An Artificial Intelligence: Based Approach for Simulating Pedestrian Movement and Gesture Recognition as a Model of Human Automation

N Laxmi Prasanna
Dept. of ECE
Ballari Institute of Technology & Management
Ballari, Karnataka
prasannanagothu@gmail.com

Neha Singh K.R
Dept. of ECE
Ballari Institute of Technology & Management
Ballari, Karnataka
nehasng275@gmail.com

Palagiri Revathi
Dept. of ECE
Ballari Institute of Technology & Management
Ballari, Karnataka
revathipalagiri369@gmail.com

Sai Bharath M.V
Dept. of ECE
Ballari Institute of Technology & Management
Ballari, Karnataka
saibharath.sunny@gmail.com

***Abstract* –Simulating human movement behaviour based on artificial intelligence technology with the concept of replacing cognitive structure of human with an analogous mechanism in artificial technology systems. Gesture is the most primitive way of communication with human automated systems.**

Large volume of microscopic human movement behaviour types was collected and encapsulated in artificial neural network and with the help of the above mentioned mechanism we can optimise the human mental process in terms of energy and time and just by working out on the algorithm it enables us to create the analogous mechanism that's nothing but a reflexive structure.

AI systems in real time which were not used before due to high time consumption and the entire study of human automation is based on information metabolism theory (IMT).

This paper proposes a novel gesture recognition and finger-count detection algorithm for automated human interactions. The body gestures are captured and the corresponding output is extracted.

The hand gesture recognition system based on the proposed methodology enables the use of affordable data glove with a small number of sensors. According to the literature, there are no similar solutions that allow efficient recognition of simple and complex static hand gestures, based on a hand gesture.

1. INTRODUCTION

The demand for increase in theoretical frames of artificial intelligence systems makes to improve the technology of including cognitive basis of behaviour into the reflex actions or behaviour into the existence.

The inducement of cognitive structures makes the capability of deciding the function to be done by it. In simple, by inducing the cognitive structure, it makes its own decisions which turns into actions.

This technology can develop a pedestrian flow model and approach that can simulate pedestrian movement from microscopic perspective crucial for design and management of public transportation facilities. Here, taking the example of walking in a crowd, here we can induce the technology of deciding how to walk in the crowd, as a certain minimum distance we can implement the functions like taking left or right by the pedestrian over there.

In other case, like alteration, based on the energy of the footprints, we can identify the tackles in the crowd.

Here coming with another idea of implementing human psyche like memory, learning process intelligence, consciousness and emotions that are studied as functional mechanism which can be applied in AI. Particularly, in agent systems and autonomous robots. In this case we can use this based on the pedestrian footprints energy, if we are using this with agent systems we can protect the tackles facing by the pedestrians in a crowd, if there is a high energy change in the pedestrian's footprint, the agent diagnoses it and instructions to safe the people can be included into the agent system.

The entire system is based on IMT (information metabolism theory) introduced by polish psychiatrist Antoni: this offers a wide range of possibilities of application as a theoretical basis of AI systems.

The main aim of the study is implementing the human cognitive structure with the reflexive structure which results in optimizing the human mental processing in terms of energy and time. We can implement algorithms which enables us to create the analogous mechanism in artificial intelligence system.

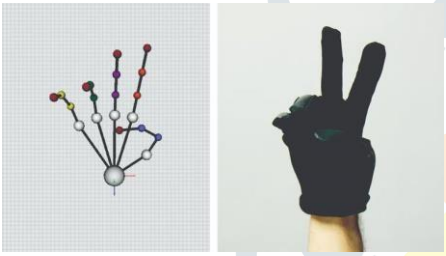
The term gesture is defined as movement of body or limbs to convey an idea. It finds enormous application in human computer interaction, human automated systems.

The gestures can be broadly categorised into the following groups:

i. Hand and arm gestures.
ii. Head and face gestures.
iii. Body gestures.

Hand and arm gestures	Recognition of hand pores, sign languages and entertainment applications.
Head and face gesture	Nodding or shaking of head direction of eye gaze, raising eyebrows, opening mouth to speak, wink, flaring the nostrils, look of surpr--ise, anger, sadness etc.
Body gestures	Analysing movement of the dancer for generating matching music an graphics.

Hand gestures can be used for communication between human and automated devices. Numerous approaches have been developed to interpret hand gesture for human automated system. The body gestures recognition approaches can be mainly divided into data-glove basedand vision based approaches. The finger motions are involved into multi-parameters data.



