

# A Review on Robo Chair Assistance using Head Gesture Recognition

Shraddha V. Manikpure, Rushikesh T. Bankar, Suresh S. Salankar

**Abstract** - Face detection is a computer technology that determines the location & size of human faces in digital images. Thus by determining the head gesture of person sitting on robo chair the controlling of the chair can be done by the improved Adaboost algorithm. The recognized gestures are used to generate motion control commands to the low-level DSP motion controller so that it can control the motion of the Robo Chair according to the user's need. Looking for something, when the commands for the movement are generating must be considered unnecessary movement, thus to avoid this, Head gesture interface focused on the central position of a person sitting on robo chair & identify only the useful head gesture. This paper determines, the improved Adaboost algorithm used for face detection is to increase the output results for the system, effectiveness of the system & efficiency on which the system implements. The concept of Obstacle detection is also used for the enhancement of the system, it is done by using ultra sonic sensors.

**Index Terms** - Face Recognition, Head Gestures, Face Tracking, Obstacle Avoidance.

## I. INTRODUCTION

A system that automatically detects & recognises human head gesture such as nodding & shaking movement of head in complex background conditions using web camera under Uncontrolled conditions are head collectively known as head gesture recognition. Performance improvement is measuring the output, increase efficiency, or increase the effectiveness of the procedure. Face detection is computer technology that states the locations & sizes of human faces in digital images. It detects face and ignores other phenomenon like buildings, trees, and bodies. Deepesh Rathore, Pulkit shrivastava, Sankalp pandey, Sudhanshu Jaiswal [1] proposed assistance of intelligent wheelchair for handicapped, visually impaired peoples. They used accelerometer and magnetometer for navigation system. This wheelchair proposed also has obstacle detection feature and also voice guidance system. A general case of face localization is face detection. In face localization, it find the locations and sizes of known number of faces (usually one), whereas, in face detection face is processed and matched bitwise with the database provide for underlying face image. Any small change in facial expression such as smile, lip movement will not match the face. Face detection can also be known as a particular case of object-class detection.

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In object-class detection, it finds the locations and sizes of all objects in an image that belong to a given class for example, upper torsos, pedestrians, and cars. Jatin chatrath, Pankaj Gupta, Puneet Ahuja, Aryan Goel, Shaifali M. Arora [2] proposed the face detection and tracking techniques in their paper, they also discussed various features used for face detection and simulated result is shown by using Vila Jones algorithm. They have worked on real-time human face detection and tracking. Face detection algorithm is based on the detection of frontal human faces. It is same as image detection in which bit-by-bit matching of the image of a person is done. Images are matched with the image stored in database. Any change in the facial feature of the database will invalidate the matching process. Face detection process has applications in biometric, as a part of facial recognition system. Also in video Surveillance, human computer interface and image database management. Generally, classification of images is based on the values of sample features. Features based systems is more advantageous to use rather than using pixel based systems, as feature based system operates much faster than pixel based systems. There are three types of features for face detection procedure, 1] Two Rectangle feature, it is the difference between the pixels sum within two rectangular regions, 2] A three-Rectangular features, it calculates the sum of two outside rectangles subtracted from the sum of centre rectangle. 3] Four rectangle features, it computes the difference between diagonal pairs of rectangle.

## II. HEAD GESTURE OF HUMAN

A system that automatically detects and recognizes human head gestures such as nodding and shaking in complex background conditions using web camera under uncontrolled conditions is known as head gesture recognition. The images of head that is captured at 20 frames per second, are very noise and are low in resolution. The moment of every image captured and extracted is given to the reorganization system that is based on discrete hidden Markov models (HMMs) to classify head gestures. In order to discuss the head gesture under any special conditions with satisfied AdaBoost frontal, profile left and profile right head gesture classifier are given in this paper. Yuan Luo Zhang-fang Hu & lin li yizhang [3] proposed, human wheelchair interaction using head-gesture. The components used for head gesture is face detection which is done by adaboost algorithm for face detection and is processed by using kalman filter. Since Adaboost is a technique used for face detection that is based on appearance of face method, the right as well as left appearance is quite similar. Generally, many-times it is difficult to guess whether the face detected is right profile or left profile. Therefore to solve this problem a simple way is used as, the profile having bigger detection window dominates the head gesture.

