Forecasting Student Clothes Purchases Intention in Bangladesh: A Machine Learning Approach

Md Mijanur Rahman, Md. Zahid Hasan, Md Golam Morshed, Sanjida Karim, Mamunur Rashid Alex

***Abstract**: Online shopping provides an excellent opportunity and platform for today's traditional businesses. Because of the advancement of online purchasing systems, students often prefer online shopping. Thus, students' involvement in online purchasing has become an important trend. The research aims to determine university students' purchase intentions toward Bangladeshi clothing brands using several machine learning approaches. An online questionnaire survey was conducted with 1000 university students, and the study goal is to understand their attitudes to online shopping from a different perspective. This paper represents a comparative study of different machine-learning techniques that have been applied to the problem of customer purchasing intention. The experiments were conducted using supervised machine learning techniques like linear regression, logistic regression, and Support Vector Machine (SVM) was also used to predict university students' purchase intentions. This study found that students' age, quality of cloth, purchase discount, and price positively impacted student purchase intentions, but the buying risk negatively affected students' purchase intentions. Linear regression gives the highest accuracy with maximum features, and the accuracy is 89.2%.*

Keywords: Bangladeshi brands, linear regression, Logistic regression, Support vector machine (SVM), online shopping, purchase intention, Machine learning.

I. INTRODUCTION

Today's online shopping is becoming another channel or pattern for buying a product or service because the internet has provided consumers with a platform where they can shop smartly.

Md. Mijanur Rahman, Assistant Professor, Department of Computer Science and Engineering, Southeast University, Dhaka, Bangladesh. E-mail: mijanur.rahman@seu.edu.bd, ORCID ID: https://orcid.org/0000-0002-4142-9626

Md. Zahid Hasan, U.G Student, Department of Computer Science and Engineering, Southeast University, Dhaka, Bangladesh. E-mail: 2018100000012@seu.edu.bd, ORCID ID: https://orcid.org/0009-0008-1195-1772

Md Golam Morshed, U.G Student, Department of Computer Science and Engineering, Southeast University, Dhaka, Bangladesh. E-mail: 2018100000016@seu.edu.bd, ORCID ID: https://orcid.org/0009-0002-3998-8100

Sanjida Karim, U.G Student, Department of Computer Science and Engineering, Southeast University, Dhaka, Bangladesh. E-mail: 2018100000010@seu.edu.bd, ORCID ID: https://orcid.org/0009-0009-9697-8460

Mamunur Rashid Alex, U.G Student, Department of Computer Science and Engineering, Southeast University, Dhaka, Bangladesh. E-mail: 22016000000223@seu.edu.bd, ORCID ID: https://orcid.org/0009-0002-0865-3666

Consumer shopping methods have significantly changed in the last decade. Online shopping is more beneficial for customers than visiting the store. In this case, online shopping saves lots of time for them, thereby becoming more dependent on it. Sometimes, people purchase online and compare different places where they can get alternatives. The internet has become a highly used medium for businesses and service providers to communicate information and deliver customer products and services [1]. It might be exhausting to go from one physical store to the next. It is simple to switch from one brand to another using the internet. Online shopping saves technologically advanced people time since they are too engaged in their occupations [2]. The motivation for this research is the present huge number of consumers opting for online shopping, and the COVID-19 crisis has also caused many uninterested consumers toward e-commerce. This trend will continue even in the future. [3]. Bangladesh has acquired a lot of credibility in online shopping. Even though several investigations have concentrated on changing eras of most current clothes brands, and numerous studies have focused on local designer clothing brands. As a result, this will have a significant effect on online purchasing. Customers can easily access mark item quality, design, details, pricing, and facts to compare to another brand [4]. The current research examines how original branding clothing affects online marketing and university students. This article examines how local Bangladeshi brands influence university students' purchase intentions. To this effect, a review of simultaneous shopper brand quantity and specialists' most encouraging purchase periodicity in Bangladesh is required. Due to globalization, individuals may understand decisions on how and where to acquire their purchase. As a result of this discussion, they tend to be worried about obtaining and recurrence of purchased clothing by purchasers of different ages, occupations, and orientations and pay [5]. The quality of celebrity participation, buyers' attitudes about ads, and consumer shopping attitudes toward brands all influence customers' purchase intention [6]. Everything would be affected in the same way in this investigation [5], [6] but from the perspective of university students, where different Bangladeshi clothing brands exist, such as Aarong, Cats Eye, Ecstasy, Yellow, Dorjibari, Kay Kraft. However, other brands have been primarily chosen to knowthe impact of the purchase intention of Bangladeshi students. When someone purchases something with the brand name in mind, the buyer seems familiar with such a specific brand [7]. Various Machine learning (ML) techniques will be applied to predict the purchase intention based on brand quality, age, discount, buying risk, and price.

