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Image Organization Using Unsupervised Deep Learning - Case Study

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ABSTRACT

Now a day's, the intelligent machines were created that works like a human is an artificial intelligence. Intelligent machines were trained with qualities such as, knowledge, reasoning, problem solving, learning, planning etc. These training of machines with various models is machine learning. Sub domain of a machine learning is deep learning method, in which computer models are trained to perform classification tasks directly from pictures, text or voice. Deep learning models can attain high accuracy, may be beyond human performance. Models are trained with large data sets & neural network architecture with several hidden levels. In a supervised deep learning, we tell machine what to do and what not to do using an algorithm. Since we are instructing machine what not to do, the machine is having limitations to solve the problem. To solve this issue, an unsupervised deep learning algorithms are used, which derive insights directly from data and that can be used to make decisions on data.

Keywords : Machine Learning, Neural Network, Deep Learning, Intelligent Machine, Unsupervised Learning

I. INTRODUCTION

Machine learning is giving computers the capability to learn without programming to it. It is the ability to learn by the machine. Automating the learning process of computers depends upon their experiences without any human support. The process of automating the machine through machine learning begins with feeding a quality data with algorithm and training the computers by building machine learning models. It is a set of assumptions about the actual nature of data to be trained. The model is used as the source for determining what a Machine Learning algorithm should learn[1],[10],[11]. A good model, which makes accurate assumptions about the data, is necessary for the machine to give good results.

Among the various types of ML techniques, a essential difference is drawn between supervised and unsupervised learning:

- Supervised machine learning: “Train” the program on a pre-defined set of “known data”, which then assist the program to reach an precise result when new data is given.
- Unsupervised machine learning: A collection of data is given to the program and it should discover patterns and relations therein.

II. SUPERVISED MACHINE LEARNING

In many of supervised learning applications, the decisive objective is to develop a well performed hypothesis function h(x) (called as predictor

function). “Learning” consists of using well defined mathematical algorithms to optimize this function so that, given input data x about a certain domain (say, date of a picture),[2] it will precisely identify some interesting value h(x) (say, location of the picture).

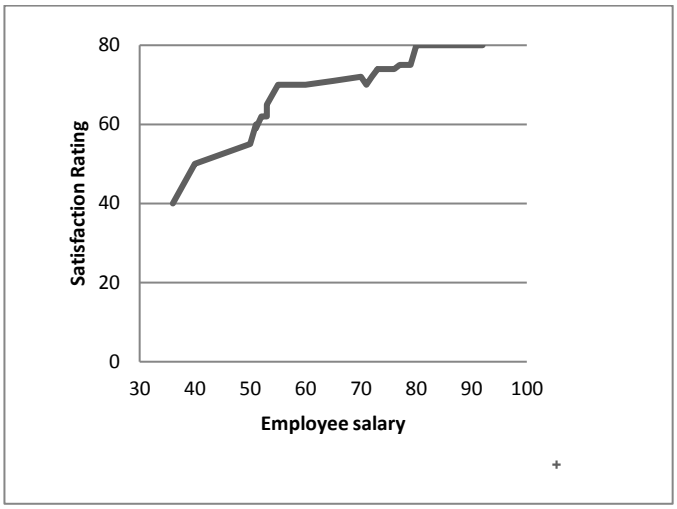
In practice, x almost always represents multiple data points. So, for example, a location of a picture predictor might take not only date of a picture (x1) but also Time of picture taken(x2), number of pictures taken (x3), solo or group picture(x4)and so forth. Predicting which input data to use is an vital part of ML design. However, for the sake of explanation, it is easiest to assume a single input value is used.

