Prediction of Compressive Strength of Concrete Using Tensor Flow: Review

Miss. Pratiksha Yadu[1], Mr.N. K. Dhapekar[2]
[2]Assistant Professor
[1, 2] Kalinga University, New Raipur, Chhattisgarh, India.

Abstract- *This research paper highlights the applicability of Tensor Flow in Productive Modeling of Civil Engineering Concrete Technology Field. Tensor Flow in general is a Platform on the purpose of Machine Learning. By desegregation the antecedent in one Platform, we can Systematize, the elements, shorten the platform arrangement, and bring down the time of Production of order from weeks to days, while delivering Platform, stability that reduces interference .The Primary Properties of concrete build structures inerrable on numerous specifications including the properties of the Composition of concrete which mainly includes Cement, Water and Aggregates. The main aim in assigning of these ingredients is to make concrete of desired Compressive Strength. Tensor Flow is a approved free publicly accessible source code released in 2015 as a Platform for developing Machine Learning and wide learning Models. It helps the user to perform on Python Programming Language and Numerical Computations by help of data flow Graphs to Construction Models. The basic aim of writing this research paper is to prepare the productive Model using Tensor Flow in Civil Engineering.*

Keywords- Tensor Flow, Machine Learning, Compressive Strength, Python Programming Language.

I. INTRODUCTION

Machine Learning is a mode of Artificial Intelligence, that permit software utilization to suit more precise end result without using direct programmed to do so. It is a algorithms that operate authentic data as input to divine new output values. Tensor Flow, evolve originally for managing large Numerical Computation. Receive data in the form of complicated Arrays (which handles large amount of data) of higher dimensions called Tensor. Labor on the account of data flow graphs, those have nodes and edges. The execution mechanism is in the form of graphs. So that makes it trouble free for executing this codes in a distributed manner among cluster of computers. Tensor is a rationalization of vectors and matrices of probably elevated dimensions. So Tensor actually offer very nice and compact way of storing and handling the data during the computation ,Tensors are really very handy in terms of keeping the data compact because they are like multi –dimensional arrays . Data is in the form of arrays is fed as input to neural network are called Tensor. The main purpose of Tensor Flow in the teaching and improvement of Artificial Neutral Networks .These network are Algebraic models that have proved skillful execution in model identification of problems and have been execute for a broad spectrum .The method of selecting appropriate materials for concrete and its quantity with the objective of producing concrete of required strength workability and durability as cost-spinning as possible for mix-design. In the past many researchers have keep on progress for error free Compressive Strength prediction model. A clear grip of such composite behavior is needed in order to benefit the use of material in different engineered structures. Therefore, prediction of Compressive Strength for concrete is an active field of research . By predicting single Compressive Strength , will describe the overall behavior of concrete but the complexity of this parameter is even now pushing towards a more wide and precise method . The main objective of this study is the prediction of Compressive Strength of concrete by employing an Artificial Intelligence network by the help of data available. The model works skillfully with multifaceted arrays, it issue flexibility of computation over machines and large data files, can make models of different layers each layers may have different properties. Basically, Tensor Flow carry out the estimation by the help of dataflow graphs .It includes nodes which constitute the working in our Model. Hence the main objective of this paper is the prediction of Compressive Strength of Concrete by the Artificial Neural Network Using Tensor Flow.

II. METHODOLOGY

Tensor

Tensors are the central unit of data in Tensor Flow and the creators define tensors as a ” typed multi dimentional array” [9]. That is, an object to store data elements of different types; e.g. strings, integers floats etc. The rank of the tensor is its number of dimensions, and the shape is its size in each of its dimensions. Examples of tensors of different sizes with integer elements are shown below.

