

# Deep Learning- Emerging Science

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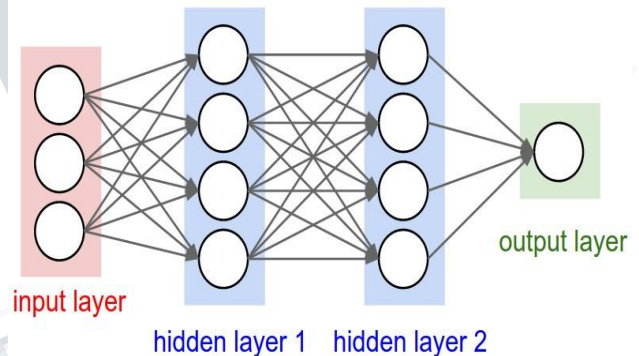
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**Abstract** - Deep learning, a subfield of machine learning concerned with algorithms is inspired or mimicked both by the structure, function and mechanism of brain and its neural structure called Artificial Neural Networks (ANN). It uses multiple layers of artificial neurons for classification and pattern recognition in its perception, analysis and understanding. Deep learning is a science that is aimed to produce algorithms mimicking and performing activities performed with human intelligence and perception associated with neural mechanisms without human intervention. In deep learning, we develop multiple layers of computations and analysis through algorithms that are embedded into chips as software, which results in better perception and results that are 90%-100% accurate. This leads to a technology that is more informative, perceptive and efficient in a way, changing the world for better.

**Keywords**- Deep learning, Artificial Neural Networks (ANN), Unsupervised learning.

## INTRODUCTION

Human intuition and perception is a feature that makes human being to stand out from rest of the animals on the earth. As in aerodynamics helps us to know how birds and airplanes fly. In the similar way key principles that could explain about our knowledge perception and intuition to be used to build knowledge based systems without learning from a set of facts or parameters to come out with a result. The human neural networks for perception can be mimicked and made into algorithms and embedded as software's into systems. These systems in turn can learn from examples, experiences and knowledge around just like humans. Deep learning follows a neural network structure which consists of input layer, hidden layers and output layer. Input at each level is passed forward as classifier for further processing till it reaches output layer called as forward propagation. Each level is given different weights and biases that give different values at each activation to its next level. In shallow learning 1-3 layers of processing of neural networks is used. In Deep learning 3-10 layers are used, making it complex system and developing its accuracy.



**Figure 1: Neural network structure**

## II. DEEP LEARNING V/S MACHINE LEARNING

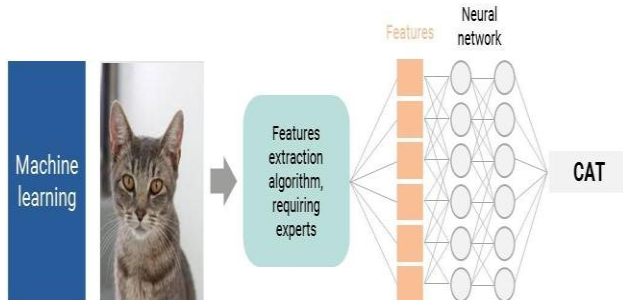
In a problem of identifying a cat, How to know that it is a cat? How do we tell it?

Because we have been watching it since childhood, we can identify it.

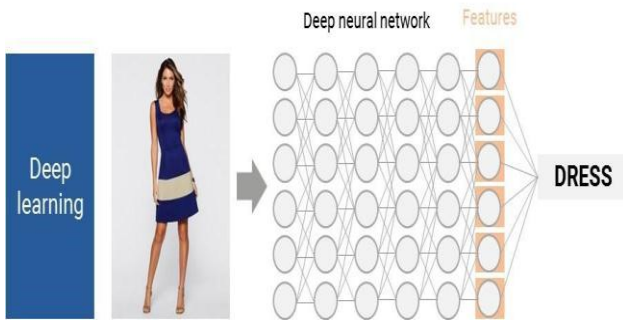
In machine learning we select features consisting of edges and corners, then references and recognizes.

**Images → features → machine learning → name of the object**

Unlike in machine learning, in deep learning features are ignored or not required. The picture is analyzed with lots of data in the form of pictures, performing perception and inference at different levels of neural networks and result is given.



**Figure 2.1: Machine learning processing to identify a cat**



**Figure 2.2 Deep learning processing to identify a dress**

Deep learning is a subtype of machine learning. It directly deals with images instead of features and is more complex. In deep learning we require a lot GPU's (graphic processing unit) and lots of data, whereas in machine learning we do not require large amount of data or GPU's. But with evolvement of concepts like big data and availability of large amount of data and chips at cheap costs, deep learning is not at all a problem. And when compared to results occurred from machine learning, deep learning results are highly accurate mostly 100% correct.

	Machine learning	Deep learning
Training dataset	Small	Large
Choose your own features	Yes	No
No. of classifiers available	Many	Few
Training time	Short	Long

**Table 1: Comparison between machine learning and deep learning**

**III. WHY DEEP LEARNING?**

It can be applied to multitude of problems and applications in present and near future. It takes problems that are dealt with specialized or domain experts pertaining expertise in that specific domain and transfer that to an engineering problem. So that any person or organization without a particular expertise can still achieve its objective of solving any convoluted and hard problems specific to any domain. Deep learning helps us to understand and generate content from text and speech. Various algorithms are present in artificial intelligence and machine learning, but Deep learning derived algorithms are most accurate and efficient.

