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Evaluation of Students' Performance in Educational Sciences and Prediction of Future Development using TensorFlow*

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Artificial Intelligence is the domain of computer science which includes the solving of problems in reasoning, knowledge representation, prediction, learning and perception areas. The large volume of data can be used for social media, e-learning, distance learning and e-commerce environment. Our research work includes the classification and prediction of students' performance in educational sciences. The analyzed results are forecasting the future plan in higher studies. In this work, we use TensorFlow Artificial Intelligence engine for classification. Deep learning is used for measuring academic performance in core courses such as mathematics, physics, chemistry, biology and computer Science. The performance can be measured in nonacademic activities also such as sports, yoga, art and social services. These papers gives prediction result using machine learning tools and give more comprehensive study of both academic and nonacademic activities. Here we take number of intermediate nodes from students' performance and number of deep learning objects from students' activities. The result is generated and compared using TensorFlow. The input of two thousand five hundred students' data is taken from Tamil Nadu Nagapattinam and Thirvarur Districts from education science department, 65% of data is trained data and 35% of data are test data. The accuracy factor is 75% to 85%. The prediction factor accuracy can be determined by using optimal configuration of TensorFlow engine. This result can be used for the benefit of the students to select their future studies and career development of students based on their higher secondary academic and nonacademic performance factors.

Keywords: artificial intelligence; deep learning; convolution artificial neural networks; TensorFlow; prediction

1. Introduction

Intelligence Agents are used for various AI applications for planning, machine learning and decision making. In Computer Science, AI research includes the device perceives input from sensor from different environment and machine can learn the input and make effective decision. The following are the AI research areas like Driverless car, natural language processing, content delivery network with intelligent routing, drone assisted network, etc. The common problems are in AI such as knowledge reasoning, machine learning and perception. The many AI tools are used in optimization, logical computation and statistical analysis based problems.

Now the AI can be used for game playing and virtual reality. The UiPath: NIDIVA survey says that all the academic research part which includes AI, Deep learning approach for predicting and forecasting the future study. Pariwat et al., the government and research organization are moving towards AI for implementing results and prediction. GPUs are used for parallel processing, storage, transaction and multimedia applications. How and what way to predict the future from students' performance is very important and huge volume of data to be needed for analyzing results. The objective of this work is to use TensorFlow for predicting higher secondary students' performance in both academic and nonacademic activities. The input taken from students' database is collected from education department. We use different questionnaires' for predicting the factors.

The involvement of stakeholders' students, teachers and parents and input of final examination, internal examinations, extra and co-curricular activities are taken as input. It is very challenging and interesting areas because here we are going to analyze different kind of students based on their category. The input dataset can be taken from educational database and could produce forecasting plan about studies of the students.

Previously number of data mining tools is used for predicting future such as decision tree, k-means, k-mediots, native bayes, support vector machines, etc. But the above tools gave good results, now the technology and industry 4.0 are played vital role for analyzing intelligent data analysis. So, the Google TensorFlow AI engines are used to analyze the students' performance. In this paper, we deploy and analyze how the students will select the future

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and career development using TensorFlow. The future prediction and deep learning methods are applied using recognition and reasoning from students' performance. The assessment results are trained by using knowledge discovery process and educational data mining techniques has been done to select attributes in dataset.

2. Related Works

2.1 Methods for Classification and Prediction

Predictive modeling can be build using classification, association and regression. The decision tree and association rule mining are used for task and categorization. Association rule mining is applied for dependences and correlation from different objects. The recommendation system is an example of physical stores, e-commerce and online shopping. The data can be selected from input students' database by using association based rule mining. As the same it can be implemented in schools also for selecting courses and choice based credit systems. Support and Confidence are two key factors for setting rule. The given dataset, each transaction two factors are involved. The two item set A and B composed for every rule. The percentage of support and confidence will be set for A and B item set. The association rule mining is applied for each item set. So the support is the probability value and indexed in record set. Also, the confidence factor can be set using conditional probability based on discrete value for original data.

Stephen O. Ekolu et al., The decision tree approach is a tree based model that describes each object instance classified. The edge table, root table and adjacent table are prepared based on nodes and edges. The internal nodes as attributes and leaf nodes are represented by class. The trees are further divided based on octree process and the decision can be taken.