When both the windows i.e, left profile and right profile detection windows are same in size, the robochair will keep the previous cycle status. The robochair will turn right or left if an only is the profile face is detected. Further detection of face as left frontal or right frontal / up frontal or down frontal / centre frontal, such frontal faces are detected from which head gesture is to be recognised. Because of certain distance from face to webcam, the face detection windows in various frames are not of same size. Thus, the detected window should be necessarily selected to a standardized size. The standard face window size is 100 X 100 pixels. Then, to calculate the precise noise position the classical template matching method is applied in this small windows that will tell the exact frontal face head gesture. Shang Fuhna [4] proposed improved adaboost algorithm based on unbalanced data exist in the real world from his research study. Also he improved methods for classification of non-equilibrium errors in data giving the effective analysis for improved methods. Due to large difference between the frontal face & profile face, Adaboost algorithm tracks frontal and profile head gestures separately. When the user gently moves his/her head to look at something around, but does not want to move the chair, adaboost algorithm distinguish this situation condition and avoid generating any command responsible for the movement of chair. To achieve this, the on-board camera should restrict to focus on face of the user who is sitting in the centre of the robochair. If the user sits side of the chair, this system will consider this situation as, the user don't want to control the chair using his head gesture. Also, it is assumed that the useful head gestures must have a range of 45 degrees of turning angles on each side i.e, up, down, left and right. If the turning angles of head gestures that is being detected are out of range, the system will treat this as no movement and no motion control commands will be generated.

### III. FACE DETECTION TECHNIQUE

Human face detection plays an important role in face recognition system. Adaboost is an algorithm designed is used for face detection techniques. A machine learning algorithm, Adaboost has achieved remarkable success in classification of data and object detection. Latter on the modified generalized version called Real Adaboost was proposed by Schapire & Singer. This real adaboost algorithm increases the weight of samples that are misclassified whereas decreases that are misclassified whereas decreases the weight for correctly classified sample in each iteration. Yi Xiang, Ying Wu & Jun Peng [5] tried to improve adaboost face detection algorithm undertaking into consideration based on weighted parameters that will eventually dominates the weak classifier for better accuracy of the result experiment. Under various following conditions the performance of adaboost is tested. a) Normal condition, b) Lightning conditions, c)Darkness, d) Face colour noise, d) Face colour noise, e)Occlusion, f) Different face colour, g) Multi faces with different colours, h) Multi faces with similar colour, i) Profile, j) Profile lighting. Jia Mingxing, Du Jungiang, Chang tao, Yang Ning, Jiang Yi, Zhang Zhen [6] proposed improved face detection algorithm by combining two methods used for detection of face as AdaBoost and SVM (support vector machine). They have noticed from this methods that is, by combining adaboost and SVM improved the detection rate whereas decreased computation amount.

### IV. METHODOLOGY

Hairong Jiang, Bradley Duerstock & Juan Wachs [7] proposed a machine which has vision-based gesture recognition interface for the peoples those are, physically impaired or disabled to perform their own activities required for daily routine to maintain. Methodology is a process according to which the flow of the process methods can be undertaken. Basically methodology defines the process steps. Initially variables are initialized in which, for face detection, for action state of robochair, searching for window will be done. For searching window, it will consider full frame. After this initialization of variables according to its contents, it will grab a frame. This frame is then matched with the database already provided to the system and thus the face is detected. Searching window then scanned and try to fix the whole frame. Then it is passed to adaboost face detection algorithm. The adaboost face detection algorithm sees for a face is to be detected. If no face matched with the provided database, it starts the process again from the beginning. But if the face is detected, it further search for the profile i.e, face detected is frontal right or frontal left and so on in all the possible conditions/directions. This is all done by scaled nose template matching. This generates the motion control commands for the robochair according to the head gesture reorganization and thus, triggering the chair to move in the direction as per users intension. Ziad Shaaban [8] proposed various face detection methods. As face detection plays an vital role in the face recognition system. This paper discussed various face detection methods required for face detection briefly. Yuichiro Tajima, Koichi Ito, Takafumi Aoki [9] improved the performance of face detection algorithm with the help of occluded-region detection. They have detected occluded region using fast-weighted principle analysis.