No research paper has been found on why Bangladeshi university students are addicted to local brands, which have been mentioned with reference above. Hence, the need to conduct more studies on university students' purchase intentions.

The primary incentive behind this research is to predict new scenarios, such as whether university students will purchase a local clothing brand if the quality of the item is excellent and the cost is within their budget. There are a few specified goals for this purpose, including the following:

(i). Predict new cases and purchase intention of university students

(ii). Provide valuable information for the future.

This study explores the effects of students' age, quality, discount, buying risk, and price of cloth on purchase intention. Firstly, the concepts are introduced, and theoretical background is provided. The second section describes the research methodology, including the sample, data collection, and measures. Lastly, the findings of the study are presented and discussed in addition to limitations [8].

II. PRELIMINARY LITERATURE REVIEW

Several research studies are based on predicting university students' purchase intention through online shopping.

According to T. Tabassum et al. [9], consumer attitudes have a big part in the parameters according to this study because their perception of online buying influences their decision. This study's most essential parameter is price. Even if they find shopping online convenient, urban youth in Bangladesh will consider the price before doing so. They addressed the city's young people using various investigations and other exploratory needs for accomplishing approaches.

According to Xhema et al. [10], there exists an inverse correlation between social media use and customer loyalty. Despite spending more time on social networks, customers do not exhibit loyalty towards any particular brand for future purchases or recommend the company's products to others. Furthermore, social media use is negatively linked to customer tolerance and positively correlates with customer experimentation. The findings suggest that customers tend to be more experimental in their purchase decisions as social media usage increases.

In the other study, Leonika Kouce Lomboan et al. [11], showed that there are three independent variables. Two independent variables in this research influence consumers' purchase intention. Various factors, including perceived quality, can influence consumer purchase intention. Among these factors, perceived price is the most significant determinant. Both perceived quality and perceived price have a significant impact on consumer purchase intention. However, the perceived value does not affect consumer purchase intention.

V. Mirabi et al. [12], the basic motive of their investigation is to identify the factors that impact purchase goals. This study examined the five components of brand name, product quality, value, bundling, and promotion as self-supporting factors that impact customers' purchase expectations. As a result, it impacts customers' purchase goals by increasing product quality. They've critically examined purchase goals on quality, pricing, packing, and brand using confirmatory factor analysis. Still, little was discussed on the importance of clients' trust in garment identification.

S.K. Suman et al. [13] study aims to determine the standard based on age, attitude regarding features, and simplicity while purchasing online products. This inquiry was divided among internet-based consumers in four wonderful residences in North India who obtained online damaged things. They talked about what age and direction people are generally drawn to when it comes to the influence of orientation on the components considered. Still, they didn't state how significant consumers are to online shopping by and large.

The findings of D. Sawafta et al. [14] revealed that viral advertising influenced client purchase intent, as indicated under the main point of brand image. Still, that age had no bearing on the association. The review's concerns focused on the impact of viral advertising on the mobile phone purchase target in Northern Cyprus. Their research claims that age has no relevance to the brand in online buying by employing multiple linear regressions. Nonetheless, they do not investigate what brand image signifies to understudies.

According to T. Sabri ERDİL et al. [15], price image significantly affects store image perception both price image and brand image can positively influence the purchase intention of consumers. Conversely, perceived risk has a negative impact on purchase intention. The analysis results indicate that store image acts as a mediator in the relationship between price image, perceived risk, and purchase intention.