Cheung et al., the categorizing is an important feature for testing each instance from root node to edges. The test result compared with each child node data and recursively moved to each leaf nodes for final decision. The set of if-then rules are applied to calculate each path instance and conditions are framed to internal nodes calculations. The conclusion can be obtained based on rules and classification results.

2.2 Predictive Analysis

The difference statistical techniques are used to analyze current and historical facts for making effective prediction about future or unknown activities/events. Google DeepMind results show the predictive model exploit the transactional data to identify the risks , values and opportunities. Each relationship is associated with many factors to permit assessment, potential condition of particular value, analyzing decision and transactions. Ezgi Pehlivanli et al., the functional events are technical approaches to analyze the prediction factor for individual instance and attributes for determining process and marketing policies. Predictive analytics provides a predictive score for large number of individuals, credit based processing, fraud detection, cyber forensics, healthcare, government sectors. This method is used in acoustics, finance, social media, online business and marketing, e-commerce, capacity planning, travelling, telecommunication and other fields. NVIDA says that the following are the important area using deep learning process for predictive analyze such as credit scoring, loan processing, customer data, ranking services.

2.3 Machine Learning

Learning from machine and taking effective decision, this is the important feature of machine learning. The various machine learning application are used in day to day life includes email filtering, optical character recognition, biometrics and computer vision. Machine learning explores the study and analyze of various algorithms that can learn from input data and predicting or decision making. It is related to computational intelligence, business intelligence and prediction-making using computers. It is strong mathematical approach and delivers application areas of data mining results.

Machine learning is unsupervised learning with behavioral profiles of various objects and devise complex objects. The commercial use of analytics process is applied for repeatable decision and results. The supervised and unsupervised machine learning techniques are used for decision making and prediction. For example, supervised learning a piece data could have X (Failure) and Y (Win) factors. The learning algorithms learn from the input by comparing actual results and learned results. Based on decision it can be changed. Jimmy Ching-Ming Chen et al., Normally the supervised learning is used for historical data processing and fraudulent services. Unsupervised learning is used for analyzing no historical labels and check transactional data. Each transaction segments are analyzed using self-organizing maps, k-means clustering, single value decompositions techniques. Semi supervised learning is also available for processing label and no label processing. It is very good method for large volume of unlabeled data set. Mannila and Heikki et al., it includes classification, regression, prediction and cost associated with labelling.

2.4 Deep Learning

Deep Learning is also called deep structured learning, hierarchical learning, deep machine learning. It is the study of artificial neural networks and relates with machine learning algorithms. The algorithms can apply for pattern analysis using unsupervised learning and classification using supervised learning. It is nonlinear and layered processing units with feature extraction and transformation procedures. The pattern can be analyzed by representation of data from lower level to higher lever historical data.

Deep learning is also a machine learning field which is learning from representation of each data and multiple levels of representation of abstraction and hierarchy. There is two set of neurons, one is used to get input signal and another one for handling output signal. Each layer will function of input signal and produced modified result in each layer operations and noted as version naming control service. The multiple linear and non-linear algorithms are used calculating edges, intensity, shape and learning from task. It is replaced from semi-supervised learning and hierarchical learning features.

In this work, to make better representations of data and create models for learning from representations using huge volume of dataset. Loosely based interpretation models are used to process information processing system and define relationship between various instance and responses. Deep learning is a buzzword and it has ability to perform machine learning algorithms, predictive analysis and decision making.

3. Neural Network – Artificial and Convolution

Deep learning methods are involved in artificial neural networks and it is cascading models with simple and complex cells. Computer vision is important area for using artificial neural network behaviours in 3D object representation and back propagation procedures. In 2006, Google Ngram chart shows the usage of layered and pre-trained data results. In 2012, the Google Brain created to recognize high level instance from videos.

The feed forward artificial neural networks are convolution neural networks. It recognizes pattern between representation of data and visual perception. It is a biological process and enables multi layering functions like pre-processing, imaging, knowledge discovery, feature recognition, recommendation systems, etc. The collection of each instance can be set by portion of input image and the region can be verified by overlapping policies. Drilling and Tailing is allowed in each layer and recursive moves to each layer translation operations

The combinations of local and global pooling layers are combining the outputs with connected layer results. Convolution operations are applied in each small region and improve the generalization. The major advantage for using convolution services is used for calculating each pixel values and memory also optimized.

