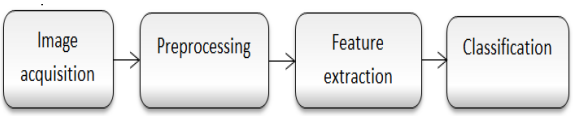

Figure 1: Stages of gesture recognition process.

The disadvantage of the primary approach is that it appears to use a high machine effort so as to realize sturdy recognition. The second approach but needs Associate in Nursing adequate preprocessing so as to realize a reliable segmentation. This report in the main keeps the main target on the latter approach since this appears to be the unremarkably used one. The whole process of static gesture recognition is often coarsely divided into four phases, as shown in Figure 1. Every part performs a selected task, whose result's passed to consecutive part. The unremarkably used techniques for every part square measure represented within the following subsections.

2.1 Image Capturing

The task of this part is to acquire picture, or a sequence of images (video), that is then processed within the next phases. The capturing is generally done employing a single camera with a frontal read of the persons hand, that performs the gestures. However, there additionally exist systems that use two or a lot of cameras so as to accumulate a lot of data regarding the hand posture [1,2]. The advantage of such a system is that it permits recognition of the gesture, albeit the hand is occluded for instance by the body of the person who performs the gesture, since the opposite camera captures the scene from another perspective. Yet one more system was conferred in [3],wherever the camera was mounted on a hat, capturing the world before of the user. Clearly the advantage of this technique is that the camera position is usually custom-made, if the person moves or turns his body around.

In general, the subsequent phases of the popularity method square measure less complicated, if the captured imagedonot have untidy backgrounds, though ma ny recognition systems [3] appear to figure reliable even on untidy pictures. There fore, the image capturing is commonly performed inavery clean up surroundings havin g aconsistent background[4]. it's additionally fascinating t o possess associate in nursing equal distribution of brightness so as to collect pictures while not shadow y regions.

2.2 Preprocessing

The basic aim of this section is to optimally prepare the image obtained from the previous innovate order to extract thefeatures within the next section. However associate optimum result sound s like depends in the main on ensuing step, since some approaches solely want associate approximate bounding box of the hand, whereas others want a properly metameric hand region so as to induce the hand silhouette. In general, some regions of interest, which will be subject of any analysis within the next section, are searched during this section. The foremost ordinarily used technic to work out the regions of interest is complexion detection [5,6]. A antecedently created probabilistic model of skin-color is employed to calculate the likelihood of every constituent to represent some skin. Thresholding then results in the coarse regions of interest. Some any analysis may for instance involve the dimensions or perimeter of the situated regions so as to exclude regions like the face. Different systems, as represented [6], at the start search the image for a constituent of a selected color mistreatment the eight nearest neighbors of the suitable change order to begin the expansion of the region. For consequent pictures the middle of the regions detected within the previous image is employed to seek out the hand regions. one more attention grabbing approach is to use antecedently non heritable image of the background, subtracting it from the image with the gesture, as projected in [5]. Supported perimeter lengths, the hand region will then be extracted.

2.3 Feature Extraction

The aim of this section is to seek out and extract features which will be want to verify the means of a given gesture. Some fascinating techniques area unit bestowed in a while during this section. Ideally such a feature, or a group of such options, ought to unambiguously describe the gesture so as to attain a reliable recognition.

Therefore, different gestures should result in different, good discriminable features. Furthermore, shift and rotation invariant features lead to a better recognition of hand gestures even if the hand gesture is captured in a different angle.

1. Hand Outline

This is often an easy approach that depends on the define of a given hand region [5]. Given a hand region the define is extracted exploitation as an example some edge following algorithmic rule. The native options area unit then described by the native extreme of the define, whereas there area unit two completely different quite extreme: The peaks and therefore the valleys. The peaks area unit sometimes found at the finger tips, wherever as the valleys area unit rather found within the regions where 2 fingers be part of the palm of the hand. One advantage of such options is that the fast exclusion of inappropriate gestures, exploitation the amount of peaks and valleys as indicators. a drawback of this approach is that the comparatively tiny variety of various gestures that may be distinguished, since solely considering the define doesn't allow exploitation the fingers' actual position. Therefore, it's as an example out of the question to tell apart between two hand postures, wherever one uses the center and therefore

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the finger, whereas the opposite hand uses the ring and therefore the fore finger. As a result, this technique solely works well in Associate in Nursing atmosphere wherever solely few gestures got to be distinguished, because it is that the case in [5].