So let's consider simple predictor which has this form:

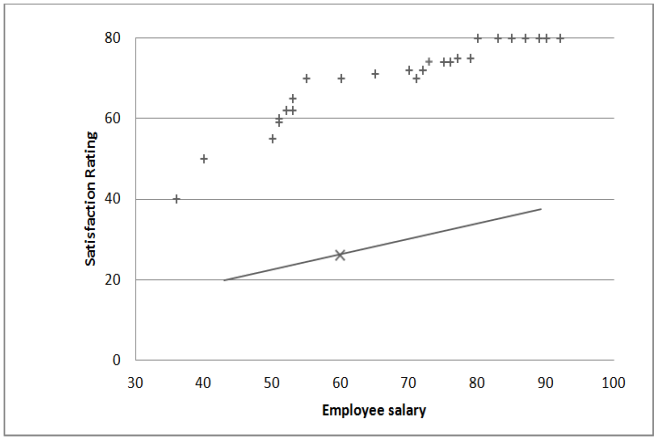
$$h(x) = \theta_0 + \theta_1$$

where θ_0 and θ_1 are constants. Our goal is finding the appropriate values of θ_0 and θ_1 to make our predictor work as well as possible.

Training examples are used to optimize predictor h (x). For every training example, There is an input value(x_t) and its corresponding output, y, is known in advance. For each example, we find the difference between the known, correct value y, and our predicted value h(x_t). With the sufficient training data examples, these differences give us a useful way to compute the “erroneousness” of h(x). We can then catch h(x) by tuning the values of θ_0 and θ_1 to make it “less wrong”. This process is repeated over and over until the system has converged on the best values for θ_0 and θ_1. By this process, the predictor gets taught, and become ready to proceed some real-world prediction.



In the above illustration, employee satisfaction is represented with respect to salary and satisfaction rating. A simple problem is considered for the purpose of illustration, but the problems are much more complex in the real world , that's the reason ML exists. Here a two dimensional data representation is illustrated. we can draw a picture of, maximum, a three-dimensional data set, but in general, ML problems focussing on data with plenty of dimensional factors, and much complex predicting functions[3]. The problems that are complex to solve by numerical procedures can be solved by machine learning methods. The objective of ML is not only to make “accurate” estimations, because ML deals in area of computer science where no such concept is adopted. The primary objective of machine learning is to perform guesses that are perfect to use.



The predictor would produce employee satisfaction rate 25 if the predictor is asked for the satisfaction of employee earns 60k. If we perform a little modification as a mathematical magic, we can

calculate, with very high conviction, that values θ_0 and θ_1 are going to give us a efficient predictor function.

A. Algorithms used for supervised machine learning –

- Nearest Neighbor
- Naive Bayes
- Decision Trees
- Linear Regression
- Support Vector Machines (SVM)
- Neural Networks

III. UNSUPERVISED MACHINE LEARNING

In unsupervised machine learning, the computer is trained with unlabeled data to identify the patterns of the data. No need of instructor in this case, the computer can be able to teach us new things after the pattern of data is learnt by the machine. this is useful when human does not know what to look in the data. unsupervised machine learning uses pattern detection and descriptive modeling[9],[12]. These algorithms use learning methods on the input to discover rules, patterns and cluster the data sets which help deriving meaningful insights.

A. Algorithms used for unsupervised machine learning –

- k-means clustering, Association Rules

B. How to Organize a Photo Gallery using unsupervised machine learning?–

I have 1500+ photos in my Smartphone right now. If I had been a selfie freak, the photo count would easily be 10 times more. Sifting through these photos is a nightmare, because every fifth photo turns out to be unnecessary and useless for me.