4. Methods for Deep Learning and Artificial Intelligence

4.1 The Graphics Processing Units

The GPUs are visual processing units, it is a specialized electronic circuit with manipulating images and accelerating output using frame buffer. GPUs are used in embedded applications, mobile phones, PCs and workstations. GPU have CPU with video card embedded. NIVIDA is a popular company for producing GPUs. It has single chip with integrated transform, rendering, lighting and clipping engine. Highly complicated operations are performed by using GPUs and specialized for rendering complex and large calculations.

4.2 Rules and Generated Policies

In education data mining process, neural networks are used and it has ability to find all possible interactions, representations and prediction. The predictor is a variable which is calculated based on number of instance and attributes in each layer. Deep learning can perform complex, nonlinear, cascaded representations of data and making effective decision.

In this work, Google TensorFlow Artificial Deep Learning Analytics Engine is used to predict the student performance from the input of higher secondary input data such as assessment marks and activities. The following are the attributes of academic performance which included mathematics, physics, chemistry, computer science and biology and their nonacademic performance such sports, yoga, social services. The above records are the input and following are the rules, generated for future prediction factor for educational sciences. The Table 1 shows that number rules generated for calculating students academic and non-academic performance.

From the 2500 students data we divided into two parts, 1800 data are trained data and remaining 700 data are test data.

To build a prediction model we used convolution artificial neural network and patterns are recognized using TensorFlow entropy.

Table 1. Generated rules for academic and non-academic performance

1. Good in Mathematics, Physics, Chemistry -> Engineering.
2. Good in Biology, Physics, Chemistry -> Medicine.
3. Good in Mathematics and Pass in Physics and Chemistry -> Engineering.
4. Good in Biology and Pass in Physics and Chemistry -> Pharmacy.
5. Good in Computer Science and Pass in all -> Select Science Courses.
6. Pass in all courses -> Select Polytechnic, Arts, Science courses.
7. Good in Sports and Pass in all -> Physical Education.
8. Good in Yoga and Pass in all -> Yoga Courses.
9. Good in Social Service and Pass in all -> Arts, Law courses.

The assessment performance of various inputs (A) $a_1,a_2,a_3....a_n$ and outputs are (B) $b_1,b_2,b_3....b_n$

By applying one hot system to calculate entropy cost function Wa + X = b where a – input, W – Weight, X – Intermediate predict calculator and b – output. Input data: Trained data 1800 and Test data 700. Fig. 1 shows that structure of deep learn results with the input of trained and test data

In this work, Python and TensorFlow is used for deployment. TensorFlow open source software library for data flow processing to perform all the tasks. It can be performed machine learning and artificial neural network problems. This framework is well supported for industry to use deep learning in application development. The following are the code to train the dataset, generating and testing the rules. This code is used in python and applies in TensorFlow. Table 2 gives the result of accuracy factor. After the generated result the trained set, the below code applied for TensorFlow to calculate performance from trained model.

The Table 3 shows that calculation of accuracy factor from current prediction values and cost specifies the input stored values. The cascaded layers consist of Hidden layer and adjacent layers. It can be compared by best configuration results by adapting each hidden node value and learning rate.

Fig. 2 shows that result generated from TensorFlow which holds number of trained and test date from Fig. 1. Here X – shows number of trained data bundles and neurons generated from convolution operations with respect to input of test data. The output shows that trained results and learning values.