2. Zernike Moments

Zernike Moments (ZM) and Pseudo Zernike moments (PZM) are normally accustomed describe shapes, whereas ZMs are sometimes higher for describing shapes than PZMs. On the opposite hand, PZMs are proverbial to be less full of noise. so as to use ZMs for hand options description, the hand is depicted as a collection of ZMs instead of employing a single ZM. In [3], they planned to 1st separate the hand into two sub-regions, wherever one region contains the finger half, and therefore the alternative consists of the palm. The ZMs and PZMs ar then calculated for every finger and for the palm, exploitation the middle of the minimum bounding circle of the hand silhouette that has the advantage of translation changelessness, creating this feature a lot of reliable. Another necessary technique, that's given in [3], uses a distinct weight for the palm and therefore the finger options. Since most gestures rely a lot of on the particular positions of the fingers and fewer on the palm position, the burden for the fingers ought to be larger than weight for the palm region. Empirical tests result in a weight of 0.7 for the finger options and 0.3 for the palm feature, that the simplest results were obtained.

3. Local Orientation Histogram

In [8], the use of thus known as local orientation histogram features is planned. In general, orientation histograms can't be directly applied handy gestures because the hand doesn't offer decent texture. Since orientation histograms show the frequency of edges aligned in a very sure angle, there may be not enough data accessible within the hand space, so as to unambiguously describe a hand gesture. In keeping with [4], the most downside that may arise is that hand gestures that look totallydifferent for somebody's being, m ight need nearly identical orientation histograms. Yet one more downside is that hand gestures that look terribly similar for humans (for example a rotation of the hand) will yield terribly totally different orientation histograms. However, in [8] it's found that the boundary of the hand form contains enough data to unambiguously describe the feature of a particular gesture. Therefore, the concept of native orientation histograms consists of making overlap ping sub windows; whereas every sub window contains a minimum of one constituent that lies within the hand form. For every of those sub windows associate degree orientation histogram is formed, that is then superimposed to the feature vector. Beside the native orientation histograms additionally the sub window positions area unit superimposed to the feature vector. These positions area unit measured relative to the norm of all constituent positions that were determined to be within the hand region. Clearly, the advantage of this method lies within the improved strength, since exploitation relativepositions ena ble in-plane translations.

2.4. Multi Scale Color Features

Multi scale color options, as employed in [2], don't need any preprocessing of the image. Multi scale options may be found in a picture at totally different scales. Therefore, the hand may be delineate mutually larger blob feature for the palm, having smaller blob options representing the finger tips that area unit connected by some rigid options. Thus, the hand may be detected within the image while not having properly segmental the hand region since blob- and rigid-feature occurrences area unit found in numerous sizes. what is more, it had been planned to perform the feature extraction directly within the color house, as this permits the mix of probabilistic skin-colors directly within the extraction section. The advantage of directly acting on a color image lies within the higher distinction of hand and background regions.

2.5 Classification

The classification represents the task of assignment a feature vector or a collection of options to some predefined categories in order to acknowledge the hand gesture. In previous years many classification strategies are projected and with success tested in several recognition systems. In general, a category is outlined as a collection of reference options that were obtained throughout the coaching part of the system or by manual feature extraction, employing a set of coaching pictures. Therefore, the classification in the main consists of finding the simplest matching reference options for the options extracted within the previous part. This section presents an outline of the foremost normally used strategies in several hand gesture recognition systems.

2.5.1. k-Nearest Neighbors

This classification methodology uses the feature-vectors gathered within the coaching to seek out the k nearest neighbors during a n-dimensional area. The coaching in the main consists of the extraction of (possible sensible discriminable) features from input image, that are then hold on for later classification. thanks to the employment of distance measure like the euclidean or Manhattan distance, the algorithmic program performs comparatively slowly in higher dimensional areas or if there are several reference options. In [8], associate degree approximate nearest neighbors classification was projected, that provides a far better performance.

