Abstract

In this work, we present an interaction technique based on computer vision for human-computer gesture interaction. With the proposed system, the user is going to be able to make different type of gestures with it’s hand and arm, and the computer will recognize the gestures in order to response individually to each of them.

The main contribution to the interaction field is that this technique implements and improves on the hedge computer vision and pattern recognition algorithms, so it offers a low cost and robust solution for a real world application.

1. Introduction

In recent years, researchers all over the world have been searching new interaction techniques and methodologies. In this field, the most natural one is the gestural interaction. With that kind of interaction, humans can express it’s ideas, request information or give information to other human beings.

The present work is focused in this scenario, so the user must be able to obtain information from a computer using a gestural interface. Much research has been done [1] [2] [3] [4] in gestural interaction and with this work we are trying to obtain a robust technique in order to use it in a real world environment.

2. Proposed Interaction Technique

The main goal of the work is to fulfil the following requirements: 1) low computational cost, 2) robustness against user changes and 3) robustness against scenario changes. In order to achieve those characteristics, the work has focused on the use of on the hedge computer vision and pattern recognition algorithms, improved to obtain a higher robustness ratio.

In the next figure can be depicted this proposed architecture.

![Proposed Architecture](image.png)

Figure 1. Proposed architecture

2.1. Technique overview

The first step is related to image capture. The developed method has to detect the hand which the user is using for the interaction and estimate its position. This information feeds a Hidden Markov Model (HMM) while the user is doing the gesture.

After the user finishes the gesture, the HMM knows which gesture the user had done, so the system is can react appropriately. In the following section we describe the used technologies.

2.2. Technique description

Hand detection is the first step in the proposed interaction system. This is possible to do from
different perspectives but in this work we had chosen the AdaBoost algorithm trained with Haar-like features [7], so we can avoid illumination and skin colour problems. In order to have a better hand detection ration, the output of the algorithm must be filtered with two custom filters, based on a Kalman predictor approach [8].

The second step of the work is the hand position estimation from a 2D image. The position estimation in the camera plane is done with the information obtained in the detection process.

Finally, a Hidden Markov Model is able to distinguish between different gestures and it is going to be the part of the system which recognizes the gesture made by the user.

3. Preliminary Conclusions and Current Work

In this research, we have proposed a vision-based gestural interaction technique. This technique combines factors like robustness against user, scenario and illumination changes, and it is based on the use of one low resolution camera. All this aspects lets the system to be used by everybody, everytime and everywhere, being suitable for mobile and embedded applications.

This interaction technique has two steps. The first one is the estimation of the user’s hand position an the second one is the recognition of the user made gesture. The first step is implemented and tested, and currently we are working on the development of the gesture recognition based on a Hidden Markov Model. With this last step the system will be capable of distinguishing different gestures and interpret them independently.

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References