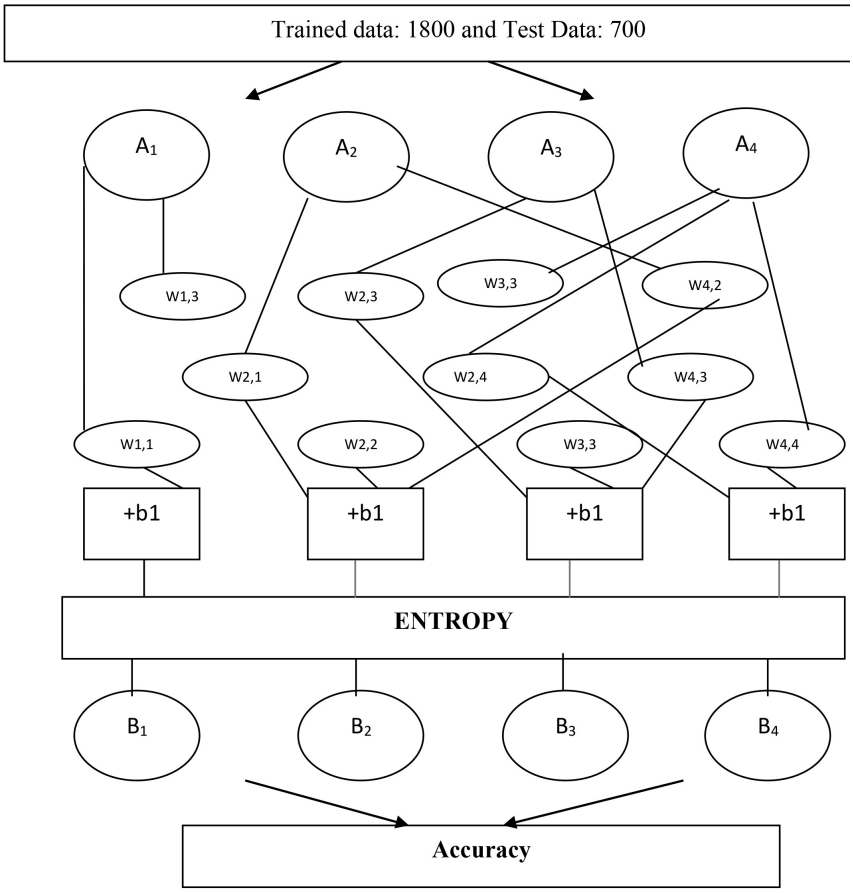

Fig. 1. Structure of Convolution Artificial Neural Networks and Entropy Calculation.

Table 2. Algorithm for prediction range

```
for all in range (A,B)
    avg_cost = 0;
    result = {A : input, B : output}
    cost = sess.run([cost,optimize])
    accuracy = cost + result
    if (cost>0)
        accuracy = current_prediction
    else
        accuracy = cost();
```

Table 3. TensorFlow code for performance factor

```
# Test Model
current_prediction = if.equal(cost(B,1)
accuracy = if.equal(cost(A,B)
result = sess.cost(A,B) + sess.cost(B,1)
print (''Accuracy_Rate:',result)
store = store + result
repeat
```

5. Performance Evaluation

5.1 Hidden Nodes and Accuracy

The number of hidden nodes (i) and number of hidden layers of deep learning accuracy factor (j) are compared for measuring accuracy rate. The table 4 shows that the iteration results of i – iterations and j – bundles (combination of trained and test data as input). The above i and j values are plotted in 3D chart in Fig. 3. Based on above result the accuracy can be increased number hidden exceeds 15.

The graph in Fig. 3 is generated from number iterations as input with respect to input of trained and test data as bundles. The graph shows that accuracy rate generated from TensorFlow based on students' performance.

5.2 Learning Rate and Iteration of Prediction Accuracy

Based on above result, the next relationship can be obtained from number of iteration (r) and learning rate (k) are compared in hidden node j =15. Table 5 shows that the results of TensorFlow values. The input is taken from Table 4 and apply the dataset in TensorFlow. The r – iteration parameter values and k – dataset as input. Fig. 4 shows that graphics result of test and trained data as input and output of

