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A University Admission Prediction System using Machine Learning and Deep Neural Networks

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Abstract: Numerous students apply yearly for undergraduate admission at various colleges in Maharashtra. Each institution uses a separate set of selection criteria to choose applicants, such as CET scores, gender, category. It is crucial for candidates to fill out the application form accurately, as it varies based on their academic standing and results from the entrance exam. Web applications and consulting services are available for recommending the best university based on a student's portfolio. These provide information on the universities that should be considered for admission. Numerous universities provide a wide range of engineering courses. Students find it difficult to arrange and identify the appropriate colleges for the courses they want to take based on their performance score. In this paper, we suggested a deep neural network (DNN) to forecast a student's likelihood of admission to a university based on their portfolio. The suggested model takes into account a number of student-related aspects, such as their CET Score and category.

***Index Terms* -** Admission, Deep Neural Network, Machine Learning, University Admission Prediction

I. INTRODUCTION

The industry's level of rivalry has skyrocketed in recent years. The heightened rivalry has also resulted in problems like joblessness and a strong need for recently developed abilities. It becomes imperative for a student to gain admission and instruction from the most appropriate institution in such a cutthroat environment. This would assist the students in honing their abilities in accordance with industry standards and obtaining a suitable employment. Thus, a student's future is greatly influenced by his or her ability to gain admission to the best college. Even if it's now easier than ever to get into engineering programmes, there are still certain risk factors that students find difficult to understand. The common entrance test (CET) is the basis for admission to engineering colleges in Maharashtra and other states. Over 1.5 lakh seats are to be distributed among over 200 engineering colleges and over 35 different engineering branches for students from a variety of categories, including open, home university, outside home university, and reserved category (SC, ST, OBC, etc.). As a result, the issue gets more complicated, making it difficult for students to choose which universities they have the best chance of getting into.

For pattern identification and categorization, neural networks are the best technique [1]. The neural network weights can be used to model the characteristics of a student's profile. His prior performance acts as a training dataset. Additionally, the factors that students take into consideration while choosing a university can alter, such as shifting financial circumstances and shifting academic interests.

Thus, a university prediction method aids students in reducing their options and determining their odds of attending the university of their choice. Additionally, this encourages students to make their own selections rather than asking counselors for suggestions for universities, or at the very least, it keeps them better informed about their chances. It is possible to predict admission to a university by taking into account a student's data and historical admissions, then creating a prediction using this information. The naive solution to this is to train a model with fundamental machine learning algorithms. Deep learning techniques can be used to acquire a better level of precision. In this article, we provide a stacked ensemble classifier [2] that forecasts an applicant's odds of admission to a specific university.

II. LITERATURE REVIEW

Based on a student's academic achievements and history, S. Fong et al. [3] created a hybrid model of decision tree classifier and neural networks that forecasts the likelihood that a student will apply to a particular university. The proposed method was evaluated using real-time data from 2400 students at Macau Secondary School and took into account thirteen factors, including place of origin, major, position in class, grades, and more. The suggested method's results demonstrate that when predicting whether a student would be admitted to a given university or not, a hybrid classifier comprising decision trees and neural networks outperforms either a single feed forward neural network or decision tree.

A framework for forecasting a student's prospects of admission was put forth by P.K. Binu et al. [4]. The suggested framework consists of two modules: a Hadoop MapReduce module for data storage and an Artificial Neural Network for chance prediction. State, rank, board, quota, and other attributes were included in the data collection. Academic credentials have not been used by the system to make predictions. Two input nodes, a hidden layer with two nodes, and an output layer with two nodes make up the neural network.

Given their present profiles, Hasan et al. 's [5] recommender system can assist students in selecting the best graduate programme. It is created and optimized into a global database, giving each attribute weights such as GRE, TOEFL, IELTS, CGPA, etc. The suggested system calculates the top 'k' similar institutions using k nearest neighbors, and then proposes the top 'N' universities to the user.