4 scalar, a rank 0 tensor with shape []
[1, 2, 3] vector, a rank 1 tensor with shape [3]
[[1, 2, 3], [7, 8, 9]] matrix, a rank 2 tensor with shape [2, 3]
[[[1, 2, 3], [1, 2, 3]], [[4, 5, 6], [7, 8, 9]]]
a rank 3 tensor with shape [2, 2, 3]

Computational Graph and Operations

Tensor Flow programs can be divided into two sections:

1. Building the computational graph.
2. Running the computational graph.

A computational graph in Tensor Flow is a series of Tensor Flow operations, where each operation is denoted as a node in the graph. The example below shows how a simple computational graph can be implemented, with the nodes a, b and c.

```
Import tensor flow as tf
 # Build graph
 a = t f . c o n s t a n t ([[ −1. 0 , −1. 0 , −1. 0] ,[ −1. 0 , −1. 0 , −1. 0]] )
 b = t f . c o n s t a n t ( 1 . 0 , shape =[3 , 2 ] ) # another way of defining a tensor
 c = t f . matmul ( a , b )
# Print output
   p r i n t ( c )
```

This will produces the output
Tensor (”MatMul : 0 ” , shape =(2 , 2) , dtype=f l o a t 3 2)
tf.matmul is a built-in Tensor Flow operation that multiplies its input matrices. Table 1 shows a list of some operations that are provided in the Tensor Flow library. Some of them will be used in the examples in this report.

Table 1: Example of some Tensor Flow operators

Operator types	Examples
Mathematical operations	add, sub, mul, div, exp, log, greater, square, less, equal
Array operations	concat, slice, split, constant, rank, shape, shuffle
Matrix operations	matmul, matrix inverse, matrix determinant
Stateful operations	Variable, assign, assign add, global variables initializer
Activation Functions	softmax, sigmoid, relu, convolution2D, maxpool
Checkpointing operations	Save, restore
Reduction operators	reduce mean, reduce max, reduce prod, reduce all Random tensor generators random normal, truncated normal, random uniform, random crop.

Tensor Board

The computational graphs in Tensor Flow can quickly become quite complicated. To get a better understanding on what's actually going on, the tool Tensor Board can be used to visualize the graph. The visualization is interactive, and the user can zoom, pan, expand or collapse different groups for a more detailed description. In order to be able to view the Tensor Board page the following line must be added to the end of your script.

```
 w r i t e r = t f . Summary. File W ri t e r ( ' o u t p u t f o l d e r ' , s e s s . graph )
```

tf. summary provide a way to save and export information about the graph to Tensor Board. The File Writer class writes the summary to a folder in the current directory, which in this case is called 'output folder'. To then launch Tensor Board the following must be done:

- Run the command: tensorboard –logdir=path/to/log-directory
- In a web browser, navigate to: localhost:6006

Variables

Objects of the Variable class makes it possible to add trainable parameters to a graph [13]. The constructor, Variable(), must be provided with an initial value that define its shape and type. The type and shape of the variable is fixed after construction. By contrast to the constant nodes a and b, shown in the examples in section 4.2, 4.3, 4.4, variables needs to be initialised explicitly. Tensor Flow has an operation called global variables initializer() that initials all variables in the program.

In the example code below, variable objects are used to fit a liner model to some data. We use the model:

$$Y_{est} = W \cdot x + b$$

We want to find the parameters W and b, that maps the relationship between x and y. In order to evaluate a model, we must have a cost function that we want to minimize. In this example the sum of all square deltas is used as the cost function:

$$cost = X(y - y_{est})^2$$

The cost function tells how far the estimated output, y_{est}, is from the provided data, y.

The following code show the implementation in using Tensor Flow.

```
import t e n s o r f l o w a s t f
 # d e f i n e model
 W = t f . V a ri a bl e ( [ 1 . 5 ] )
 b = t f . V a ri a bl e ( [ −1 . 5 ] )
 x = t f . pl a c e h ol d e r ( t f . f l o a t 3 2 )
 y e s t = t f . add ( t f . m ul ti pl y (W, x ) , b )
 # c r e a t e s e s s i o n o b j e c t
        s e s s = t f . S e s si o n ( )
 # i n i t i a l i z e v a r i a b l e s
        i n i t = t f . g l o b a l v a r i a b l e s i n i t i a l i z e r ( )
. run ( )
```

III. CONCLUSION

The basic purpose of this study is to predict and measure the compressive Strength .This research paper has given an insight what tensor flow is and what it can be used for. The major conclusion drawn from the above review is in depth class of all the sectors of Tensor Flow is out of the scope for this report. This research paper presents the, main concepts behind the software study and its building blocks .On the other hand as Tensor Flow is very new, and in constant development it also has a large and active section. This makes it possible for inexperienced users to quickly find from more experienced users.