2.5.2. Hidden Mark off Models

The Hidden Markoff Model (HMM) classifiers belong to the category of trainable classifiers. It represents a applied mathematics model, within which the foremost probable matching gesture-class is set for a given feature vector, supported the coaching information. In [6], HMMs were with success wont to distinguish up to 40 completely different hand gestures with associate

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degree accuracy of up to 91.9%. So as to coach the HMM, a Baum-Welch re-estimation algorithmic program, that adapts the interior states of the HMM according to some feedback regarding the accuracy, was used.

3. Multi-Layer Perceptron

A Multi-Layer Perceptron (MLP) classifier relies on a neural network. Therefore, MLPs represent a trainable classifier (similar to Hidden Markoff Models). They use three or a lot of layers of neurons that are all connected. Throughout the coaching part, the weights of the connections between the neurons are tailored supported the feedback that describes the distinction between the output and therefore the expected result. In [7], a MLP classifier was wont to acknowledge 26 kannada language completely different sign language gestures with a recognition rate of up to 98.7%, counting on the quantity of options wont to describe the gesture.

3. APPLICATIONS

In this section two example systems that show totally different doable static gesture recognition applications are bestowed.

3.1 ASL Recognition

In [6], two static gesture recognition systems that ar employed in order to acknowledge the ASL gestures are delineated . The first one could be a table based mostly system, wherever the linguistic communication person is captured employing a frontal read. The second system is wearable, whereas the camera is mounted on a hat as delineated in section 2.1. For each systems constant recognition system was used, that is predicated on a HMM classification. so as to coach and take a look at each systems a 500 sentences information, of that 400 were used for coaching and a 100 for testing, was used. the 500 sentences were made out of a 40 gestures synchronic linguistics. For the second system a further gesture silence was introduced, that describes things wherever the hands are in rest or if no hand may well be detected within the image. The new gesture became necessary since turning the top whereas performing arts gestures will result in such pictures. The tests showed a recognition rate of concerning 97 for the wearable system and around 92 for the table based mostly system. A doable explication for the higher rate of the wearable system is that there's less occlusion between each hands or the face. Another rationalization is that the wearable system mechanically compensates body rotation. However, the authors mentioned 25% of all errors were insertion errors, caused by continual recognition of constant gesture.

3.2 3D Gesture Recognition System

The aim of the system instructed in [2] is to represent a a lot of natural reasonably device, which may be accustomed navigate in 3D environments. This gesture recognition system represents adoable application ofarather straightforward practicality that solely distinguis hes 4 gestures: purpose, Reach, Click and Ground, whereas solely purpose and Reach are static gestures. However the clicking gesture can even be thought to be a static gesture since its recognition depends solely on a preceding purpose gesture. In distinction to the opposite 3 gestures the bottom gesture could be a pseudo gesture that is employed for any unrecognized hand posture or just in case the image didn't embody a hand in any respect. The system is predicated on 2 table mounted cameras that capture the frontal read of the user, every from aunique angle. mistreatment each pictures of constant gesture permits the system to extract a direction vector, representing the inform direction. So as to demonstrate the varied prospects the system really provides, it absolutely was accustomed produce composite objects during a 3D editor surroundings. What is more, a computer game y-through over a 3D tract was bestowed, mistreatment gesture based mostly navigation. The latter example applied the system within the notable 3D computer game Doom[1]. As associate degree overall statement the system was thought about to be terribly stable and test-users claimed that the system is a lot of intuitive and simple to use compared to a mouse or a keyboard.

4. DISCUSSION

In [4], there appear to be some issues regarding multiple recognition of one gesture once victimization the non-restricted synchronic linguistics. whereas missing a true clarification for the development it's indicated that this happens once a gesture is performed over a comparatively long amount of your time. However, it remains unclear, However a shift between 2 hand gestures is detected and whether or not this might be an answer to the antecedently mentioned drawback. Additionally within the different articles,either it's not expressly mention howe ver such a shift is detected or a shift isn't mentioned in the least. AN solely clarification is planned in [2], wherever particle filtering is employed to trace the hand position and a posture amendment is outlined as a random variation of over 30% of all particles.