M. Mehtaj et al. [16], This research attempts to identify the factors that influence customers' decisions to buy local clothing brands. A self-administered survey was used to collect data. About 350 people managed the review from three different geographical fields (Dhaka, Chittagong, and Sylhet). This study highlighted an understanding of customers' purchasing intentions for local clothing brands. This research will help fashion businesses and organizations proceed and manage their products in our country. In comparison to the sample, the result isn't huge. However, if the sampling size is large, the results will be more appreciated. In the other study, by Dr.K.Maheswari et al. [17], Several customers tend to make a purchase on a specific shopping website once every three months. Recommendations from friends, advertisements, and discount offer influence some customers' decisions to buy products. Based on the observations, the age group of 15 to 24 years recorded a higher percentage of purchases between 2007 and 2014 than other age groups.From the experimental results, more than seven young customers have been attracted to online products in recent years. I. B. Islam et al. [18], this study observed an understanding of the elements that impact young consumers' purchase objectives toward sustainable clothing. With the addition of one replacement for conventional elements, the TPB model was applied to consumers' purchasing goals in Bangladesh. According to the study, apparent social control and moral commitment impact active Bangladeshi shoppers' purchase expectations toward sustainable clothing.

They only received 60 responses, Which is very less. Getting more responses would have resulted in better results. To overcome the above limitations, there would be a need to conduct comprehensive studies with students from various universities in Bangladesh. Students provide data samples based on age, brand product quality, and price. The next part will employ multiple linear regression techniques to predict purchase intention among Bangladeshi university students.

III. METHODOLOGY

This research aims to develop a framework that utilizes the most effective machine learning algorithms to predict shoppers' intentions. Data collection and analysis have been performed to predict the purchasing behavior of university students. The research methodology of this study is illustrated in Figure 1.
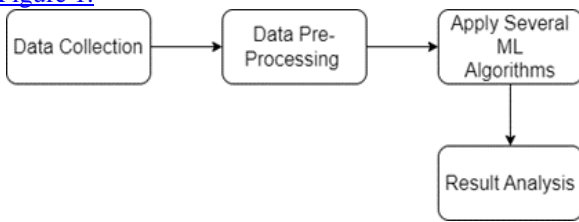

Figure 1: Methodology of Proposed Work

Data Collection: The data for this investigation was collected using a questionnaire method. Data was assembled through the web using Google forms. The link of the survey was shared on different social media to collect their data. They participate through Email, Facebook, Messenger, and other social media networks. The collected data was analyzed using python. The survey questionnaire contains ten questions. The questions were categorized into three parts. The first section contains short questions and answers, the second section contains the nominal scale, which is, Yes or No, and the third section shows a multiple-choice answer.

Data Preprocessing: Preprocessing is a step in Machine learning to remove null values, transform, clean and reduce the data to fit the model better. This paper used the Python pandas library to clean unnecessary data and transform it into standard scaling. After identifying the missing attributes in our dataset, it was replaced with values derived from the existing ones.

Apply Several Machine Learning Algorithms: Three machine learning algorithms can be utilized for both classification and regression tasks. In this study, the problem is related to classification, specifically the revenue generated. To address this issue, several classification techniques related to machine learning will be employed, including

Linear Regression Analysis: Linear regression is a fundamental and widely used statistical technique in predictive analysis. It aims to create a model that can capture the relationship between a dependent variable and one or more independent variables. This is achieved by fitting a linear equation to the observed data. The resulting regression estimates can be used to describe the data and explain the association between variables. The linear regression is expressed as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 \ldots + b_PX_P + \varepsilon i,$$

Where Y represents the dependent variable of purchase intention, b_0 represents the regression constant, b_1, b_2, b_3, b_4 ..., and b_P are the regression coefficients, and X_1, X_2, X_3, ..., X_P stand for the independent variables of the attitude of students' age, the quality of clothes, buying risk, Products discounts respectively. εi represents the error or residual term.

