Tensorflow

Tushar B. Kute,
http://tusharkute.com

Tensorflow

- TensorFlow is a software library or framework, designed by the Google team to implement machine learning and deep learning concepts in the easiest manner.
- It combines the computational algebra of optimization techniques for easy calculation of many mathematical expressions.

Tensorflow: Features

- It includes a feature of that defines, optimizes and calculates mathematical expressions easily with the help of multi-dimensional arrays called tensors.
- It includes a programming support of deep neural networks and machine learning techniques.
- It includes a high scalable feature of computation with various data sets.
- TensorFlow uses GPU computing, automating management.
- It also includes a unique feature of optimization of same memory and the data used.

Tensorflow: Why Popular

- TensorFlow is well-documented and includes plenty of machine learning libraries. It offers a few important functionalities and methods for the same.
- TensorFlow is also called a “Google” product. It includes a variety of machine learning and deep learning algorithms.
- TensorFlow can train and run deep neural networks for handwritten digit classification, image recognition, word embedding and creation of various sequence models.

Tensorflow: installation

- pip install tensorflow -U

Scaler / Real Numbers

- Real number is any number that can be found in the real world. We find numbers everywhere around us.
- Natural numbers are used for counting objects, rational numbers are used for representing fractions, irrational numbers are used for calculating the square root of a number, integers for measuring temperature, and so on.
- These different types of numbers make a collection of real numbers.

Scaler / Real Numbers

- Any number that we can think of, except complex numbers, is a real number. For example, 3, 0, 1.5, 3/2, √5, and so on are real numbers.
- Definition of Real Numbers
  - Real numbers include rational numbers like positive and negative integers, fractions, and irrational numbers.
  - Now, which numbers are not real numbers? The numbers that are neither rational nor irrational are non-real numbers, like, √-1, 2 + 3i, and -i. These numbers include the set of complex numbers, C.

Real Numbers: Types

- Rational Numbers
  - Any number which can be defined in the form of a fraction p/q is called a rational number.
  - The numerator in the fraction is represented as 'p' and the denominator as 'q', where 'q' is not equal to zero.
  - A rational number can be a natural number, a whole number, a decimal, or an integer.
  - For example, 1/2, -2/3, 0.5, 0.333 are rational numbers.

Real Numbers: Types

- Irrational Numbers
  - Irrational numbers are the set of real numbers that cannot be expressed in the form of a fraction p/q where 'p' and 'q' are integers and the denominator 'q' is not equal to zero (q≠0.).
  - For example, π (pi) is an irrational number. π = 3.14159265...In this case, the decimal value never ends at any point.
  - Therefore, numbers like √2, -√7, and so on are irrational numbers.

Real Numbers: Symbols

- Real numbers are represented by the symbol R.
- Here is a list of the symbols of the other types of numbers.
  - N - Natural numbers
  - W - Whole numbers
  - Z - Integers
  - Q - Rational numbers
  - $\bar{\bar{\bar{\bar{Q}}}}$ - Irrational numbers