### V. OBSTACLE DETECTION TECHNIQUE

In obstacle detection sonar is used to send ultrasonic sound waves out and detects objects. Sensors are the device that senses or detects the change in the surrounding and conveys or records the information in various manners. There are various specifications of sensor: Accuracy of a sensor is defined as, error between the true value being measured and the result of a measurement. Resolution of a sensor is given as the smallest increment of measure that a device can make. Sensitivity can be stated as, the ratio between the small change in input physical signal to a change in the output signal. Slope of the input-output fit line. Repeatability/Precision is considered as over a number of trials the ability of the sensor to result the same value for the same input Widodo Budiharto, Djoko Purwanto, Achmad Jazidie [11] proposed a robust obstacle avoidance system for the service robots as wheelchair or robochair works according to Bayesian approach. This is in the indoor environment. The reorganization and detection, avoidance is done by ultrasonic sensor in the proposed paper. When the robot or robochair touches the obstacle there are various types of sensors such as, Bump sensor that automatically activated switches. Infrared proximity detectors, which detect the presence of an object in front of the sensor. Ultrasonic range sensors, which determine the range of the object in front of it.

Laser range finders, which work on the same principle as ultrasonic. Obstacle avoidance is a primary requirement for any autonomous mobile robo chair. The robot acquires information about its surroundings through sensors mounted on the chair.

## VI. RESULTS

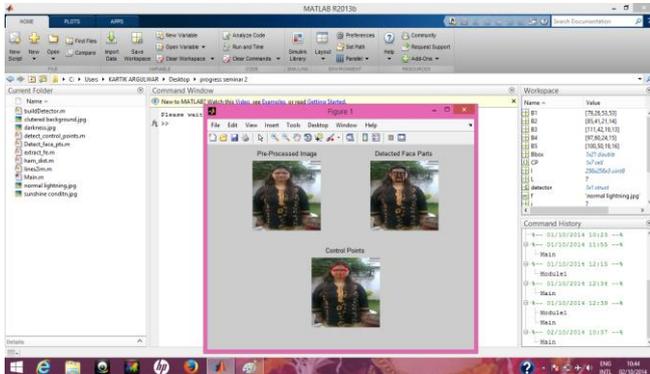


Figure 1: Lightning Condition

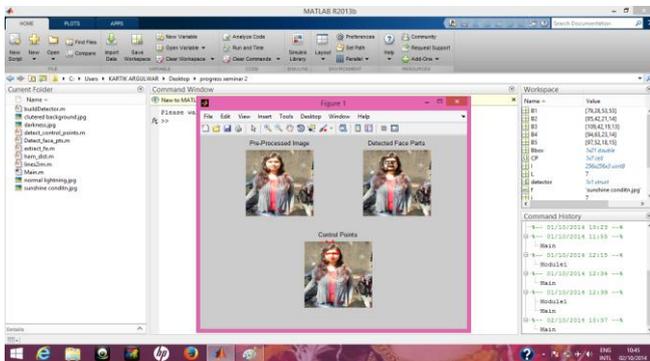


Figure 2: Sunshine Condition

Here we used AdaBoost algorithm to generate the control points used for as the command input to robochair according to which it will mobile. The results showing the simulation result in lightning condition. Among the 3 small images in figure 1, first is the pre-processed image; next to it is the detected face points image and the final shows the control points generated for the mobility of robochair. According to which the chair move in the best possible directions. This image is taken in sunshine condition shown by the label pre processed image, then the image is passed through the algorithm to detect the face parts (facial geometry) & then the final result is obtained i.e, the control points are detected, according to these control points generated the mobility for the chair can be estimated.

## VII. CONCLUSION

The importance of gesture recognition is to make the flexible interaction between the human-machine in an efficient way. In this article, we have provided a survey on gesture recognition with particular emphasis on head gesture and facial expression which is used for the face detection process. In this review paper, a system is considered called as robochair used for the disabled person with the aim to make their life easier and simple. This chair recognizes the head gesture & detects the face using webcam fixed on the chair. By detecting the head gesture motion control commands are generated and is briefly discussed in this paper.

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