**IV. DEEP LEARNING AN UNSUPERVISED LEARNING**

There are two types of learning supervised and unsupervised learning. In supervised learning, computers are guided how to work for a specific example, but it requires a lot of human labor and data sets (images, speech, and natural language) and let it learn by itself. In deep learning unsupervised learning is employed. For instance, let us consider a three year old child, how does he learn to speak, how does he identify people and things around him? This is done under own supervised way based on data and learning from experiences and surroundings. And coming to deep learning unsupervised learning, a lot of data is used to tell the system, which we do through cloud sourcing.

**V. TECHNOLOGIES INVOLVED IN DEEP LEARNING**

**A. Sentiment Analysis**

In this analysis, it provides reviews regarding various subjects like movies, products and politics through interpretation of words provided in the reviews.

Example: PRODUCT REVIEW SAMPLE:

Your review: Product was not exactly as shown in the website, but overall the product is good.

Program response → Positive review

**B. Parts of speech identification**

In this identification, for a given sentence different parts of speech are identified and outputted.

Legend: Click the legend words to toggle highlighting. [Get help](#) on this page.

Noun Pronoun Verb Adjective Adverb Conjunction Preposition Article Interjection

She is upset, but she didn't realize nothing is wrong with Neil's mind. It's what he'll always say. He'd always be someone who'd understand.

**Figure 5.1: Parts of speech identification**

**C. Named Entity Recognition**

In named entity recognition, given a paragraph or sentence of text, it is detected for attributes like organization, person name, place, year, time etc.

EXAMPLE: Google CEO Sundar Pichai faces an all-hands meeting on Thursday afternoon that could come to define his leadership of the Alphabet unit.

Organization-Google  
Position in company- CEO  
Name- Sundar Pichai

**D. Language translation**

A text or paragraph or file given in language is converted to another specific language required or mentioned.

EXAMPLE: Google translation from one language to other

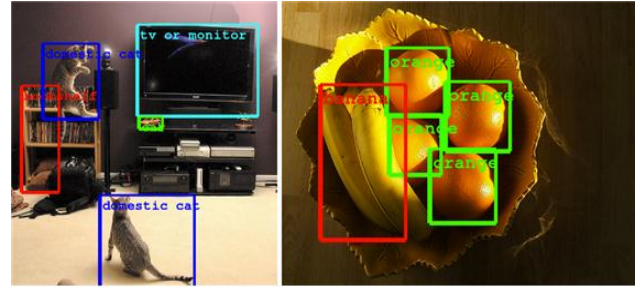
**E. Question Answering**

Given a sequence of sentences and put a question. The software is able to analyze and provide the correct answer.

Example:  
Bob went home.  
Eddy went to school.  
Eddy picked up bag.  
Eddy came back to home.  
Where is bag now? → Answer: home

**F. Detection of objects in pictures and videos**

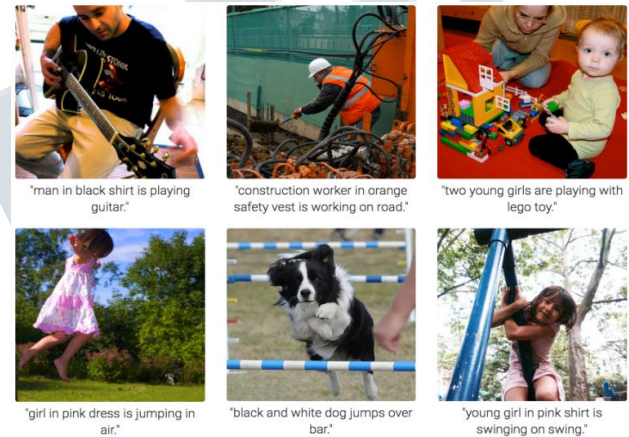
Deep learning helps to identify objects or persons as single unit and each one with specific details. It even detects if a person is partially seen or sometimes blur. It explains context of picture. Presently, it is being done in social Medias like Facebook and Google.



**Figure 5.2: Object detection using Deep learning**

**G. Automatic caption Generation**

It analyses objects in the given picture and provides it a caption of accuracy ranging from 90% to 100%.



**Figure 5.3: Captions generated for pictures**

**H. Medicine field**

It helps in better diagnosis helping in early prediction and assisting doctor. Using of Genomics for personalized medicine that is medicines are given based on one's own DNA suitable to their bodies showing no side effects.

**VI. INNOVATIONS AND CONTRIBUTIONS USING DEEP LEARNING**

**A. Alpha Go**

Go game is a Chinese based toughest game in the world. Google's deep mind developed a program call Alpha Go. This program built in robot, can beat even the champions in the world.



Figure 6.1: "Alpha Go" winning over in challenge

3. Wang, Haohan, Bhiksha Raj, and Eric P. Xing. "On the Origin of Deep Learning." arXiv preprint arXiv:1702.07800 (2017).

### B. Self Driving Cars

It is a driverless car that does not require manual or human intervention for driving. It detects its path consisting of objects on the road, navigating and driving on its own.

### C. NVIDIA Devices

NVIDIA comes up with various devices for Face recognition, object recognition, text reading and devices to help blind people for moving around and detecting their objects and surroundings.

## CONCLUSION

Earlier days, computation and memory was costly. But as the cost of chips is becoming less day by day and increase in computation power, deep learning can be developed at ease at nominal cost. As deep learning has its functioning based on human neural network, better perception and inference requiring problems and questions can be solved. As a result domain expertise involvement is not required. Deep learning as whole shapes or transforms the world.

## REFERENCES:

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