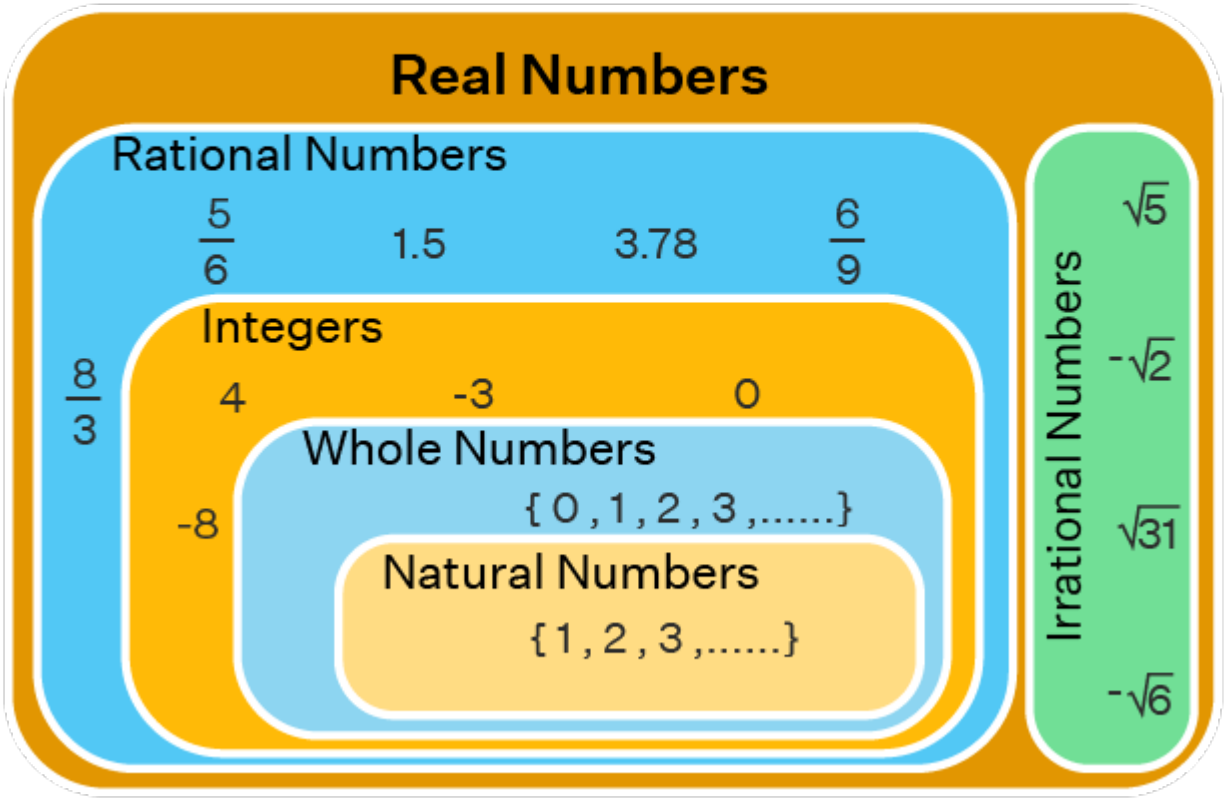
Real Numbers: Subset

- All numbers except complex numbers are real numbers.
- Therefore, real numbers have the following five subsets:
  - Natural numbers: All positive counting numbers make the set of natural numbers, N = {1, 2, 3, ...}
  - Whole numbers: The set of natural numbers along with 0 represents the set of whole numbers. W = {0, 1, 2, 3, ..}

Real Numbers: Subset

- Integers: All positive counting numbers, negative numbers, and zero make up the set of integers. Z = {..., -3, -2, -1, 0, 1, 2, 3, ...}
- Rational numbers: Numbers that can be written in the form of a fraction p/q, where 'p' and 'q' are integers and 'q' is not equal to zero are rational numbers. Q = {-3, 0, -6, 5/6, 3.23}
- Irrational numbers: The numbers that are square roots of positive rational numbers, cube roots of rational numbers, etc., such as √2, come under the set of irrational numbers. ($\bar{\bar{\bar{\bar{Q}}}}$) = {√2, -√6}

