

Role Of Machine Learning In Object Detection: A Review

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ABSTRACT

In the eminent era of breakthrough in technology, the world is presented with a boon and bane. The need for machines is inevitable as they have become a part of human source. Our human vision is capable of capturing the object or image and identifies the captured input. When a massive data set is given as input along with required GPUs and algorithm which consumes less computation time and provides output with high accuracy, the computers are skilled to detect and classify the captured input. Artificial Neural Network is one such technique to train the machine to have a skill set. Particularly, Machine Learning plays a major role in detecting and classifying the objects using various algorithms. ML is widely used in tracking, face recognition, video surveillance, etc. The detected object's characteristics are classified as classes using algorithms. The necessity for object detection emerged when the object needs to be identified from the images and video sources. Over the years, many algorithms were replaced by the latest and efficient algorithms which detected the objects with high accuracy rate. The performances of certain algorithms used in object detection will be discussed with their respective pros and cons. The solved and unsolved issues using Machine Learning algorithms are discussed in this paper.

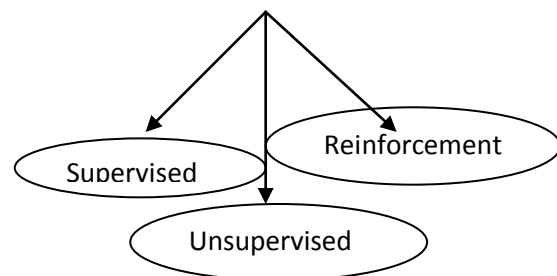
KEYWORDS : Artificial Neural Networks, Machine Learning, Object Detection

Machine Learning:

The system is being trained with data sets to deliver the outputs without any explicit training. The main goal of ML is to provide self-learning systems. The patterns given as inputs are recognized and decisions are made after classifying the classes for generating output. It is implemented in various sectors for reaching their targets effectively. There are three techniques involved in ML. They are:

Supervised Learning
Unsupervised Learning
Reinforcement Learning

ML TECHNIQUES



SUPERVISED LEARNING:

This learning technique depends on supervision and so dependent. The input data given is processed to produce the output which is already known by the system. The relationship between the Instructor-Student is the real time example for supervised learning techniques. The algorithm works based on the output provided to achieve the target. Training data sets are used by algorithms for the system's training. The output will be erroneous if the system is deceived. The datasets set the right path and guides the system. The output is generated using the algorithm's input.

UNSUPERVISED LEARNING

The following tasks are accomplished by unsupervised learning:

Clustering
Representation
Estimation of output

The innate structure of the data is provided without labels. The system is not trained with data sets. The algorithm works down to the data without any supervision. The information is usually unstructured which are sectioned into groups with their respective similarities and differences figured out using the tasks listed above. Generative learning models are often associated with unsupervised learning. This learning technique deals with unlabeled and unstructured data without any pre-requisite training.

The system fed with Artificial Intelligence is tested with unsupervised learning. Complexity is handled a bit more than supervised learning by unsupervised learning.

Two categories of algorithms

1. **Clustering:** The objects flocked are grouped into clusters which will be based on their similarities and characteristics.

2. **Association:** The data is syndicated among them according to the rule of association. Amongst large databases, the interestingness is measured.

REINFORCEMENT LEARNING

The system is obliged with trial and error method. High dimension inputs are efficiently processed using reinforcement learning. Output produced by reinforcement learning are from the optimized inputs. The actions to be performed depend on the current state of the system. The feedback is given the precedence for the system to proceed further. The environmental situations are considered for decisions and no external supervision is needed. Markov decision process is the framework used in reinforcement learning to produce long term goals.

Machine Learning approaches

Viola-Jones Object Detection

Scale Invariant Feature Transform(SIFT)

Histogram Oriented Gradients(HOG)

Deep Learning approaches

R-CNN, Fast CNN, Faster CNN

Single Shot Detector(SSD)

YOLO – You Look Only Once

Deep Learning:

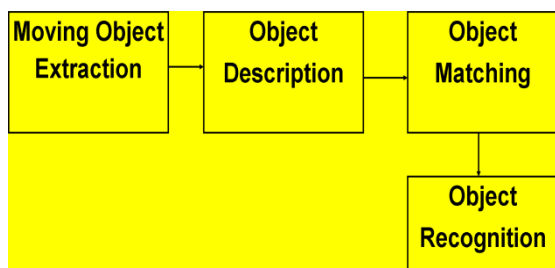
The structured and hierarchical learning which is in the wide family of Machine Learning techniques based on the data sets representations, in response to tasks performed in accordance with algorithms.

Object Detection using Deep Learning:

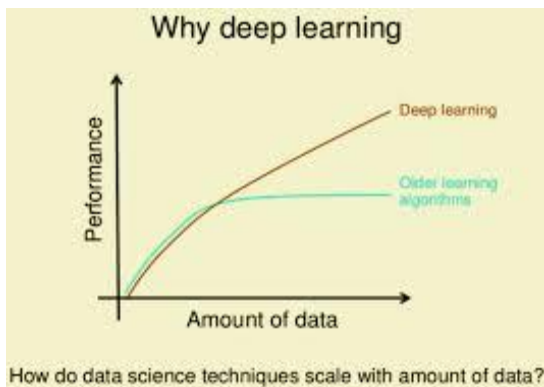
1. Take an image as input.
2. Divide the image into different section .
3. Each section to be considered as separate images.
4. Move all these sections (images) to the CNN and divide them into various classes.
5. After dividing each section into its equivalent class, we can combine all these sections to get the original image with the detected objects.



Block diagram of Object Detection:



Why deep Learning?



Deep Learning is ruling the world because of its accuracy of results. Scalability is an another successful factor in deep learning.

Applications:

Content-based image retrieval

Tracking

Video surveillance

Image recognition

Front end for recognition

CONCLUSION

Machine Learning plays a vital role in object detection. In the world of technology, everything need to be detected and analysed for further decisions. So object detection using Machine Learning is ruling the world .

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