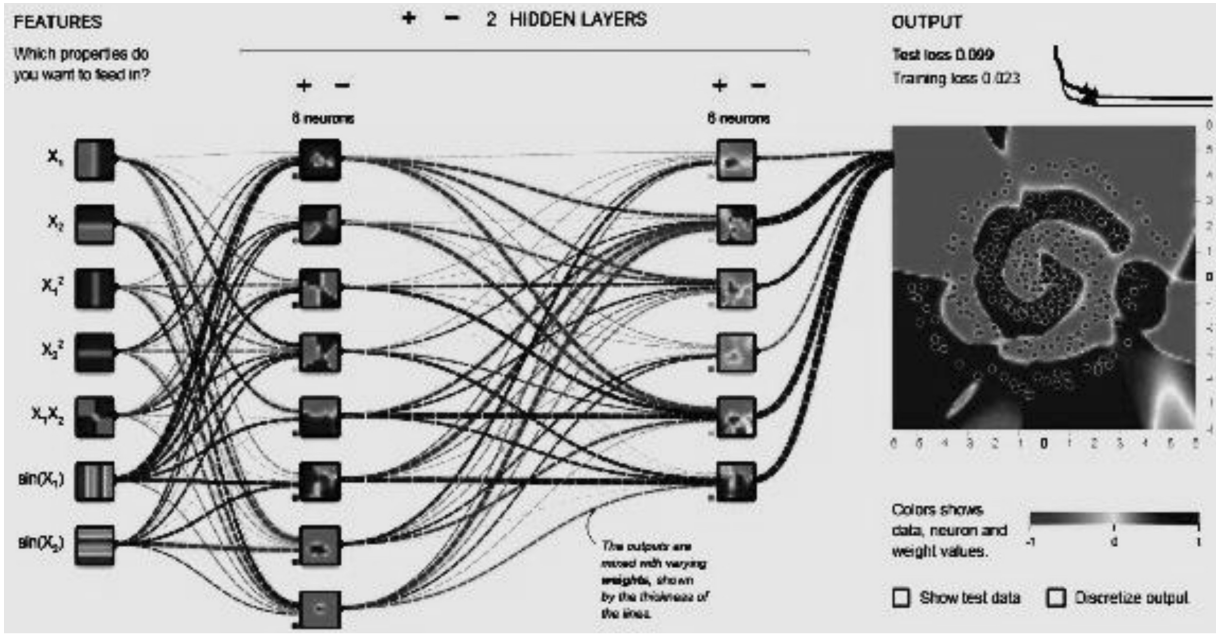

Fig. 2. TensorFlow result Hidden nodes and learning results.

Table 4. Hidden nodes (i) and deep learning accuracy factor (j) compared results

(i)	3	5	8	10	13	15	18	20	23	25	28
(j)											
1	0.75	0.76	0.78	0.80	0.83	0.83	0.87	0.89	0.91	0.94	0.98
2	0.68	0.70	0.72	0.78	0.82	0.83	0.85	0.86	0.87	0.90	0.95
3	0.56	0.61	0.61	0.63	0.69	0.71	0.73	0.74	0.76	0.79	0.84
4	0.44	0.51	0.54	0.65	0.68	0.71	0.72	0.74	0.75	0.77	0.81
5	0.31	0.34	0.38	0.45	0.51	0.55	0.57	0.60	0.62	0.65	0.71
6	0.29	0.31	0.33	0.44	0.47	0.49	0.51	0.53	0.55	0.57	0.67

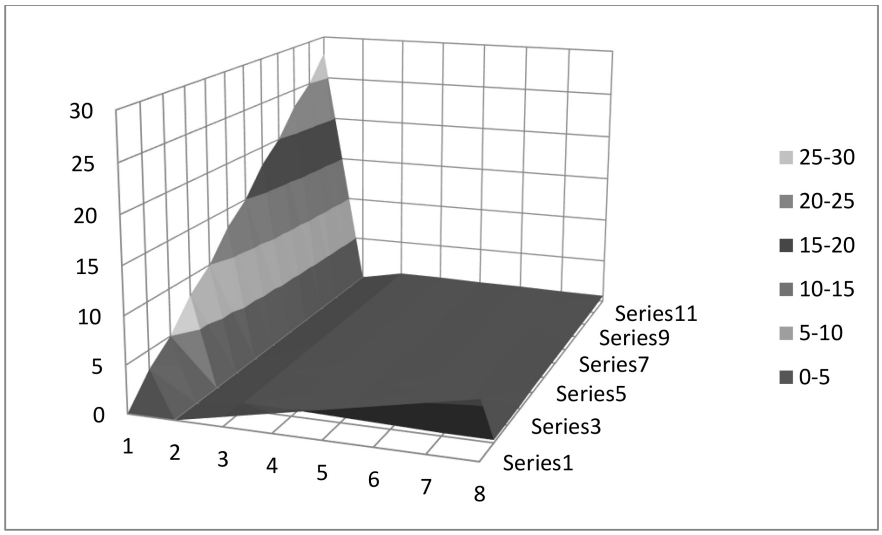

Fig. 3. Result of hidden nodes and learning nodes.

