

# Electronic Governance of Housing Price using Boston Dataset Implementing through Deep Learning Mechanism

E.Laxmi Lydia, Gogineni Hima Bindu, Aswadhati Sirisham, Pasam Prudhvi Kiran

**Abstract:** The growth of technology in our day-to-day enterprise with advanced machines are outstanding through Artificial Intelligence involving both machine learning and deep learning all over the world. As things go on the forecast of innovations to business and society applying Artificial Intelligence influence technological transformations. This will possibly lead to vulnerable with reference to security. In this paper, we intend to constitute particular prediction forms depending on deep learning to regulate the actual data of the real estate processed apartments data in Boston to predict the housing price. We construct a Linear regression prediction model related to Supervised Learning in Artificial Intelligence. In this paper, a comprehensive study on house pricing using different class labels. Finally, the supervised data was produced, which is important to estimate and prediction of the housing price in the real estate business. Connecting with Artificial Intelligence, we will acquire the capacity of composing higher intelligent predictions regarding future management and developments on smarter intelligent systems and prototypes.

**Keywords:** Artificial Intelligence, Supervised Learning, smarter intelligent, deep learning

## I. INTRODUCTION

Artificial Intelligence is a procedure that authorizes the machines to pretend close to humans by simulating their role and kind. Artificial Intelligence models machines to achieve their skills through their training. The machines regulate their reaction depending on the newly incoming inputs through operating human-like activities by transforming high volumes of information and identifying patterns among them. Machine learning and deep learning are subdivisions of Artificial Intelligence which use its approach in statistical methods to enable machines to improve. Machine learning specifies computers with the performance to learn explicitly beyond its design. Deep Learning is the subdivision of Machine Learning that makes the computing of multi-layer neural network appropriate.

**Classification:** Classification of the data is essential to analyze and later predict. The model generated from the training data classifies into already defined classes. This process is known as supervised learning. Supervised Learning is the process points the input variables (X) and an output variable (Y). This algorithm is used to discover the mapping function in between input and output.

**Revised Manuscript Received on March 26, 2019**

**E. Laxmi Lydia**, Department of Computer Science Engineering, Vignan's Institute of Information Technology(Autonomous), Visakhapatnam, India.

**Gogineni Hima Bindu**, Asst. Prof., MCA, Vignan's Institute of Information Technology(Autonomous), Visakhapatnam, India.

**Aswadhati Sirisha**, Asst. Prof., MCA, Vignan's Institute of Information Technology(Autonomous), Visakhapatnam, India.

**Pasam Prudhvi Kiran**, Asst. Prof., IT, Vignan's Institute of Information Technology(Autonomous), Visakhapatnam, India.

Existing two models of supervised learning are Regression and classification. A real estate deliberation firm has the data apartments costs in Boston. This data includes standards like crime rate, age, accessibility, population etc. Depending on the extracted data, the company chooses to decide the price of the new apartments. This issue can be figured through a linear regression model.

**Regression:** In contradiction to classification, regression output results in continuous-valued numeric data. It analyzes suitable structure to determine labels identical to multi-label classification using Regression analysis. A Dependent Variable is a variable to be predicted or explained. An Independent Variable is a variable related to the dependent variable in an equation. Regression is the prediction of a numeric value based on an input. Regression has been tested in distinct applicational fields.

## II. BACKGROUND

Classification and prediction are the most regular and complicated areas in obtaining accurate outcomes through class labels. Practical implementations of higher computational layers in neural networks through deep learning in present days are very much powerful. Deep Learning operates on detection process indeed with a composite nonlinear dependency within both dependent and independent variables [2]. Usual conventional data mining systems as Neural Network is an additional materialized approach executed in educational data mining. The dominance of the neural network is that it has the capability to reveal all potential communications within predictors variables [3]. This was treated as the most useful prediction method.