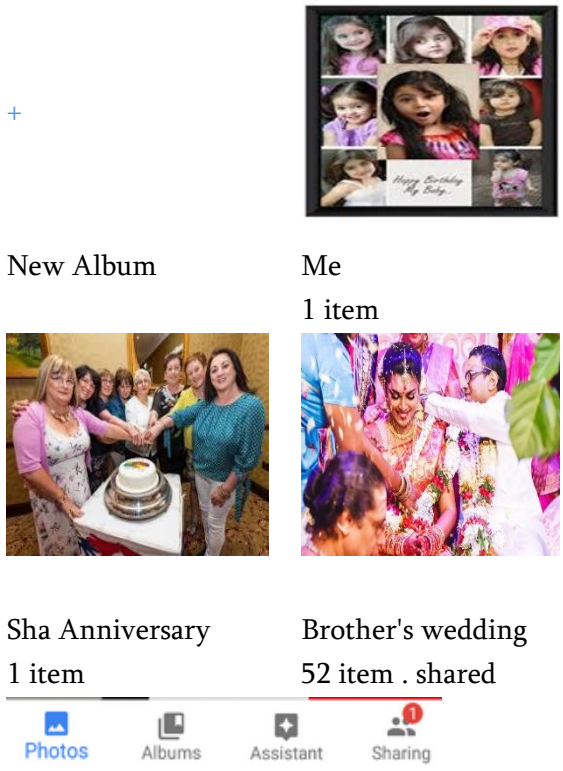
To get a clearer perspective of the problem[5], I went through my mobile and tried to identify the categories of the images by myself. Here are the insights I gathered:

one third of my photo gallery is filled with circulars/notifications from my office. I would like to collect images of motivational and interesting quotes. There are at least 300 images I captured, or shared by my colleagues and group pictures. There are few images/screenshots for my reference that has to be purged after use. There were numerous "good morning", "happy birthday" and "festival greetings" pictures that I desperately want to delete from my gallery. How much I exterminate them, they just keep coming back.

In this scenario, better ways can be adopted to organize photos using automated algorithm in such a way to access them in less time[4].

IV. APPROACHES TO ORGANIZE PHOTOS IN SMART DEVICES

A. Approach 1 - Arrange on the basis of important date



This is the simplest way to arrange the photos based on important dates say birthday, anniversary etc. It is quite easy to search photos based on date.

B. Approach 2 - Arrange on the basis of time

The simplest way is to arrange the photos on the basis of time. Each day different folders can be created. Typically most of the photo viewing applications use this approach.

C. Approach 3 - Arrange on the basis of location

This way of arranging photos is good because if the photos are maintained based on the location that have been visited by us. If the GPS location of the smart device is turned on, then this approach can scrutinize the photos and organize more often &rapidly.

D. Approach 4 - Arrange on the basis of the image received through group

We are in the modern world where we are controlled by machines in one extreme. Social media are playing a vital role and that became medium of communication for us. the best example is whatapp group. Any corporate or academic individual could be a part of at least 5 whatsapp groups which is only for information sharing & communication. At this scenario, if the images are clustered according to the group through which group it come from[6].

E. Approach 5 - Extract Semantic meaning from the image and use it to define image collection

These approaches were mostly dependent on the metadata that is captured along with the image[7]. A better way to organize the photos would be to extract semantic information from the image itself and use that information intelligently.

Suppose there are similar variety of photos. What trends should the algorithm capture?

1. Is the captured image of a natural scene or is it an artificially generated image?[8]
2. Is there textual material in the photograph? If there is – can we identify what it is?
3. What are the different kinds of objects present in the photograph? Do they combine to define the aesthetics of the image?
4. Are there people present in the photograph? Can we recognize them?

Are there similar images on the web which can help us identify the context of the image?

So the algorithm should ideally capture this information without explicitly tagging what is present and what is not, and use it to organize and segment our photos. Ideally, the final organized app could look like this:

This approach is called “unsupervised way” to solve problems. The expected outcome is not directly defined. Instead, the algorithm is trained to find those outcomes for us! This algorithm summarizes the data in an intelligent manner, and then tries to solve the problem on the basis of these inferences.

V.CONCLUSION

Deep learning focuses on various dimensions of given data. unsupervised deep learning extracts the characteristics of these data and cluster them according to similarity of data. If a teacher teaches a concept to a student then other set of students can learn from that one student whom taught by a teacher which does not require any supervisor(Teacher). In photo gallery organization, similarity between the images based on their basic semantics, images can be clustered. These clusters can be used to generate automatic algorithm which would be trained to organize photo gallery effectively. So, the algorithm is trained with semantic data model and not the machine. As a conclusion, unsupervised deep learning to solve a problem can be efficient with respect to time complexity and produce high performance.

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