III. PROPOSED METHODOLOGY

The graduate admission dataset has been divided into a training dataset and a testing dataset in order to finish the study. In order to hasten the DNN model's training, data cleaning and preprocessing has been done. The DNN model has been trained with the best hyperparameters using the training dataset. It has been evaluated using certain common benchmarkings. The results of the DNN model have also been contrasted with those of the current approaches. Figure 1 displays the steps using a flowchart.

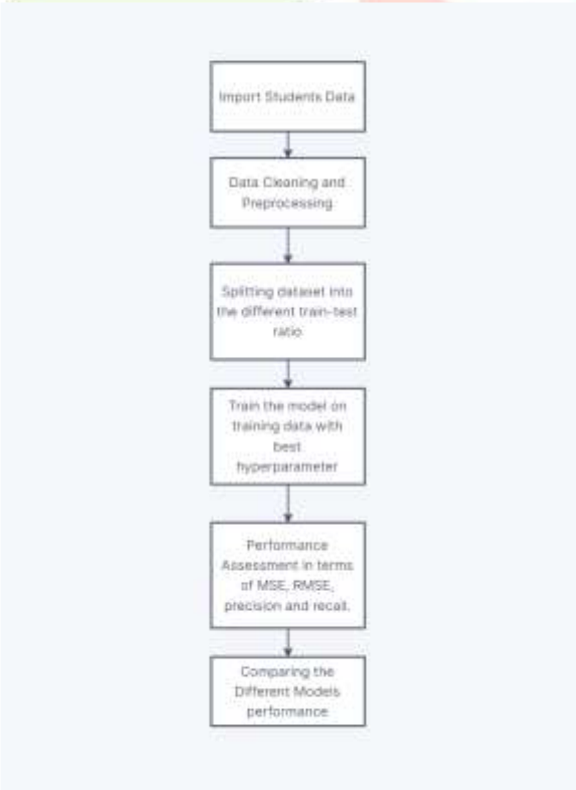


Fig. 3.1. Proposed methodology

A. Dataset

The dataset was posted by Kaustubh Bhiwsankar to kaggle[6] and is freely available there. There are 26,838 occurrences total, including 3 target variable and 6 characteristics. The dataset was needed to be preprocessed to be in a suitable format to train the model.

Before the dataset is fed into the models, it is cleaned and preprocessed. The first step is to normalize every numerical number, including the Percentile information. Additional attributes like College Name, Branch, Seat type, City, Family Income, are also normalized and transformed to a numerical format. This dataset cleaning is a crucial part of the university prediction process. There are 35848 normalized samples total in the cleaned dataset.

Table 3.1 Data Description

Attributes	Description
Number of Colleges	326
No of different Branch Types	95
No of different Seat Types	77
Percentile	Range: 100 Max: 99.843394 Min: 0.004739
No of Cities	123
Types of Gender	Boolean Value
Family income less then 8 LPA	Boolean Value
Types of Category	8

B. Deep Neural Network (DNN)

In the era of cutting-edge technologies, artificial intelligence (AI) is a hot topic. It will be heavily utilized by all automated systems. One subset of it is machine learning. The deep neural network enters here if we delve even more. Artificial neural networks (ANNs) like DNN are modeled after biological neurons. Each biological neuron is roughly connected to 10,000 other neurons, with the connection being made via the dendrite and synapse.

When a neuron is electrically activated, it receives signals through its dendrites and transmits them to the next neuron it is linked to through its synapse. The same characteristic applies to ANN. There are three different kinds of layers in it: input layer, concealed layer, and output layer. There are certain nodes in each stratum. Similar to a biological neuron, each node of a layer is connected to every node of a succeeding layer. A DNN is used when an ANN's hidden layer has multiple layers.

Each node has an activation function that is comparable to the way neurons are excited. Each node-to-node connection has a parameter called weight that is multiplied by the first node's output before being sent to the next node. For higher precision, it is necessary to optimize the weight of each connection. The mistake of the output layer is sent back to the input layer throughout the optimization process using the back-propagation method. Error is decreased by optimizing weights.

