# Deep Learning Based Assistive Robot

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***Abstract*: *The use of Deep learning[1] in the field of Artificial Intelligence[2] is increasing rapidly. It contributes immensely to the advancement of automation process and improves the interface between man and machine in numerous applications. Several research works have been focusing on new techniques and methods that would reduce the human effort where the work need not be mandatorily done by humans. Our proposed model is an assistive robot, which would assist the elderly, physically impaired people. It has applications like face recognition, text translation and in advanced driver assistance systems. So, in this project an attempt is made to develop an assistive robot which is based on the deep learning model which relays on Caffe Framework[3]. The use of Intel Movidius neural compute stick[4] which is used as a vision processing unit helps in the processing of a trained model in a better way. The proposed model of an assistive robot is simple compared to other models and also economical.***

***Index Terms*: *Assistive robot, Deep Learning, Artificial Intelligence, Robotics***

## I. INTRODUCTION

Rapid advances are occurring in the field of robotics. The growth of Artificial Intelligence (AI) is a major contribution for robotics. Deep Learning and Machine Learning are parts of AI. In this paper a brief explanation of the Assistive Robot (AR) developed by the use of a Deep Learning Model is discussed. Direct interaction of humans and robots are in significant manner within the field of AR Robots allow to amend mobility, activities of daily life and improved communication with other people. They are helpful where there is a lack of caretakers. There are so many types of socially assistive robots till date and more to come, the target of all these types of robots is to enhance the lives of elderly people or the persons with any physical impairment. The robots that are available till date are advanced but not cost effective. The project mentioned in this paper is an attempt to develop an AR which is not only advanced but also economical.

A pre-trained Deep Learning Model is taken which was developed on the Caffe framework is taken for the project. Model can identify 30 different objects. Each object consists of a dataset of 25,000 images which were taken for training. The model is an open source based on SSD_MobileNet[5].

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## II. WALKTHROUGH

### A. Theoretical Framework

There are different models which were based on AI. Companies like Google, Amazon, Honda and institutes like MIT were working on the field of robotics from some years back. Google ImageNet[6] and Amazon AlexNet[7] had a large data set from each image which was used for training a model. Honda ASIMO[8] is one examples of assistive robots. There was still research going on to improve the performance of the robots to perform all the tasks that a human can do.

The MIT Cheetah[9] is robot which had been training from few years and there was a drastic improvement on the abilities and performance of the robot. The performance improves with the large training dataset and also on the experimental process.

There are robots which were tested for the people in the healthcare systems and also in the elderly care. There is no perfect robot till date which had all the capabilities of a human and research is going on.

Assistance with the help of robots improves the lifestyle of the persons with disabilities and for elderly people. These types of robots can be developed on a full scale because of the rapid improvement in the field of AI.

### B. Methodology

An Intel Movidius Neural Compute Stick (NCS) was integrated with the Raspberry Pi 3 for enhancing AI to the machine. NCS is a Virtual Processing Unit (VPU) which helps for the processing of Deep Learning Models. High quality camera is used for the object detection. Initially the NCS SDK is to be installed in the Raspberry Pi. The SDK comes with the additional features which helps us to compile and make a graph file, comes with a set of example files. Camera frame is set to a 620*480 (width*height).

On Successful detection of an NCS device, the images that occurred in the frame are pre-processed, after this process labelling is done to the identified objects which were there in the trained dataset. The whole environment covered by the frame can be seen by the NCS live inference screen. A threshold level of object detection probability of 0.6 was set. The obtained results are printed on the terminal with the percentage of probability. So, if a person commands the robot to bring an object, it will scan the entire room for the object and when found, approaches the object and gets hold of it and return to the person and places the object there.