REFERENCES

[1] 2V. K. Alilou. “Designing a learning machine for prediction of the compressive strength of the concrete by using artificial neural networks”. M.sc Thesis, Science and Research Branch, Islamic Azad University,Tehran,Iran, August 2009

[2] “Microsoft Encarta Encyclopedia”, Microsoft Corporation, (2009)

[3] Chu Kia Wang, Charles G. Salmon. “Reinforced Concrete Design”, Harper & Row Publishers, USA, (1979)

[4] N.K. Dhapekar & S.P. Mishra, Effective utilization of construction and demolished waste concrete-review, Research Journal of Engineering Sciences, Vol. 6 (7), 2017, 52-57.

[5] N.K. Dhapekar, A.S. Majumdar & Dr. P.K. Gupta, Study of phase composition of Ordinary Portland Cement Concrete using X-Ray Diffraction, International Journal of Scientific & Research, Vol. 6 , 2015, Issue 11

[6] Testing of strength of recycled aggregate concrete using Microsilica and it's applicability DPSC N.K.Dhapekar Journal of advances and scholarly researches in allied education. Volume 16, Issue 06 Pages 625-627 Publisher Ignited minds journal.

[7] N.K. Dhapekar & D.M. Chopkar, Structural Health Monitoring of Ordinary Portland Cement Concrete Structures Using X-Ray Diffraction, International Journal of Applied Engineering Research, Vol. 11, 2016, 6128-6131.

[8] N.K. Dhapekar, Structural Health Monitoring of Concrete Structures Evaluating Elastic Constants and Stress Strain Parameters by X-Ray Diffraction Technique, International Journal of Civil Engineering and Technology (IJCIET), Vol. 5, Issue 1, 2014, 01-12.

[9] N.K. Dhapekar & Purnachandra Saha, Structural Health Monitoring of Historical Monuments by Rapid Visual Screening: Case Study of Bhand Deval Temple, Arang, Chhattisgarh, India, International Journal of Civil Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD), Vol. 3, 2013, Issue 3.

[10] Integreated approach to construction and demolition waste management in Raipur. N.K.Dhapekar & Abhinav Singh Gautam, International journal of advance research in science and engineering,6,02,pp 1-3,AR research publication.

[11] Efficient Utilization of Construction and Demolition Waste in Concrete,NK Dhapekar & SP Mishra, 216-226, American Society of Civil Engineers.

[12] Testing of strength of recycled aggregate concrete using Microsilica and it's applicability, Dr.P.S.Charpe & N.K.Dhapekar, Journal of advances and scholarly researches in allied education,16,06,pp 625-627, Ignited minds journal.

[13] Scope of utilization of recycled aggregates in construction sector,N.K.Dhapekar, International Journal of Science and research,8,04,pp 1580-1581,IJSR.

[14] Design of pavement by super civil cd software (Road),N.K.Dhapeka & Priyanka Dixit, International Journal of science and research,8,issue-05,PP 565-568, IJSR, Rabindranath Tagore University.

[15] Design and Analysis of Isolated Footings using RCF software,N.K.Dhapekar & Rajnish Kumar Tiwari,International Research Journal of Engineering and Technology,7,issue -08,PP 1349-1352, IRJET.

[16] Use of RCF software in construction industry, N.K.Dhapekar & Chetan Sonkar, International Journal of creative journal thoughts,volume-8,issue-08,PP 1537-1542, IJCRT.

[17] Design of highway road project by using mix road and heads software,N.K.Dhapekar, International research journal of engineering & technology,volume-7,issue-08,PP 3070-3073,IRJET.