

Title of Your BTP

*A B. Tech Project Report Submitted
in Partial Fulfillment of the Requirements
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by

Student Name
(03010104)

under the guidance of

Your guide name



to the

**DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
INDIAN INSTITUTE OF TECHNOLOGY PATNA
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CERTIFICATE

*This is to certify that the work contained in this thesis entitled “**Title of Your BTP**” is a bonafide work of **Student Name (Roll No. 03010104)**, carried out in the Department of Computer Science and Engineering, Indian Institute of Technology Patna under my supervision and that it has not been submitted elsewhere for a degree.*

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Acknowledgements

Write acknowledgements, if your want to.

Contents

List of Figures	iv
List of Tables	v
1 Introduction	1
1.1 Artifical Neural Networks	2
1.2 Convolutional Neural Networks	3
1.3 Conventional Implementation of Neural Networks	4
1.4 Disadvantages of Conventional Implementation	5
2 Review of Prior Works	6
2.1 Section name	6
2.2 Conclusion	6
3 Algorithm I	7
3.1 Conclusion	7
4 Algorithm II	8
4.1 Construction	8
4.2 Improved Method	8
4.3 Conclusion	8
5 Conclusion and Future Work	9

List of Figures

1.1	Blackbox representation of a ANN	2
1.2	Feedforward ANN	3
1.3	Working of kernel and convolution in CNNs [1]	4

List of Tables

Chapter 1

Introduction

Ever since machine learning has been introduced into the field of computer science, it has been spearheading breakthroughs in a number of fields. It has taken the world by storm and now, many fields will simply cease to function without these techniques. Deep learning is one sub-field of machine learning which is deeply rooted in today's society. Deep learning is now part of common man's everyday life and it will remain so for the foreseeable future.

As data collection and storage becomes more prominent, machine and deep learning has continued to dominate the data space, provide insights into complex data which is simply not possible with other mathematical methods. Deep learning is one of the most rapidly expanding machine learning technologies, relying on multi-layered artificial neural networks (ANNs) implemented in digital electronics to handle big data sets, integrating and analysing massive volumes of information quickly without the need for explicit instructions. These ANNs have been modified and augmented in many ways, leading many domain specific techniques, most notable one being Convolutional Neural Networks (CNNs) which is primarily used in image analysis.

1.1 Artificial Neural Networks

Artificial neural networks refers to those algorithms which are inspired by the biological neural networks that constitute animal brains. Such systems learn to perform tasks by considering examples, generally without being programmed with any task-specific rules. For example, in image recognition, they might learn to identify images that contain cats by analyzing example images that have been manually labeled as "cat" or "no cat" and using the results to identify cats in other images. They have found most use in applications difficult to express with a traditional computer algorithm using rule-based programming.

Traditionally ANNs have been described as a black box of sorts. It has a number of input variables and output variables using simple arithmetic connections, gives output from the input.

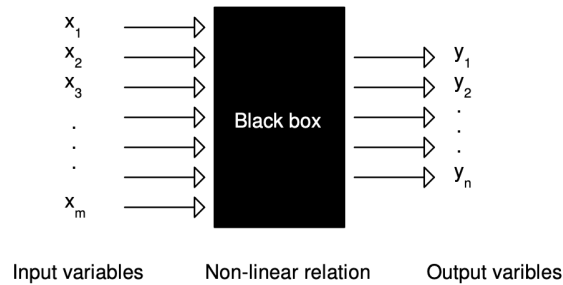


Fig. 1.1: Blackbox representation of a ANN

ANNs Traditionally tend to excel where the relations between inputs and outputs are non-linear. It is practically better and more efficient at classifying or identifying non-linear relationships rather than linear ones, where it might perform worse than a more statistical approach.

Nowadays, the most common type of ANN is the feedforward neural network, which consists of a group of neurons (called a layer) that transfer data to another group of neurons in a feedforward manner. The first layer is called the input layer, and the last layer is called the output layer. The layers in between are called hidden layers. The input data travels through the layers in a feedforward manner, and the output is the result of the last layer.