While purchasing the houses buyers are extremely interested in the dealings related to housing prices in their ups and downs. Despite the long process observations of real estates most of the buyers sometimes be at loss to invest high prices. To figure out and clarify such kind of problems, systematic prediction information regarding inconstancy rates are been specified. Change in the technological trends, the prediction and identification process all over the world is available through research by sitting at home with no proficient business applications [4]. The fundamental search of housing price primarily investigates the bearing of housing price at the price levels and rate of growth [5]. Further, arising the perspective of statistical and analytical, the time series method, impacts the tendency of house pricing predictions.



# Electronic Governance of Housing Price using Boston Dataset Implementing through Deep Learning Mechanism

Lately, with the advancement of big data, predictions using deep learning has turned into the powerful prediction method [6]. To train and predict data using S-RNN for st-graph. Predicting node labels by connecting both nodes and edge features implementing modern and edge RNN. It incorporates the high-levelspatiotemporal graphs includes the order in designing RNN [8]. Implementation of deep learning predictions analyze the feature attributes of the house pricing correctly [7]. It is remarkablyactivated and tested for house price prediction.

In this paper, based on the context of supervised deep learning techniques, the prediction is carried out with real estate information. This paper mainly functions in a few situations like to analyze the real estate information of Boston city that consequences the surroundings of the house, area, location and facilities to value the housing price. Based on the house price, information in Boston city a specific and practical prediction was given. A method using linear regression not only capture the feature attributes of the house but also reflect the time series attributes exactly.

### III. METHODOLOGY

#### Tensorflow

Tensorflow is an open-source made by Google for calculating computations using libraries. It is a prominent selection for developing applications that have extreme computations and use to handle graphics handling for the computation projects. These are the fundamental considerations to work on machine learning applications, especially Deep Learning. It also has APIs for evaluating the high level of representation for generating Machine Learning applications. The linear regression model using Tensorflow managing of all the computations and then functions all the computations. Libraries like Numpy and Matplotlib are implemented in this paper. Figure demonstrates the implementation mechanism of Linear regression using Tensorflow.

#### Procedure for Linear Regression method using Tensorflow

- Step1: Initially, import all the related libraries to function linear regression
- Step2: Convert tabular data to a data frame to obtain a format and check it for regression analysis
- Step3: After conversion, load the data into python and isolate our dependent variables from independent variables. Split the dataset into train set and test set.
- Step4: Build a Linear Regression model
- Step5: Now apply the model to train set.

Step6: Execute predictions using the generated model and use the same model for testing

Step7: compare both predicted values and check for the efficiency of the model.

Step8: Finally, calculate the mean squared error(MSE) and print output

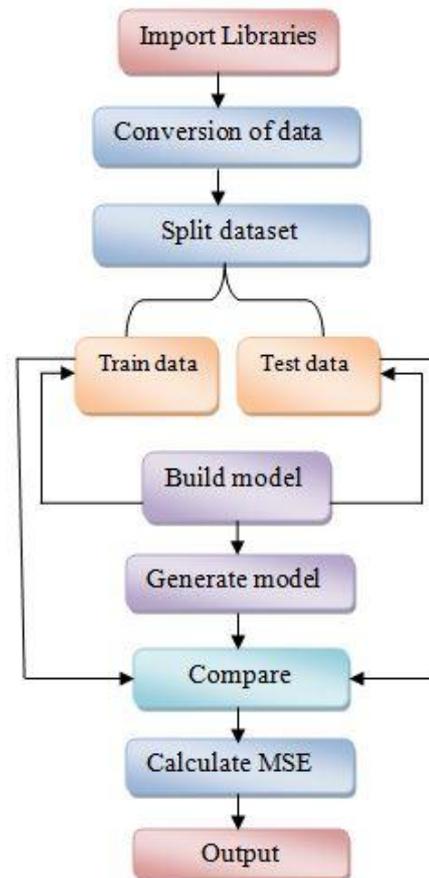


Fig. 1 Flowchart description for Linear regression using Tensorflow

#### Result Analysis

For the experimental purpose, figure1 has been taken as a sample input from Boston dataset. Boston dataset is relevant information related to the prediction of house price is stored for assessment. Following are the 14 attributes of the Boston dataset that are considered in table1.