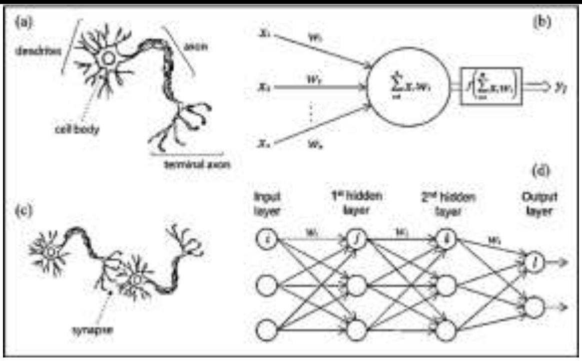


Fig. 2. (a) a single biological neuron; (b) an artificial neuron;(c) connection between biological neurons;(d) a deep neural network model [7].

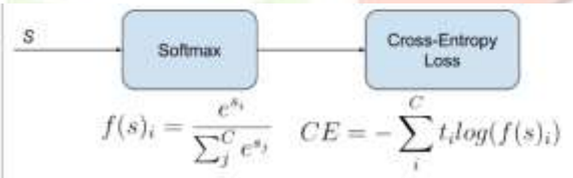
C. FeedForward Neural Network

The Perceptron is the most fundamental neural network component that is based on a single neuron. Several perceptrons (or neurons) are connected to one another in layers to form a multilayer perceptron (MLP) [8]. The input layer receives the input data, while the output layer receives the output data. The hidden layers are those layers that exist between the input layer and the output layer. According to convenience, both the total number of hidden layers and the number of neurons in each hidden layer can be changed. The degree of a model's intricacy and accuracy will vary depending on this. It is typical to use a trial-and-error approach to choose the best neural network architecture for a given issue.

D. Performance Metrics

There are some well-known benchmarks for evaluating regression tasks, such as Accuracy and Loss

$$\text{Accuracy} = \frac{(TP + TN)}{(TP + FP + TN + FN)} \quad (3.1)$$



$$f(s)_i = \frac{e^{s_i}}{\sum_j^C e^{s_j}} \qquad CE = -\sum_i^C t_i log(f(s)_i) \quad (3.2)$$

IV. IMPLEMENTATION

DNN must be trained using the hyperparameter tuned ideally to provide better results. The DNN model's best parameters, which were determined through numerous trials, are listed in table II. Since the graduate admission dataset's features were all used as input, the input layer had to have 2 nodes.

Table 4.1 Model Description

Input Layer	**Hidden Layer**	**Output Layer**	**Model**
2 nodes	**2** hidden layers, **64** nodes/layer, Activation Function: **Softmax**,	**2** node, Activation Function: **Softmax**,	Optimizer: **Adam,** Loss Function: **categorical_crossentropy**, Epoch: **25**

The DNN model used in this study comprises two hidden layers with a total of 64 nodes in each layer. Softmax activation has been utilized on each node. The output layer has 1 node because the DNN model must predict the likelihood of admission. As the activation function Softmax has been utilized.

V. RESULT AND DISCUSSION

The admission prediction dataset has been randomly divided into multiple ratios for experimentation purposes, including 8:2, 7:3, 6:4, and 5:5 for constructing training and testing dataset. Table III displays the evaluation results for the proposed model using various train-test ratios against various benchmarks.

Table 5.1 Results

Split Size (Train/Test)	Training Accuracy	Training Loss	Validation Accuracy	Validation Loss
80/20	0.8912	124.74	0.9035	129.05
70/30	0.8948	128.73	0.9006	129.16
60/40	0.8984	125.73	0.8983	124.45
50/50	0.9017	125.80	0.8966	124.50

VI. CONCLUSION

Machine learning and deep neural networks can be used to develop a university admission prediction system that can help students and universities in a number of ways. For students, the system can provide an estimate of their chances of admission to a particular university, which can help them make more informed decisions about their applications. For universities, the system can help them identify qualified applicants and reduce the workload on their admissions offices. Overall, machine learning and deep neural networks have the potential to revolutionize the university admissions process. By providing students with an estimate of their chances of admission and helping universities identify qualified applicants, these systems can make the process more efficient and equitable for everyone involved.

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