The output is then compared to the expected output, and the error is calculated. The error is then backpropagated through the network, and the weights are adjusted accordingly. This process is repeated until the error is below a certain threshold.

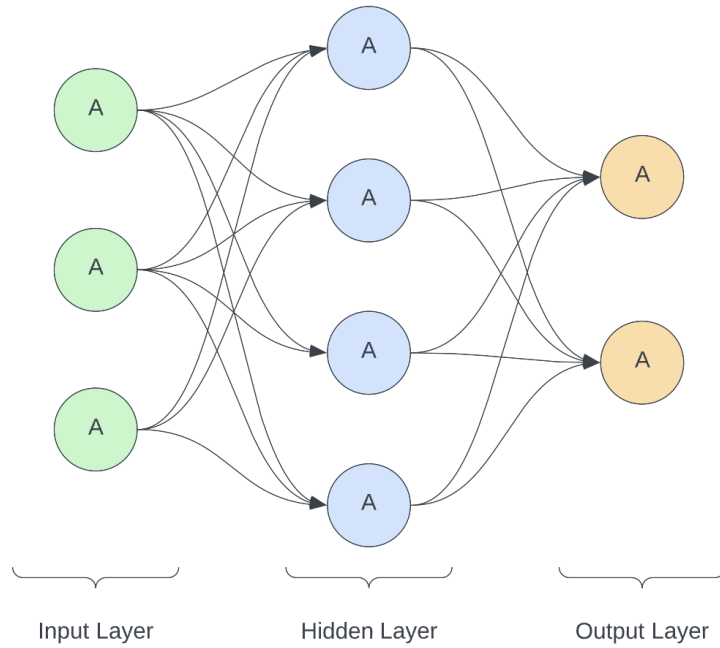


Fig. 1.2: Feedforward ANN

1.2 Convolutional Neural Networks

Convolutional Neural Networks (CNNs) are a class of deep neural networks, most commonly applied to analyzing visual imagery. They are also known as shift invariant or space invariant artificial neural networks (SIANN), based on their shared-weights architecture and translation invariance characteristics. They have applications in image and video recognition, recommender systems, image classification, medical image analysis, natural language processing, brain-computer interfaces, and financial time series.

CNNs usually apply convolution operation over the image (hence the name) by using a filter, called the kernel. This produces a smaller image but where features can be extracted

easily. Different filters are applied to the same image in the form of multiple channels resulting in diverging features in each channel which can be detected. This is called feature mapping. The feature maps are then flattened and fed into a fully connected ANN which gives the final output. The application of kernel is illustrated in figure 1.3.

