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Basic Concepts of Algebra in Deep Learning

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ABSTRACT

Algebra is extremely important for understanding Machine Learning, especially for Deep Learning. They provide you better feeling for a way algorithms really work under the duvet, which enables you to form better decisions. You would wish to be an expert during this field; you can't escape from mastering of its concept. During this topic we'll give the foremost important concept of algebra that are utilized in Deep Learning.

Keywords : Machine Learning, Algorithms, Numpy, Dimensions, Tensor.

I. INTRODUCTION

Deep Learning is a sub field of machine learning, concerned with the algorithm which imitates the function and structure of the brain called the synthetic neural network.

Linear algebra is a kind of continuous instead of discrete mathematics; several computer scientists have small experience with it. The superb thoughtful of algebra is vital for understanding and functioning with many machine learning algorithms, specially deep learning algorithms.

II. MATH IN DEEP LEARNING

Linear algebra, probability and calculus are the 'languages' during which machine learning is formulate. Learn these topics will contribute a deeper understanding of the essential algorithmic technicalities and permit improvement of latest algorithms. When restricted to smaller levels, everything is math behind deep learning. So it's necessary to know basic algebra before getting started with deep learning and programming it.

Scalar	Vector	Matrix	Tensor
1	$\begin{bmatrix}1\\2\end{bmatrix}$	$\begin{bmatrix}1 & 2\\3 & 4\end{bmatrix}$	$\begin{bmatrix}[1 & 2] & [3 & 4]\\[5 & 6] & [7 & 8]\end{bmatrix}$

The core data structures behind Deep-Learning are Scalars, Vectors, Matrices and Tensors. Programmatically, let's solve all the essential algebra problems using these.

2.1 Scalars

Scalars are only single numbers and are an example of an ith-order tensor. The notation $x \in R$ states that x may be a scalar belong to a group of real-value numbers R.

There are different sets of numbers in deep learning. N represents the set of positive integers 1,2,3,…. Z designates the integers, which combine positive, negative and 0 values. Q represents the set of rational

numbers which will be expressed as a fraction of two integers.

Few built-in scalar types are int, float, complex, bytes, Unicode in Python. In Numpy a python library, there are 24 new fundamental data types to explain differing types of scalars.

Defining Scalars and Few Operations in Python:

The following code program explains few arithmetic operations on Scalars.

```
# In-Built Scalars
a = 5
b = 7.5
print(type(a))
print(type(b))
print(a + b)
print(a - b)
print(a * b)
print(a / b)
```

Output

```
12.5
-2.5
37.5
0.6666666666666666
```

2.2 Vectors

A Vector is an controlled array of single numbers and may be during a row or a column. Vectors are fragments of objects referred to as vector spaces. A vector space are often considered of because the total collection of all possible vectors of a specific length or dimension. A Vector has presently one index, which may point to a selected value of the Vector. The three-dimensional real-valued vector space, denoted by R^ 3 is usually wont to represent our real-world notion of three-dimensional space mathematically. for instance, V2 refers to the second value within the Vector.

$$X = \{X_1, X_2, X_3, \dots \dots \dots X_n\}$$

To classify the required element of a vector clearly, the scalar element of a vector is written as

Use NumPy to make an one-dimensional array:

```
# Load library
import numpy as np
# Create a vector as a row
vector  row = np.array([1 ,2 , 3])
# Create a vector as a column
Vector column = np.array( [ 1 ] ,
                          [ 2 ],
                          [ 3 ] ] )
```

2.3 Matrix

A Matrix is an ordered 2D array of numbers and it's two indices. the primary one points within the row and therefore the other to the column. for instance, refers to the worth of the third row and therefore the second column. A Matrix can have multiple numbers of rows and columns. If m and n are positive integers, that is m, n ∈ ℕ then the m×n matrix contains m*n numbers, with m rows and n columns. Note that a Vector is additionally a Matrix, but with just one row or one column.

The full m×n matrix are often written as:

$$A = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \cdots & a_{1n} \\ a_{21} & a_{22} & a_{23} & \cdots & a_{2n} \\ a_{31} & a_{32} & a_{33} & \cdots & a_{3n} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ a_{m1} & a_{m2} & a_{m3} & \cdots & a_{mn} \end{bmatrix}$$

It is often useful to scale back the complete matrix component display into the subsequent expression:

In Python, We use numpy library which helps us in creating n dimensional arrays. Which are mainly matrices, we use matrix method and pass within the lists and thus defining a matrix.

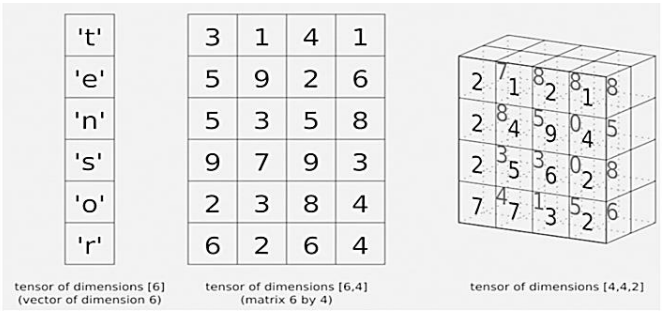
Python examples within the matrix with numpy array:

```
>>> a=np.matrix ('1   2 ; 3  4')
>>> a
  matrix ([[ 1, 2],
           [ 3, 4]])
a = np.matrix ('1   2 ; 3  4')
a
```

```
>>>np.matrix([ [1 , 2] , [3 , 4] ])
matrix ( [ [ 1, 2] ,
           [3 , 4] ])
np.matrix( [ [1 , 2 ], [3 , 4] ])
```

2.4 Tensor

You can consider a Tensor as an array of numbers, arranged on a daily network, with a variable number of axes. A Tensor has three indices, where the primary one points to the row, the second to the column and therefore the third one to the axis. for instance, T123 points to the primary row, the second column, and therefore the third axis. This refers to the worth 0 within the Tensor within the graphic below:



Tensor is that the mainly general term of all of those concepts above because a Tensor may be a multidimensional array and it are often a Vector and a Matrix, counting on the amount of indices it's. it's sometimes necessary both within the physical sciences and machine learning to form use of tensors with order that exceeds two. for instance, a first-order Tensor would be a Vector (1 index). A second-order Tensor may be a Matrix (2 indices) and third-order Tensors (3 indices) and better are called Higher-Order Tensors (3 or more indices).

III.CONCLUSION

In this paper, you educated about the mathematical objects of Linear Algebra that are used in Machine Learning. Get knowledge to add, subtract, multiply and divide these algebraic objects. Also, you have learned about the most important properties of Matrices. Even though there are also other parts of Linear Algebra used in Machine Learning, this post gave you an appropriate introduction to the most important concepts.

IV. REFERENCES

[1]. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong "Mathematics for Machine Learning", Cambridge University Press, 2020, ISBN: 08679935, 978110867993011

[2]. Charu C. Aggarwal, "Linear Algebra and Optimization for Machine Learning" Springer International Publishing, 2020, ISBN: 3030403432, 9783030403430

[3]. Manuel Grana, Carlos Toro, Robert J. Howlett, Lakhmi C Jain, "Knowledge Engineering, Machine Learning and Lattice Computing with Applications" Springer International Publishing, ISBN: 978-3-642-37342-8

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