Figure2 shows the variable data of Boston dataset, Figure3 demonstrates the training epochs, Figure4 calculating the MSE value and Figure5 Demonstrates the Measured and predicted plot.

Table. 1 Attributes with a description for Boston dataset

S.No	Attributes	Description
1.	CRIM	per capita crime rate by town
2.	ZN	the proportion of residential land zoned for lots over 25,000 sq.ft.
3.	INDUS	the proportion of non-retail business acres per town.
4.	CHAS	Charles River dummy variable (1 if tract bounds river; 0 otherwise)
5.	NOX	nitric oxides concentration (parts per 10 million)

6.	RM	the average number of rooms per dwelling
7.	AGE	the proportion of owner-occupied units built prior to 1940
8.	DIS	weighted distances to five Boston employment centers
9.	RAD	index of accessibility to radial highways
10.	TAX	full-value property-tax rate per \$10,000
11.	PTRATIO	the pupil-teacher ratio by the town
12.	$B - 1000(Bk - 0.63)^2$	Where Bk is the proportion of blacks by the town
13.	LSTAT	% lower status of the population
14.	MEDV	The median value of owner-occupied homes in \$1000's

	CRIM	ZN	INDUS	CHAS	NOX	RM	AGE	DIS	RAD	TAX	PTRATIO
count	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000	506.000000
mean	3.593761	11.363636	11.136779	0.069170	0.554695	6.284634	68.574901	3.795043	9.549407	408.237154	18.455534
std	8.596783	23.322453	6.860353	0.253994	0.115878	0.702617	28.148861	2.105710	8.707259	168.537116	2.164946
min	0.006320	0.000000	0.460000	0.000000	0.385000	3.561000	2.900000	1.129600	1.000000	187.000000	12.600000
25%	0.082045	0.000000	5.190000	0.000000	0.449000	5.885500	45.025000	2.100175	4.000000	279.000000	17.400000
50%	0.256510	0.000000	9.690000	0.000000	0.538000	6.208500	77.500000	3.207450	5.000000	330.000000	19.050000
75%	3.647423	12.500000	18.100000	0.000000	0.624000	6.623500	94.075000	5.188425	24.000000	666.000000	20.200000
max	88.976200	100.000000	27.740000	1.000000	0.871000	8.780000	100.000000	12.126500	24.000000	711.000000	22.000000

Fig. 2 Boston Dataset

```

for epoch in range(training_epochs):
    sess.run(training_step, feed_dict={x: train_x, y: train_y})
    cost_history = np.append(cost_history, sess.run(cost, feed_dict={x: train_x, y: train_y}))
    pred_y = sess.run(y_, feed_dict={x: test_x})
    mse = tf.reduce_mean(tf.square(pred_y - test_y))
    print("MSE: %.4f" % sess.run(mse))

plt.plot(range(len(cost_history)), cost_history)
plt.axis([0, training_epochs, 0, np.max(cost_history)])
plt.show()

```

```

MSE: 570.0344
MSE: 537.1244
MSE: 508.3779
MSE: 482.9569
MSE: 460.2126
MSE: 439.6427
MSE: 420.8571
MSE: 403.5522
MSE: 387.4912
MSE: 372.4888
MSE: 358.3987
MSE: 345.1057
MSE: 332.5176
MSE: 320.5606
MSE: 309.1749
MSE: 298.3115
MSE: 287.9298
MSE: 277.9957
MSE: 268.4803

```

Fig. 3 Demonstrating the training epochs

```

pred_y = sess.run(y_, feed_dict={x: test_x})
mse = tf.reduce_mean(tf.square(pred_y - test_y))
print("MSE: %.4f" % sess.run(mse))