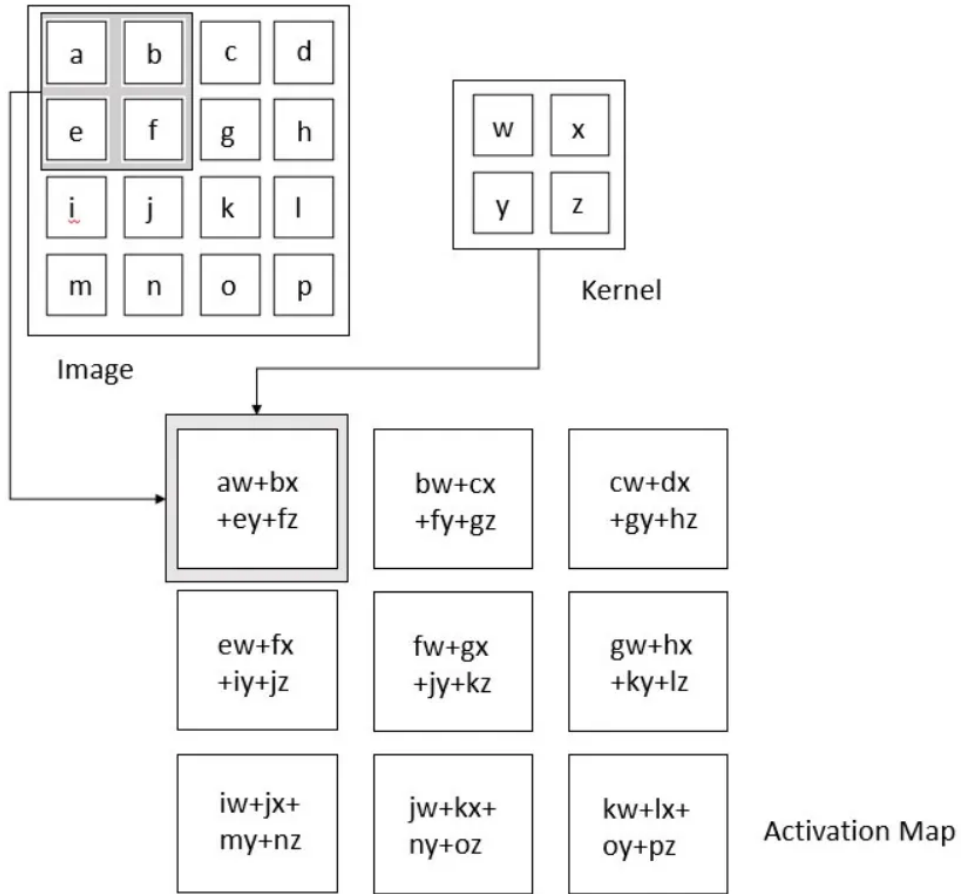


Fig. 1.3: Working of kernel and convolution in CNNs [1]

1.3 Conventional Implementation of Neural Networks

Neural networks, for the most part, have been software based. The algorithms are implemented in code and is executed in high-power GPUs for fast parallel computations. This form is extremely flexible and can be used for a variety of applications. The model can

be changed as and when the need arises and is relatively commitment-less. The hardware itself is also largely independent of the software and changed/replaced whenever deemed necessary.

There has been a recent growth in certain of Application Specific Integrated Circuits (ASICs) specifically for neural networks, some notable examples being from popular manufacturers like NVIDIA [2] and Apple. These chips are designed to perform neural network computations and are extremely fast and efficient. They are also extremely expensive and are not easily available.

Even with the advent of ASICs in Machine learning space, the field still suffers from the fact that the hardware is not really coupled with the software. By increasing the specificity of the hardware, the efficiency of the system can be increased by a large margin.

1.4 Disadvantages of Conventional Implementation

The conventional implementation of neural networks has a number of disadvantages. The most prominent one being the fact that the hardware is not really coupled with the software. The hardware is not really designed to perform neural network computations and is not really efficient at it. Large amounts of power are required to train models for prolonged amounts of time. This leads to a lot of inefficiencies in the system.

Chapter 2

Review of Prior Works

Survey comes hear

2.1 Section name

write

2.2 Conclusion

This chapter provided details of the some of the existing distributed algorithms for constructing a CDS in wireless ad-hoc networks. The results of these evaluations are summarized in table. In next chapter, we discuss our distributed Algorithm I, for constructing a small backbone in ad-hoc wireless network.

Chapter 3

Algorithm I

give details of your algorithm

3.1 Conclusion

In this chapter, we proposed a distributed algorithm for construction of xyz. The complexity of this algorithm is $O(n \log n)$. Next chapter presents another distributed algorithm which has linear time complexity based on xyz.

Chapter 4

Algorithm II

The algorithm presented in previous chapter has $O(n)$ time complexity. We further propose another distributed algorithm in this chapter based on xyz which has linear time complexity.

4.1 Construction

Write ...

4.2 Improved Method

Write...

4.3 Conclusion

In this chapter, we proposed another distributed algorithm for XYZ. This algorithm has both time complexity of $O(n)$ where n is the total number of nodes. In next chapter, we conclude and discuss some of the future aspects.

Chapter 5

Conclusion and Future Work

write results of your thesis and future work.

References

- [1] I. Goodfellow, Y. Bengio, and A. Courville, *Deep Learning*. MIT Press.
- [2] NVIDIA T4 Tensor Core GPU for AI Inference — NVIDIA Data Center. [Online].
Available: <https://www.nvidia.com/en-us/data-center/tesla-t4/>