The extra sensors are used to collect hand configuration and movements, but the devices are quite expensive andit needs experience for the operation of the device. In contrast, vision based methods do not require any extra device

1. RELATED WORKS

Anomaly detection using energy footprints has been partially investigated in the literature.
In general, energy based anomaly detection methods are grouped according to how measurements are performed.

a) System Based: An energy footprint is created by considering the whole consumption of device. The "clean system" is represented by obtained data that serves as a baseline for malware discovery.
b) Application Based: Here also an energy footprint is created for a well-defined pool of applications (e.g. Games) and each one is measured separately. The collected traces are then compared at runtime against the data obtained with a single process granularity.
c) User Based: An energy footprint is created by analysing the typical behaviour of users and the related power consumption.
d) Attacked Based: Measurements are done while real attacks or malicious malware are targeting a controlled environment.

2. FRAME WORK OF THE PROPOSED GESTURE RECOGNITION

To enable efficient use, the gesture recognition system should have following features:

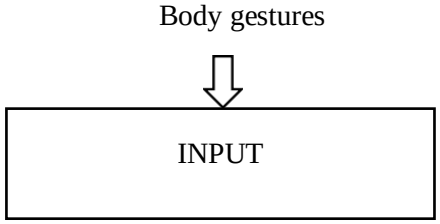
1. Fast training.
2. High gesture recognition rates.
3. Ability to work with various users.
4. Extensible gesture dictionary.

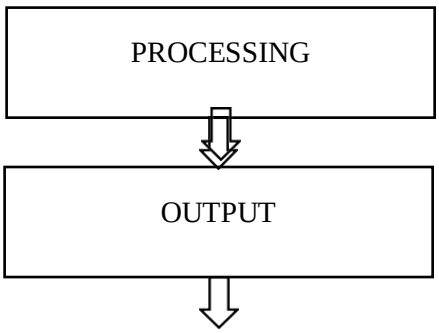
From the aspect of training speed and gesture dictionary (template matching table), PNN is the most convenient option for the core component of the proposal gesture classifier.
The PNN trains immediately, it does not require time consuming iterative training.

3. METHODOLOGIES

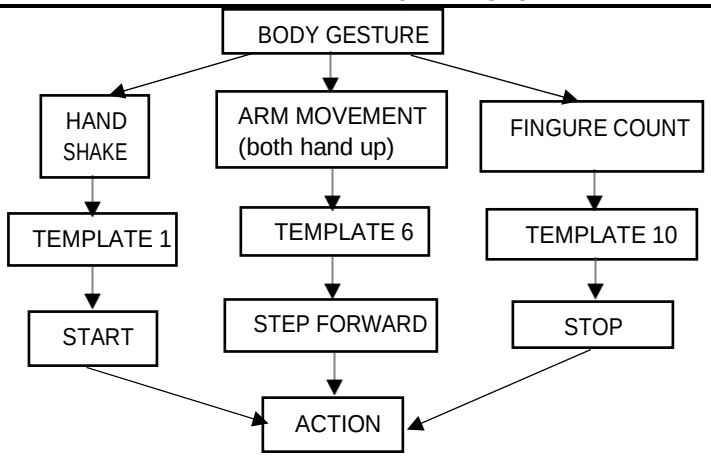
4.1 Template matching for gesture recognition

As systems become more pervasive in society, facilitating natural human-system interaction will have a positive impact on their use. Hence, these has been growing interest in the development of new approaches and technologies for bridging the human-system barrier the ultimate aim is to bring human-system interaction to a regime where interactions with systems which are implemented by human automation, will be as natural as an interaction between humans, and to this end, incorporating gestures in human-system (human automation) is an important research area.





Corresponding response is obtained



Inputs: The input provided by the pedestrian is taken under the processing system. The inputs provided here are body gestures. In this way we can apply stimulus/stimuli to the human automated system which responds to the particular body gestures.

Processing: The processing is done by taking the input by the pedestrian to the system to function by the human automated system technique or technology. The corresponding output for the provided input is produced through template matching. The input provided is checked from all the templates available in the system and the corresponding output for the particular template is produced as the final result. Here, the action provided by the pedestrian comes into picture and produces result as the reflex action by the automated system. Here are some of the templates shown below for the reference.

Inputs	Templates	Outputs
Handshake	Template-1	Start
Arm-movement (right)	Template-2	Move towards right
Arm-movement (left)	Template-3	Move towards left
Finger count 1	Template-4	Apply break
Finger count 2	Template-5	Decrease the speed
Arm-movement (both hands up)	Template-6	Step forward
Clap of 1	Template-7	Step backward
Clap of 2	Template-8	Hold on for 5min
Finger count 3	Template-9	Restart the process
Finger count 4	Template-10	stop

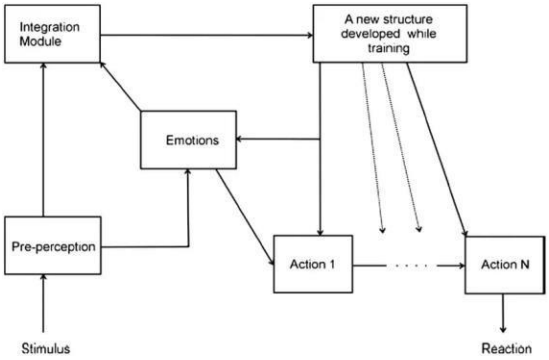
Output: The output is produced on the basis of human automation template matching. Every template has a body gesture as its input. After processing level, the template matching is done and the respective output is produced. This is how, the process takes place and the tasks performed are based on the template matching provided.