5. CONCLUSION

In the past, many time period gesture recognition systems, for instance the signing recognizer in [6] are bestowed, that clothed to control correct on a comparatively little set of gestures. The most drawback of static gesture recognition lies within the quality of the classification algorithms, particularly once victimization high dimensional feature vectors that become necessary so as to be able to distinguish many many gestures. Thus, the event of quicker classification ways and a lot of correct and precise options is extremely vital, So as to run such systems in time period.

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BIOGRAPHIES

Ramesh. M. Kagalkar was born on Jun 1st, 1979 in Karnataka, India and presently working as a Assistant. Professor, Department of Computer Engineering, Dr.D.Y.Patil School Of Engineering and Technology, Charoli, B.K.Via –Lohegaon, Pune, Maharashtra, India. He has 13.5 years of teaching experience at various institutions. He is a Research Scholar in Visveswaraiah Technological University, Belgaum, He had obtained M.Tech (CSE) Degree in 2006 from VTU Belgaum and He received BE (CSE) Degree in 2001 from Gulbarga University, Gulbarga. He is the author of text book Advance Computer Architecture which cover the syllabus of final year computer science and engineering, Visveswaraiah Technological University, Belgaum. He is waiting for submission of two research articles for patent right. He has published more than 18 research papers in International Journals and presented few of there in international conferences. His main research interest includes Image processing, Gesture recognition, speech processing, voice to sign language and CBIR. Under his guidance four ME students awarded degree in SPPU, Pune, five students at the edge of completion their ME final dissertation reports and two students started are started new research work and they have publish their research papers on International Journals and International conference.

Dr.H.N Nagaraja was born on 13 December 1963 at Hosanagara in shimoga district in Karnataka, India and presently working as a Professor and Director, IITE Ahmedabad, Gujarat, India. He has the vast teaching experience of 28 years at various levels. Since 2007 to 2011. He was heading SDM Institute of Technology,Ujire as principal. Since 2011 he is working as principal and director of AITM, Belgaum, Karnataka and also worked as PG Coordinator, Department of PG studies, Visveswaraiah Technological University, Belgaum and He had obtained Ph.D in Power Electronics from IIT, Kharagapur, India in 2006, M.E Degree from WCE Sagali, Maharashtra in 1991 and He received BE (E&E) Degree in 1985 from Govt. B.D.T College of Engineering, Davanagre, Karnataka. He is the life member of many national and international societies. He has presented more than 36 papers in the national and international conference and journals. He has also given 15 invited lecturers at various engineering colleges. He has been conferred best paper presentation award the national conference held at Vellore Institute of Technology, Vellore in the year 2003. His research papers were presented at Japan, Hong kong and Malaysia.

Dr. S.V Gumaste was born on 02 April 1968 in Karnataka, India and presently working as a Professor & Head, Computer Engineering, R. H. Sapat College of Engineering, Nashik, Maharashtra, India. He has 22.5 years of teaching experience at various institutions. He received Ph.D degree from Sant Gadge Baba Amravati University, Amravati in 2015. He obtained M.E (CSE) Degree in 2007 from Prof. Ram Meghe Institute of Technology & Research, Badnera, Amravati. (Sant Gadge Baba Amravati University, Amravati, Maharashtra) and He received BE (CSE) Degree in 1992 from BLDE College of Engineering & Technology, Bijapur. (Karnataka University, Dharwar). He is the author of 03 Books such as fundamentals of C Programming, Exel Publication, Amravati. (In August, 2005), C Programming with 150 solved programs, Exel Publication, Amravati. (In January, 2005) and Basics of C Programming: A Practical Approach, Jai Publication, Pusad. (In August, 2004). He has published more than 12 research papers in International Journals and presented 12 papers in international conferences. His main research interest includes networking ,image processing and speech processing. He is the life Membership with Professional Bodies of LM-20507, Indian Society for Technical Education, New Delhi, Institutional Member (N0046703), Computer Society of India, Mumbai (2008-09) and (MH/222/1645), All India Federation of University & College Teachers' Organizations, Hyderabad (AIFUCTO).