Table 5. Iteration (r) and learning rate (k) compared results

(r) (k)	500	750	1000	1500	2000	3000
0.001	0.879	0.890	0.884	0.887	0.881	0.886
0.002	0.867	0.879	0.873	0.876	0.870	0.875
0.003	0.821	0.981	0.901	0.941	0.861	0.927
0.004	0.845	0.987	0.916	0.951	0.880	0.939
0.005	0.786	0.789	0.787	0.788	0.786	0.788
0.006	0.874	0.934	0.904	0.919	0.889	0.914
0.007	0.834	0.875	0.854	0.864	0.844	0.861
0.008	0.769	0.836	0.802	0.819	0.785	0.813
0.009	0.876	0.836	0.856	0.846	0.866	0.849
0.010	0.763	0.821	0.792	0.806	0.777	0.801
0.011	0.857	0.846	0.851	0.848	0.854	0.849
0.012	0.876	0.824	0.850	0.837	0.863	0.841
0.013	0.836	0.835	0.835	0.835	0.835	0.835
0.014	0.768	0.846	0.807	0.826	0.787	0.820
0.015	0.876	0.867	0.871	0.869	0.873	0.870

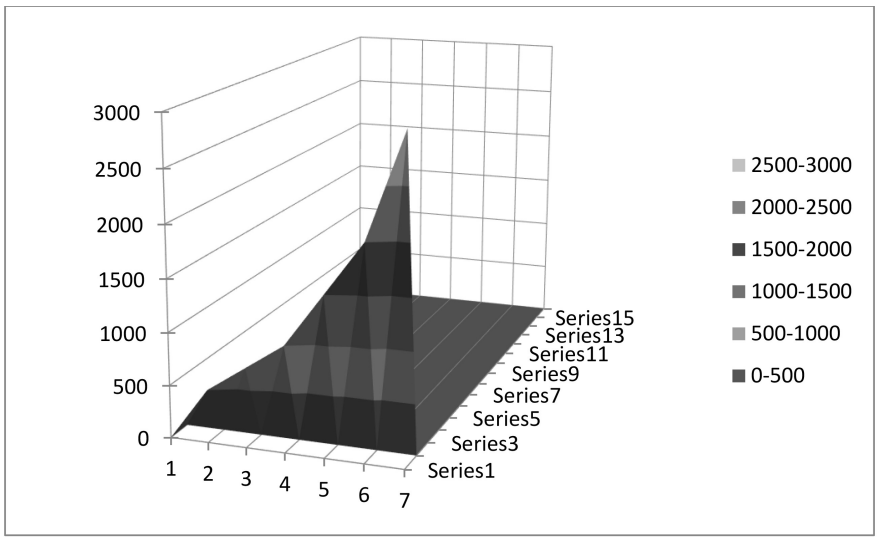

Fig. 4. Combination of Iteration (r) and learning rate (k) result.

learning rate with respect to students' performance factor.

Tables 4 and 5 and the graph (Fig. 4) show a series of results with the combination of students' performance. Fig. 3 shows the students' performance factor based on academic and non academic factor results. Based on that, more students are interested to select their higher studies from their academic results. The percentage is calculated from TensorFlow and the range is 85 to 90%. Fig. 4 shows that the prediction factor from Fig. 3. This decision (Table 5) is shown various series with respect to students' performance in academic and non academic factors. Here the students are decided their future and career in higher studies related to their specific domain category. The work is used for various students and stakeholders to apply their opinion in higher studies and career development. The accuracy range is obtained 85% to 90% in education science area.

6. Conclusion

Artificial Intelligence, machine learning and deep learning are machine perception and interpret sensor data. Algorithms can train supervised and unsupervised learning inputs. The labeled trained set can vary number of iteration and hidden factors. Deep learning algorithms can classify, cluster, predict the future and make effective decision. That is anything can predict and digitize. Classification and prediction techniques are applied by using traditional data mining techniques such as association rule, decision tree, clustering applied for training and testing. The TensorFlow is used for finding deep learning and artificial intelligence for solving prediction and nonlinear values. In these work number hidden layers, hidden nodes, iteration, accuracy rate, prediction factor are calculated and compared. The deep learning model developed with number of input and output factor using entropy. For this learning rate can be found and increased the rate from trained model. So, the prediction performance improved from low and high. This work explained and compared the deep learning of students' performance and the accuracy rage between 85% to 90% in educational science. It is good result for stakeholders can select the best path way for students in science related areas. In future we will same tool for various education and corporate purpose.

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