ROBOTICS CONTROL BASED NEURAL NETWORK AND C PROGRAMMING

S. STEROSE, Assistant Professor, Department of computer Application, St. John's college of Arts and science, Ammandivilai

DR. R. KAVITHAJABA MALAR, Department of computer Science, St. John's college of Arts and science, Ammandivilai

ABSTRACT: Human hands can precisely perform a wide range of tasks. This paper investigates key performance differences when conventional robotic hand controllers are combined with Neural Networks (NN). This work aims to apply the concepts associated with neural networks in the control of an autonomous robot system. The robot was tested in several arbitrary paths in order to verify the effectiveness of the neural control.

KEYWORDS- Autonomous, Control, Neural Control, Robot Hand.

I. INTRODUCTION

Robotic manipulators have become increasingly important in the field of flexible automation. Neural Networks (NNs) can flexibly map nonlinear functions. Networks can be trained and applied either on or off-line. Of the many neural network types, two of the most widely used are multi-layer perception (MLP) and radial basis function (RBF). Back propagation is most popular method of implementing multi-layer perception (MLP). There are three major learning paradigms: supervised learning, unsupervised learning and reinforcement learning. Each learning paradigm is suitable to solving a specific set of problems. Neural networks have been widely applied in robot control and motion planning. Neural Networks can be implemented into robotic structures in several ways and with different controllers to provide improved solutions. A learning process is designed for the two-links PAM manipulator to have an adaptive and dynamic self-organizing structure using NN and fuzzy logic. The present paper combines neural networks with the PID, Bang-bang and Back-stepping algorithms. Force sensors are implemented on the fingertips of the ambidextrous robot hand. Use of these sensors with intelligent controllers increased robot hand autonomy as the grasping trajectory of each finger is based not only on its own feedback data, but also on that of the closest fingers. The investigation on Artificial Neural Networks (ANN) has been motivated and developed by the acknowledgment that the human brain processes all the information captured in a very particular way. The brain can be compared to a very complex, non-linear and parallel computer. It is capable to structure and organize their process units, known as neurons, with the purpose of performing a very complex and much faster processing task than any other digital computer available today .

II. PROPOSED STUDY

In the commonly used TOF systems, an echo is produced when the transmitted pulse encounters an object and a range value r = ct=2 is produced when the echo amplitude first exceeds a preset threshold level back at the receiver at time t. Here, t is the TOF and c is the speed of sound in air (at room temperature, c = 343:3 m/s). In general, it is observed that the echo amplitude decreases with increasing range and azimuth. With a single stationary transducer, it is not possible to estimate the azimuth of a target with better resolution

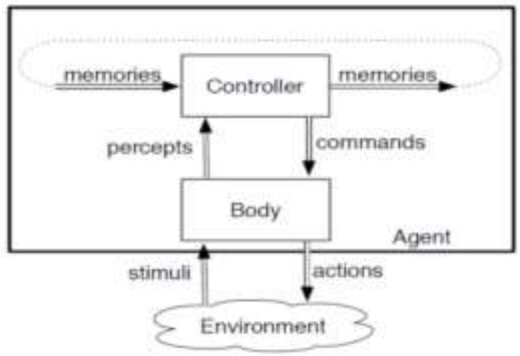

Fig.1 Robot Basic Control Architecture

Here two identical acoustic transducers a and b with center-to-center separation d are employed to improve the angular resolution. Each transducer can operate both as transmitter and receiver and detect echo signals reflected from targets within its own sensitivity region. Both members of the sensor configuration can detect targets located within the joint sensitivity region.

The target primitives modeled in this study are plane, corner, acute corner, edge, and cylinder. Since the wavelength is much larger than the typical roughness of surfaces encountered in laboratory environments, targets in these environments reflect acoustic beams specularly, like a mirror. Specular reflections allow the single transmitting–receiving transducer to be viewed as a separate transmitter T and virtual receiver R. The level of amplitude and TOF noise is also illustrated by plotting the 3A and 3t curves together with the average amplitude and TOF curves, respectively.