Gestures have been considered as an interaction technique that can potentially deliver more natural, creative and intuitive methods for communicating with human automated systems. This provides an analysis of comparative surveys done in this area. The use of body gestures as a natural interface serves as a motivating free for research in gesture taxonomies.

Its representations and recognition techniques, software platforms and frameworks. It focuses on the three main phases of body gesture recognition i.e. detection tracking and recognition.

Different application which employs body gestures for efficient interaction has been discussed under core domains. We can also use this technique in multisensor data fusion. Multisensor data fusion is an emerging technology applied to department of defence (DOD) areas such as automated target recognition, guidance and control of autonomous vehicles.

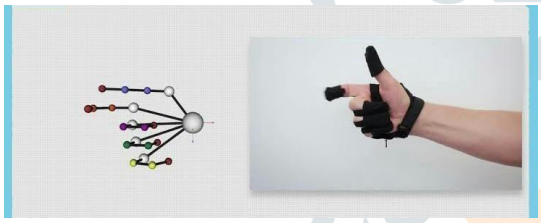
Techniques for multisensor data fusion are drawn from a wide range of areas including artificial intelligence, pattern recognition. We can even implement autonomous robot that can function successfully in indoor environment.



4.2 Glove based approach

A data glove is an interactive device, resembling a glove worn on the hand, which facilitates tactile sensing and fine motion control in robotics and virtual reality. Data gloves are one of the several types of electromechanical devices used in haptics applications.

In this approach the user needs to wear a glove which employee mechanical or optical sensors attached to it that transforms finger or flexions into electrical signals to determine the hand postures.



3.3 Vision based gesture recognition

Vision based approach are more user friendly and do not require any extra devices for analysing gestures. It is the most natural way of user interaction as human automated system perceives information from their surroundings. The methods under this approach deal with some properties such as texture and columns for identifying the gesture.

4. CHALLENGES IN GESTURE RECOGNITION

The most promising challenges in gesture recognition are:

i. Scale problem: when the hand poses have different sizes In the gesture image, the problem arises.

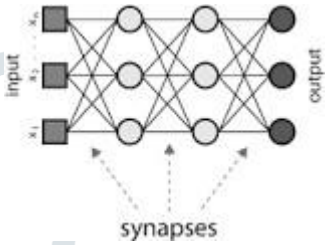
ii. Translation problem: the variation of hand position in different image can also lead to enormous representation of the features.

iii. Background problems: this problem arises when the back ground contains any skin-coloured objects, which leads to misclassifications.

iv. Variation of illumination conditions: any change in the lighting conditions greatly affect in skin segmentation.

5. FUTURE DEVELOPMENT SCOPE OF HUMAN AUTOMATED SYSTEM

Using artificial neural network, we can induce the functioning of brain. The main moto here is just by the thought in the brain, the body has to work accordingly to the thinking of the brain. The artificial neural network can be implemented where in the body is not supporting with the actual nervous system. We can implement this in case of a paralysis patient.



In this case we cannot make to work the normal nervous system. So by implementing artificial neural network we can control the working of the body. The thing which can be achieved here is the function of the body by artificial neural network which is initialised by a thought in brain about some particular activity.

CONCLUSION

In today's world people are demanding the evolution of touch to touchless technology. The natural user interfaces are simple and easy to use, but very difficult to implement. In this paper vision based, data glove based and template matching based, gesture recognition techniques have been reviewed. Recognition of dynamic gestures compared to static gestures needs more computation. From the comparative analysis of some papers on dynamic gesture recognition it is observed the scope towards this direction could be gesture segmentation. Another direction could be to develop efficient algorithm for extraction of relevant features and feature selection that leads to good recognition. So in this way the efficient recognition of gestures can be implemented through human automated systems.

