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Automated Static Body Language Identification System for Human-Robot Interaction: A Review

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Abstract: For social robots to be successfully integrated and accepted within society, they need to be able to interpret human social cues that are displayed through natural modes of communication. Service robots directly interact with people, so finding a more natural and easy user interface is of fundamental importance. In particular, a key challenge in the design of social robots is developing the robot's ability to recognize a person's affective states (emotions, moods, and attitudes) in order to respond appropriately during social Human–Robot Interactions (HRIs). In this project development of a social robot which will be able to autonomously determine a person's degree of accessibility is proposed. The work will determine the performance of our automated system in being able to recognize and classify a person's accessibility levels and investigation of how people interact with an accessibility-aware robot which determines its own behaviours based on a person's accessibility levels.

Keywords: Rehabilitation, Recognizes a body gesture, Face expressions, Modelling of body gestures.

1. INTRODUCTION

Human–Robot Interaction (HRI) involves investigating the design and performance of robots which are used by or work alongside humans. These robots interact through various forms of communication in different real-world environments. Namely, HRI encompasses both physical and social interactions with a robot in a broad range of applications, including cognitive rehabilitation.

In today's world, most of all sectors, the work is done by robots having different number of degree of freedoms as per the requirement. The idea is to change a perception of remote controls for actuating manually operated Robot. We eradicate the buttons, joysticks and replace them with some of the more intuitive technique. The proposed electronics system recognizes a particular body gesture that will be performed in front of webcam & transmitted respected signals wirelessly through RF module. Depending on the received signals the robot performs the receptive motions at the receiver section. Thus, it is important that during social HRI, a robot has the ability to identify and categorize human displays of static body language with the aim of improving engagement during such interaction through its own appropriate display of behaviours.

The development of human-like social robots with the social functionalities and behavioural norms required to engage humans in natural assistive interactions such as providing reminders, health monitoring and cognitive training and social interventions. In order for these robots to successfully partake in social HRI, they need to be able to recognize human social cues. This can be achieved by perceiving and interpreting the natural communication modes of a human, such as body language, paralanguage (intonation, pitch, and volume of voice), speech and facial expressions. It has been shown that changes in a person's affect are communicated more effectively with nonverbal behaviour than verbal utterances.

Our work focuses on recognizing a person's affect through body language. Body language displays are very important for communicating human emotional states emotion recognition from images of posed static postures with the face and hand expressions obscured is as accurate as emotion recognition of facial expressions.

The majority of automated systems that have been developed have primarily focused on classifying a person's affective state from dynamic body gestures only a few automatic body language-based affect recognition techniques consider static body poses and postures.

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A recognition system based on facial features obtained from a camera, posture information from a pressure sensing chair, pressure information from a pressure sensitive mouse, and skin conductance from a wireless sensor was able to predict if a child would become frustrated during a problem solving activity on a computer with a 79% recognition rate.

The recognized affective states were compared with the affective states determined from verbal information to identify an actor's overall affective state during a drama improvisation scenario. This information was used to determine the behaviour of a virtual agent interacting with actors. Furthermore, changes in static body language can induce changes in affective states. One main advantage to using static body language is that a person usually displays these unconsciously and unintentionally, and therefore, they are natural and not forced. In communicative situations, body language can be a dominant source of information regarding gross affect states between two interactions.

2. LITERATURE REVIEW

I. Kathy L. Walters and Richard D. Walk[1] found that To investigate whether the dynamic moving condition in a videotape would transfer to a photograph, we showed subjects still photographs of emotions (anger , disgust, fear, happiness, sadness, and surprise) depicted as points of light in dynamic light displays. Overall recognition was 70.4 % with the dynamic light displays, but it dropped to 25.5% with the blurred tracks in the photographs, significantly above a chance level of 16.7%, but not large. Happiness, anger, and sadness were the most accurately recognized. The transfer effect of abstract movement to a still photograph may not be high, but the most active emotions (happiness, anger) and the most inactive one (sadness) do transfer. Our results may have some implications for the artistic rendition of movement in pictures

II. Schouwstra and Hoogstraten[2] conducted a study with stick figures with varying head and spinal positions in which they asked college students to infer emotional states from the positions. Their findings indicate a significant relationship between emotion, and head and spinal positions.