Real Numbers: Summary



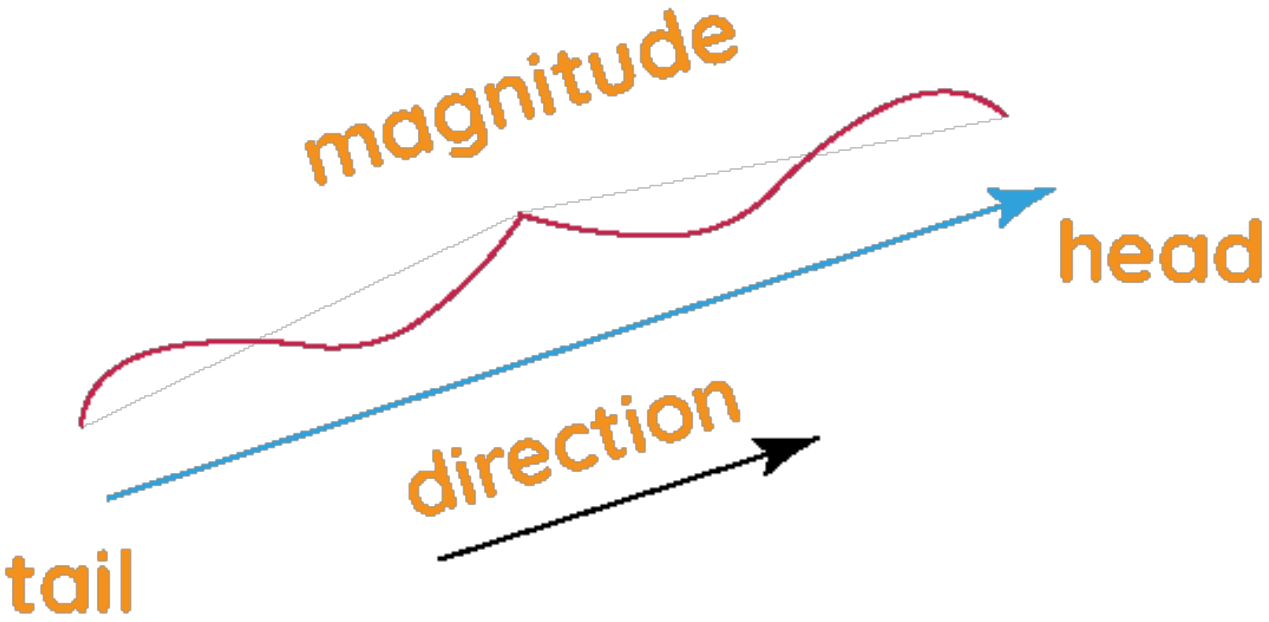
Vector

- Vectors are geometrical entities that have magnitude and direction.
- A vector can be represented by a line with an arrow pointing towards its direction and its length represents the magnitude of the vector.
- Therefore, vectors are represented by arrows, they have initial points and terminal points.
- The concept of vectors was evolved over a period of 200 years.
- Vectors are used to represent physical quantities such as displacement, velocity, acceleration, etc.

Vector

- A vector is a Latin word that means carrier. Vectors carry a point A to point B.
- The length of the line between the two points A and B is called the magnitude of the vector and the direction of the displacement of point A to point B is called the direction of the vector AB.
- Vectors are also called Euclidean vectors or Spatial vectors.
- Vectors have many applications in maths, physics, engineering, and various other fields.

Vector



Matrices

- Matrices, the plural form of a matrix, are the arrangements of numbers, variables, symbols, or expressions in a rectangular table that contains various numbers of rows and columns.
- They are rectangular-shaped arrays, for which different operations like addition, multiplication, and transposition are defined.
- The numbers or entries in the matrix are known as its elements.
- Horizontal entries of matrices are called rows and vertical entries are known as columns.

Matrix

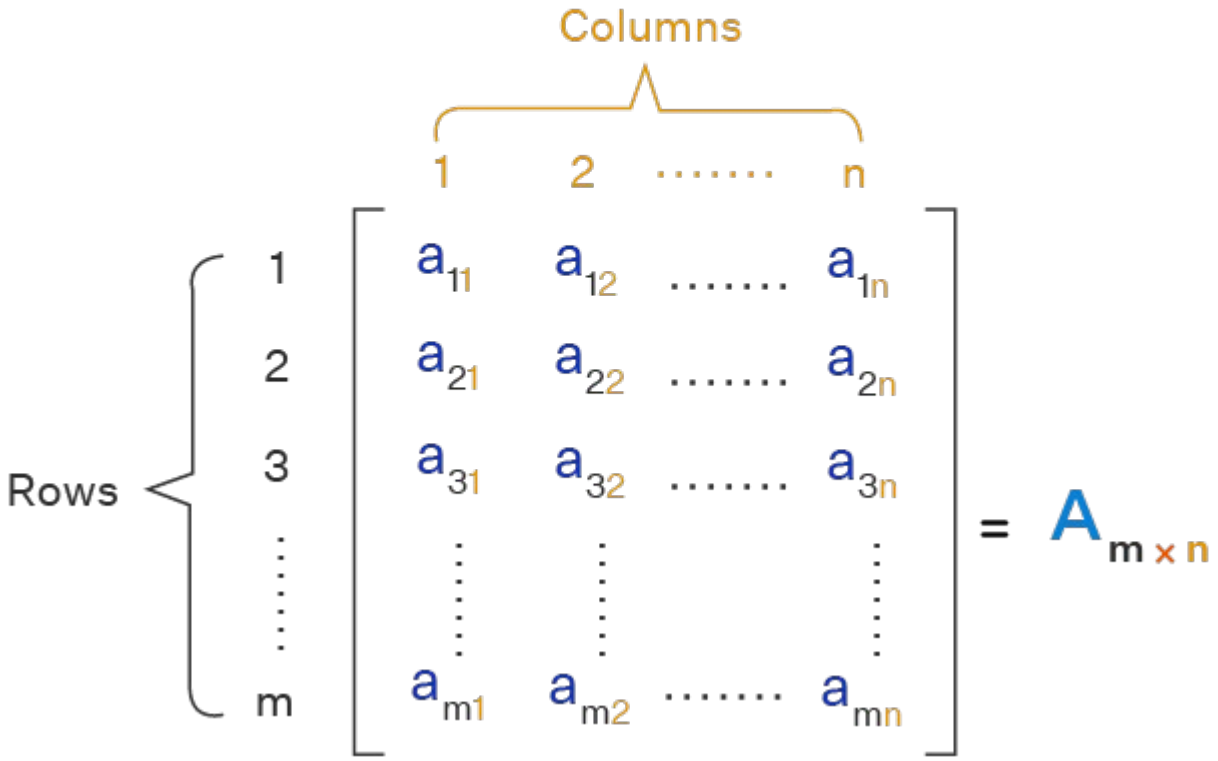
- A matrix is a rectangular array of numbers, variables, symbols, or expressions that are defined for the operations like subtraction, addition, and multiplications.
- The size of a matrix (which is known as the order of the matrix) is determined by the number of rows and columns in the matrix.
- The order of a matrix with 6 rows and 4 columns is represented as a 6 × 4 and is read as 6 by 4.