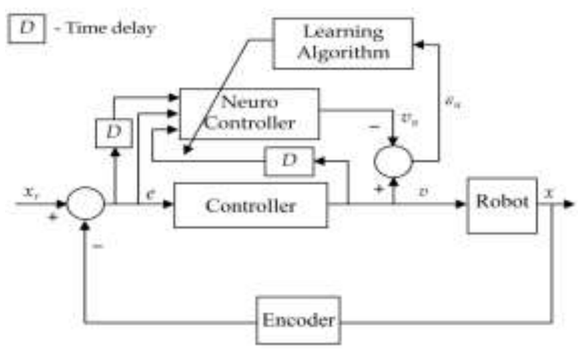

Fig.2 Mobile Robot Motion Controller

The Levenberg-Marquardt algorithm uses this approximation to the Hessian matrix in the following Newton-like update:

$$x_{k+1} = x_k - J^{T} J + \mu I^{-1} J^{T} e$$

Where, the parameter μ is a scalar controlling the behavior of the algorithm. When μ is zero, this is just Newton's method, using the approximate Hessian matrix. When μ is large, this becomes gradient descent with a small step size. Newton's method is faster and more accurate near a minimum error, so the aim is to shift toward Newton's method as quickly as possible. Thus, μ is decreased after each successful step and is increased only when a tentative step would increase the performance function.In this way, the performance function is always reduced at each iteration of the algorithm. This algorithm appears to be the fastest method for training moderate-sized feed forward neural networks.

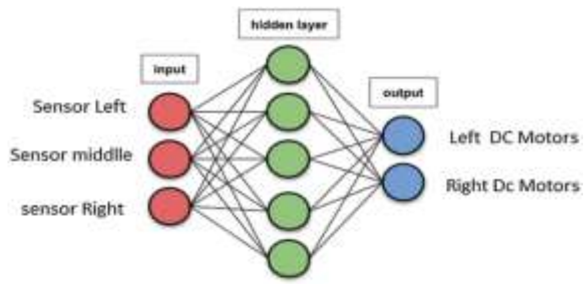

Fig.2 Neural network structure

Here, two-layered feed forward networks supervised by the backpropagation algorithm are employed. Thus, two functions must be constructed, i.e., one for the inputs to hidden layers, and the other for the hidden layers to output layers or targets. The neural network algorithm developed and implemented for the proposed mobile robot was programmed in the C language for implementation in an embedded system. However, there are some challenges associated with implementing a neural network in a very small system, and these challenges have been significant for the inexpensive microcontrollers and hobbyist boards of earlier generations. Fortunately, Arduinos, like many modern boards, can complete the required tasks quickly.

III. DISCUSSION

In this work, we have proposed a robot platform with a fixed four-wheel configuration chassis and an electronic system designed using Arduino Uno interfaces. The results demonstrate that neural networks are well suited to mobile robots because they can operate with imprecise information. More advanced and intelligent control methods based on computer vision and convolutional neural networks .

IV. CONCLUSION

This paper presented the control of an autonomous robot through neural networks. A comparison with FLC was also made. It can be concluded that the implementation of the ANN from the FLC that was previously implemented on the robot was successful. Also, the ANN control from the remote system had a satisfactory behavior. A comparison with previously investigated approaches to decision fusion indicates improved performance.

REFERENCES

[1] Seong-Hyun Baek, Dong-Sun Park, Jae-Wan Cho, YongBum Lee, " A Robot Endeffector Tracking System Based on Feedforward Neural Network", FLINS, pp. 324-33 1.

[2]Mohamad H. Hassoun, Fundamentals ofdrtijkial Neural Network, The MIT Press, 1995

[3]H. J. Lee, L. F. Luang and Z. Cheng. "Muti-frame ship detection and tracking in an infiared image sequence", Pattern Recognition, Vol. 23, pp.785-798,1990.