There is an extensive processing done by the Raspberry Pi and the NCS in order to efficiently detect an object. The whole setup was placed on a frame which was made of UPVC pipes and the frame is about 2.5 feet high. It was developed so as to look like a person who can take care of another

person. Geared torque (1 N-m) motors were used for the movement and also helps in carrying weights of about 5-10 kg. In this manner, the robot developed can be used for personal care of elderly, physically impaired people which would help them lead a better life. It can be developed as an advanced machine which can do all the tasks similar to a person

### C. Tables and Figures

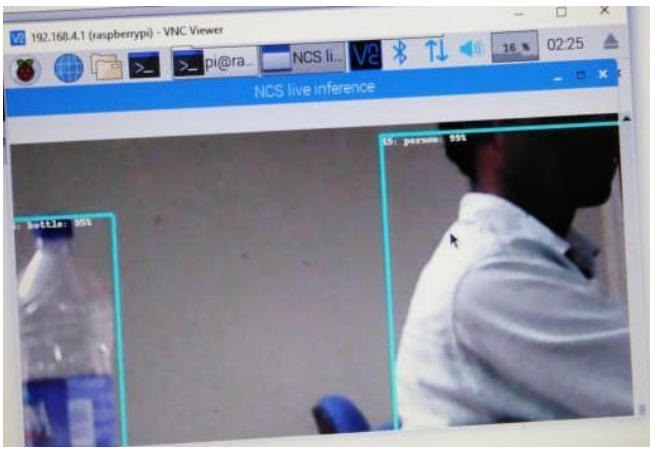


**Fig 1. Deep learning model detecting two objects at a time**

**Fig 2. Robot Setup**

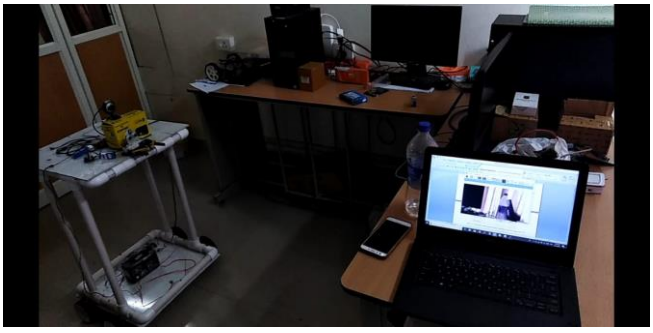

**Fig 3. Complete setup with the simulation shown**

**FLOW CHART**

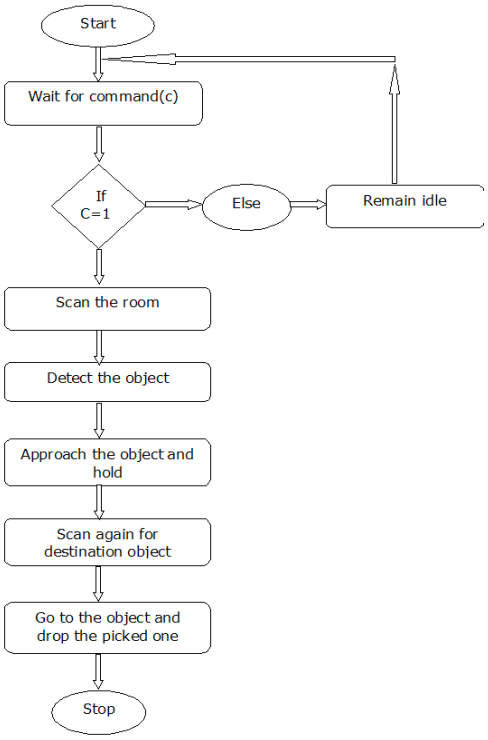


**Fig 4. Flowchart**

The above flowchart describes the process of the robot to be executed.

The images shown in Fig 1,Fig 2, Fig 3 and Fig 4 are the experimental result, setup, complete setup with the simulation included and flowchart describing the process respectively. Setup comprises of a raspberry pi board, Intel Movidius Neural compute Stick, robotic arm, 12v battery, L298N motor driver.

## III. CONCLUSION

A deep learning based assistive robot is developed by using the Caffe framework and with the help of Raspberry Pi board. Advancement of this robot can be done by further processing thereby increasing the efficiency of the detection rate of objects and also the decision making.

## REFERENCES

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