III. L. Zhang and B. Yap[3], adaptive resonance theory neural networks were used for affective pose recognition via five specific Kinect SDK static skeleton poses for the affective states of frustration, disagreement, confusion, anger, and shyness. The recognized affective states were compared with the affective states determined from verbal information to identify an actor's overall affective state during a drama improvisation scenario. This information was used to determine the behaviour of a virtual agent interacting with actors.

IV. S. Gong, P. W. McOwan, and C. Shan[4] shown that changes in a person's affect are communicated more effectively with nonverbal behaviour than verbal utterances One main advantage to using static body language is that a person usually displays these unconsciously and unintentionally, and therefore, they are natural and not forced. They also investigate affective body gesture analysis in videos, a relatively understudied problem. Spatial-temporal features are exploited for modelling of body gestures. They also present to fuse facial expression and body gesture at the feature level using Canonical Correlation Analysis. The current spatial-temporal features based video description does not consider the position relations of cuboids detected.

V. T. Lourens, R. van Berkel, and E. Barakova[5] found a 2-D color camera, oriented to capture a front view of a person's upper body, was used to determine human affective (happy, angry, sad, or polite) hand movements. Skin color segmentation and geometric region marking were used with motion tracking to determine the Laban movement features of weight, space, flow, and time. The method is proposed for HRI applications. Preliminary experiments, without a robot, showed that sad, happy, and angry hand movements were identified from strumming a guitar.

3. PROBLEM DEFINITION

Service robots directly interact with people, so finding a more natural and easy user interface is of fundamental importance. While earlier works have focused primarily on issues such as manipulation and navigation in the environment, few robotic systems are used with user friendly interfaces that possess the ability to control the robot by natural means. The accessibility-aware robot behaviour type was perceived to

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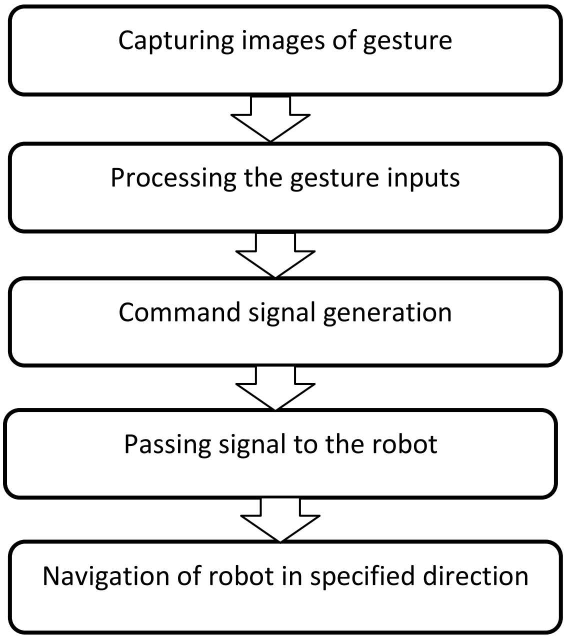
be significantly more socially intelligent than the non accessibility-aware robot behaviour But it very complex method having low accuracy.

4. PROPOSED WORK

In this project, we will consider extending the current system to an affect aware system which will consider the fusion of other modes of communication. we implement the automated static body language identification and categorization system for designing an accessibility-aware robot that can identify and adapt its own behaviour to the accessibility levels of a person during one-on-one social Human Robot Interaction. The stages in the proposed methodology are shown below in the form of flow chart.



The architecture of our multimodal static body pose estimation approach in which 2-D images and depth data acquired by the sensor are used by the human body extraction and body part segmentation modules to first extract a person from the background and then to identify each specific body part. The body parts are used to identify static body poses via the static pose identification module. The reverse tree structure ellipsoid model module then determines the 3-D poses of each of the body parts in these static poses. Lastly, the body pose estimation module determines the orientations and leans of each static body pose.

5. CONCLUSION

We aim to utilize our social robot in a large variety of indoor locations, including large public/semi-public areas, such as retirement homes, office buildings, museums, and shopping malls, which may consist of cluttered interaction environments as well as the potential of having other people located around the interaction scene. A statistical model of the environment is generated by creating an mixture of Gaussians for each pixel. During the one on-one interactions, the statistical model of the scene is investigated further with connected component analysis.

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