Matrix

- For example, the given matrix B is a 3 × 4 matrix and is written as [B]3×4

$$B = \begin{bmatrix} 2 & -1 & 3 & 5 \\ 0 & 5 & 2 & 7 \\ 1 & -1 & -2 & 9 \end{bmatrix}$$

Matrix


Columns
1 2 ..... n
Rows
1 2 3 ⋮ m
a_{11} a_{12} ..... a_{1n}
a_{21} a_{22} ..... a_{2n}
a_{31} a_{32} ..... a_{3n}
a_{m1} a_{m2} ..... a_{mn}
= $A_{m \times n}$

Matrix Notations

- If a matrix has m rows and n columns, then it will have m × n elements.
- A matrix is represented by the uppercase letter, in this case, 'A', and the elements in the matrix are represented by the lower case letter and two subscripts representing the position of the element in the number of row and column in the same order, in this case, 'a_{ij}', where i is the number of rows, and j is the number of columns.

Matrix Notations

- For example, in the given matrix A, element in the 3rd row and 2nd column would be a_{32}, can be verified in the matrix given below:

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

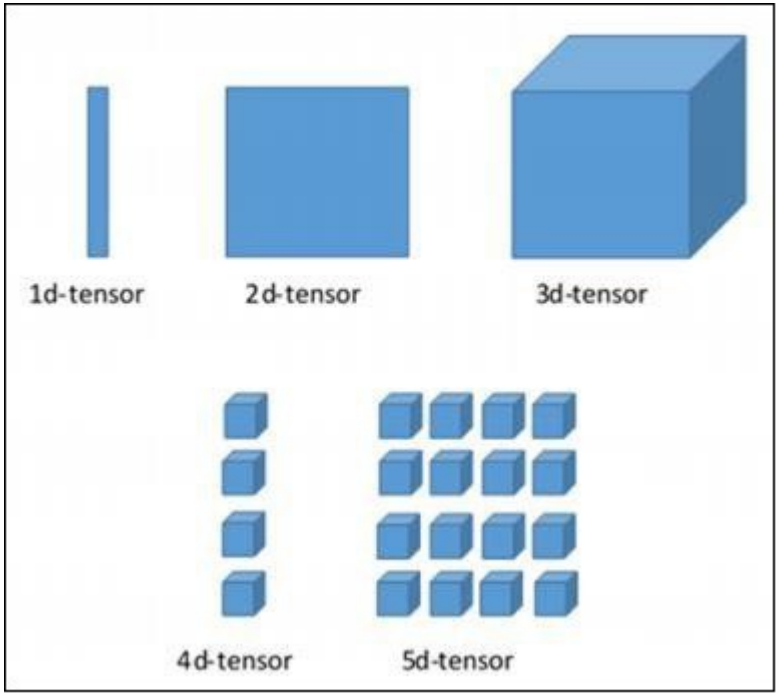
Tensor Data Structure

- Tensors are used as the basic data structures in TensorFlow language. Tensors represent the connecting edges in any flow diagram called the Data Flow Graph. Tensors are defined as multidimensional array or list.
- Tensors are identified by the following three parameters –
- Rank
  - Unit of dimensionality described within tensor is called rank. It identifies the number of dimensions of the tensor. A rank of a tensor can be described as the order or n-dimensions of a tensor defined.
- Shape
  - The number of rows and columns together define the shape of Tensor.

Tensor Data Structure

- Type
  - Type describes the data type assigned to Tensor's elements.
- A user needs to consider the following activities for building a Tensor –
  - Build an n-dimensional array
  - Convert the n-dimensional array.

Tensor Data Structure



Thank you

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https://mitu.co.in
http://tusharkute.com

@mituskillologies

contact@mitu.co.in

tushar@tusharkute.com