REFERENCES

[1] M. Agarwal, N. Kumar, and L. Vig, "Non-additive multi- objective robot coalition formation," Expert Syst. Appl., vol. 41, pp. 3736–3747, 2014.
[2] J. H. Andreae, "A multiple context brain for experiments with robot consciousness," IEEE Trans. Autonom. Mental Develop., vol. 3, no. 4, pp. 312–323, Dec. 2011.
[3] M. Asada, K. Hosoda, Y. Kuniyoshi, H. Ishiguro, T. Inui,
Y. Yoshikawa, M. Ogino, and C. Yoshida, "Cognitive developmental robotics: A survey," IEEE Trans. Autonom. Mental Develop., vol. 1, no. 1, pp. 12–34, May 2009.
[4] F. Aristizabal and M. I. Glavinović, "Simulation and parameter estimation of dynamics of synaptic depression," Biol. Cybern., vol. 90, pp. 3–18, 2004.
[5] A. Bielecki, "A neuronal system for simulation of consciousness dynamics based on information metabolism theory," in Proc. 7th Nat. Conf. Appl. Math. Biol. Med., Zawoja, Poland, 2001, pp. 15–19.
[6] A. Bielecki, "Mathematical analysis of artificial neural networks," in Advances in Multi-Agent Systems, R. Schaefer and S. Sdziwy, Eds. Kraków: Wydawnictwo Uniwesytetu Jagielloñskiego, 2001, pp. 173–190.
[7] A. Bielecki, "Mathematical model of architecture and learning process of artificial neural networks," Task Quart., vol. 7, no. 1, pp. 93–114, 2003.
[8] A. Bielecki and P. Hajto, "A neural-based agent for IP traffic scanning and worm detection," Lecture Notes Artif. Intell., vol. 3070, pp. 816–822, 2004.
[9] A. Kokoszka, "Information metabolism as a model of consciousness," Int. J. Neurosci., vol. 68, pp. 165–177, 1993.
[10] A. Kokoszka, "Information metabolism as a model of human experience," Int. J. Neurosci., vol. 97, pp. 169–178, 1999.
[11] L. Muratet, S. Doncieux, Y. Briere, and J. A. Meyer, "A contribution to vision-based autonomous helicopter flight in urban environments," Robot. Autonom. Syst., vol. 50, pp. 195–229, 2005.
[12] N. Bellomo, B. Piccoli, and A. Tosin, "Modeling crowd dynamics from a complex system viewpoint," Math. Models Methods Appl. Sci., vol. 22, Aug. 2012, Art. no. 1230004.
[13] R. L. Hughes, "A continuum theory for the flow of pedestrians," Transp. Res. B, Methodol., vol. 36, pp. 507– 535, 2002.
[14] C. Xie, D. Y. Lin, and S. T. Waller, "A dynamic evacuation network optimization problem with lane reversal and crossing elimination strategies," Transp. Res. B, Methodol., vol. 46, no. 3, pp. 295–316, May 2010.
[15] J. Dzubiella, G. P. Hoffmann, and H. Löwen, "Lane formation in colloidal mixtures driven by an external field," Phys. Rev. E, Stat. Nonlinear Soft Matter Phys., vol. 65, 2002, Art. no. P021402.
[16] M. Gardner and S. Dorling, "Artificial neural networks (the multilayer perceptron)—A review of applications in the atmospheric sciences," Atmos. Environ., vol. 32, no. 14/15, pp. 2627–2636, Aug. 1998.
[17] J. G. Juang and K. C. Cheng, "Application of neural networks to disturbances encountered landing control," IEEE Trans. Intell. Transp. Syst., vol. 7, no. 4, pp. 582–588, Dec. 2006.
[18] Thomas, M. C., and Pradeepa, A. P. M. S. 2014. A COMPREHENSIVE REVIEW ON VISION BASED HAND GESTURE RECOGNITION TECHNOLOGY. International Journal, 2(1).
[19] Pavlovic, V., Sharma, R., and Huang, T. S. 1997. Visual interpretation of hand gestures for human- computer interaction: A review. Pattern Analysis and Machine Intelligence, IEEE Transactions on, 19(7), 677- 695.
[20] Quek, F. 1994. Toward a vision-based hand gesture interface. InVirtual Reality Software and Technology Conference (pp. 17-29).
[21] Baudel, T., and Beaudouin-Lafon, M. 1993. Charade: remote control of objects using free-hand gestures. Communications of the ACM, 36(7), 28-35.
[22] Sturman, D. J., and Zeltzer, D. 1994. A survey of glove-based input. Computer Graphics and Applications, IEEE, 14(1), 30-39.
[23] Stergiopoulou, E., and Papamarkos, N. 2009. Hand gesture recognition using a neural network shape fitting technique. Engineering Applications of Artificial Intelligence, 22(8), 1141-1158.
[24] Garg, P., Aggarwal, N., and Sofat, S. 2009. Vision based hand gesture recognition. World Academy of Science, Engineering and Technology, 49(1), 972-977.
[27] Ramamoorthy, A., et al. "Recognition of dynamic hand gestures." Pattern Recognition 36.9 (2003): 2069- 2081.
[29] Verma, R., and Dev, A. 2009. Vision based hand gesture recognition using finite state machines and fuzzy logic. In Ultra-Modern Telecommunications & Workshops, 2009. ICUMT'09. International Conference on (pp. 1-6). IEEE.