```

```

MSE: 30.4187

```

Fig. 4 Calculating the MSE value

# Electronic Governance of Housing Price using Boston Dataset Implementing through Deep Learning Mechanism

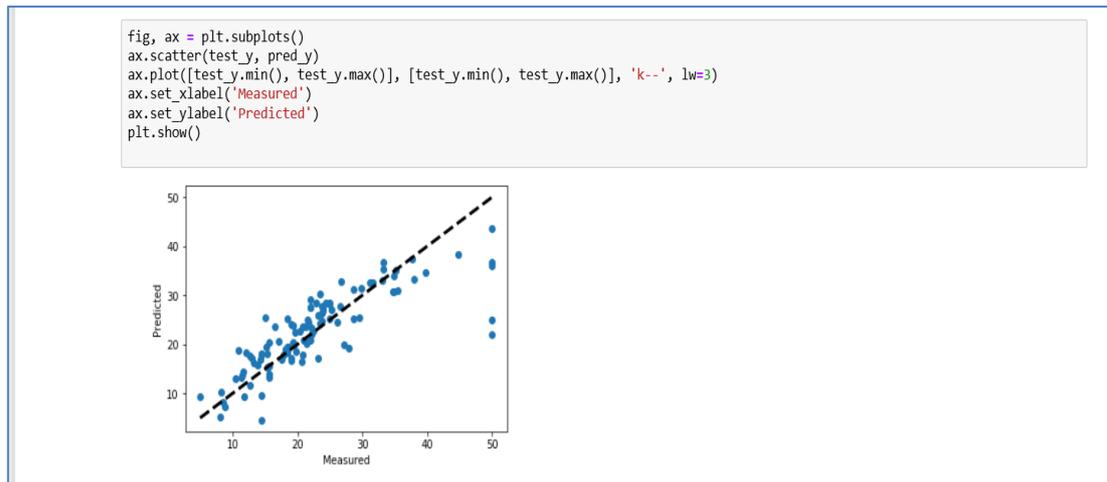


Fig. 5 Demonstrating the Measured and predicted the plot

## IV. CONCLUSION

The increase in popularity using Tensorflow for deep learning and artificial intelligence stretched out new access and course for working on prediction problems. More advanced learning rate has speed up the merging for the trained format. Based on the learning rate the optimal prediction performance progress on the high learning rate. In this paper, implementation of Linear regression for Boston dataset is executed for predicting the house price using Tensorflow. Thus prediction results maintain useful applications of deep learning for buying houses.

## REFERENCES

1. Li Yu, Chenlu Jiao, Hongrun Xin, Yan Wang, Kaiyang Wang, “ Prediction on Housing Price Based on Deep Learning”, World Academy of Science, Engineering and Technology International Journal of Computer and Information Engineering Vol.12, No.:2, 2018.
2. Amirah Mohamed, Shahiri Wahidah, “ A Review on predicting students performance using data mining techniques”, Procedia Computer Science, volume 72, 2015, Pages 414-422, <https://www.sciencedirect.com/science/article/pii/S1877050915036182>
3. Wilton W. T. Fok, Y. S. He, H.H. Au Yeung, K.Y. Law, KH Cheung, YY. Ai, P. Ho, “Prediction Model for students future development by deep LearningandTensorflow AI Engine”.
4. SiqinLI, Lin L, Sun C, Click-Through Rate Prediction for search Advertising based on Convolution Neural Network(J), Intelligent Computer & Applications, 2015
5. Akbar N MA, Ali F M, Maryam Z. The Dynamic Effect of Macroeconomic Factors on Functions of Housing Price in Iran (1990-2007) (J).2010
6. Heydon A, Najork M. Mercator: A scalable, extensible web crawler(J), Worldwide wen-internet & web information systems, 1999, 2(4):219-229.
7. Xian Z B, Qiang L, Arma-based Traffic Prediction and overload detection of Network (J). Journal of computer research & development 2002,39(12):1645-1652.
8. Jain A, ZamirAR, Savarese S, et al. Structural- RNN: Deep Learning on Spatio-Temporal Graphs (J)2015:5308-5317