Logistic Regression Analysis: Logistic regression is a statistical approach that seeks to model the connection between one or more independent variables and a dependent variable. This method aims to forecast the probability of a particular outcome based on the independent variables' values. The outcome is represented by a binary variable, meaning that it has only two possible outcomes. The outcome is determined using a binary system, which only allows for two possible outcomes. This method is used to forecast a binary result, such as True or False, 1 or 0, or Yes or No, based on a series of input variables. These equations serve as the illustration of the logistic regression model:

$$x = c_o + \sum_{i=1}^{n} c_i x_i$$

$$P(x) = \frac{e^x}{1 + e^x}$$

Support Vector Machine: The Support Vector Machine classifier represents the separation of data points through a hyper-plane with a significant amount of margin [19]. A hyperplane is an $(n - 1)$ level subspace that does not pass through the origin. Hyperplanes are difficult to draw in higher dimensions, so the $(n - 1)$ dimensional level subspace is still used. An SVM classifier can be easily constructed if a discrete hyperplane exists. The task of support vector machines (SVM) is designed to identify the most suitable hyperplane for accurately classifying new data points. A hyperplane in p-dimensions can be expressed as follows:

$$\beta_0 + \beta_1X_1 + \beta_2X_2 + \cdots + \beta_pX_p = 0$$

where the variables X_1, X_2, ..., X_p are sample data points in a p-dimensional space, while β_0, β_1, β_2, ..., β_p are assumed values.

IV. RESULT AND DISCUSSION

The results of the study showed that the branding of clothes significantly impacts the purchase intention of university students in Bangladesh. The findings revealed that the significant predictors of student age, quality of cloth, price, and discount are affected by students' purchase intentions. And buying risk discourages students from shopping online. The study suggests that branding plays a crucial role in shaping students' purchase intentions towards Bangladeshi branded clothes. We used three algorithms in this study. Linear regression, logistic regression, and support vector machine algorithm were used to calculate Forecasting Student Clothes Purchases Intention. From our literature review, we found that these three algorithms were mostly used for predicting cloth purchase behavior.

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To have an effective comparison, each classifier was evaluated with the following measurements: accuracy, precision, recall, F1 score, ROC area, and time to implement the model. The calculated performance measures are illustrated in figure 9.
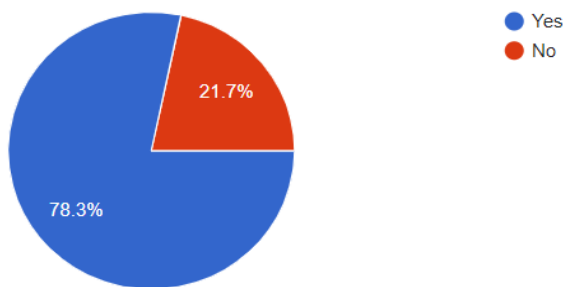

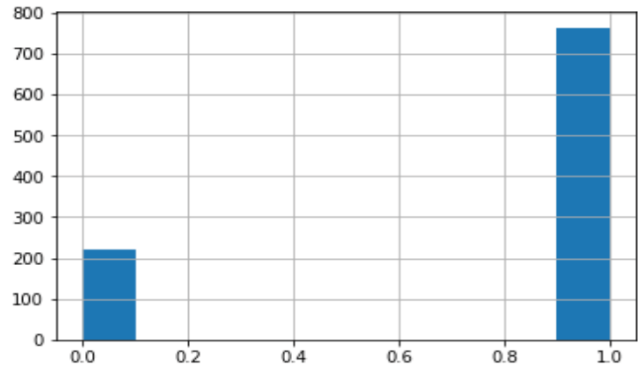**Figure 2: Histogram of online Shopping**
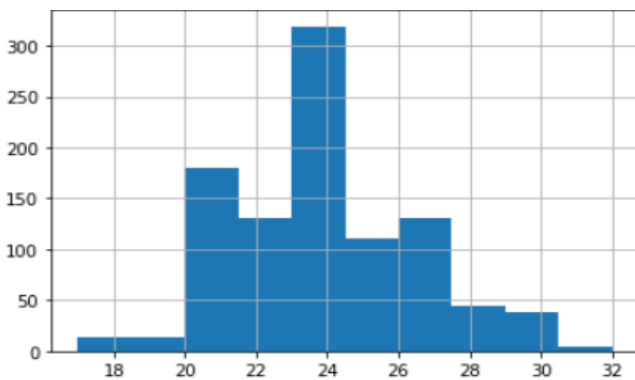
Figure 3: Histogram of Students' age

Figure 2 reveals that 78.3% of the students shop online, and the remaining 21.7% do not shop online. Figure 3 illustrates the histogram of attributes, which reveals students' age. This graph represents the number of students whose age range falls between 18-32, and those who fall under the age of 24 show that they are most interested in buying the brand's products.
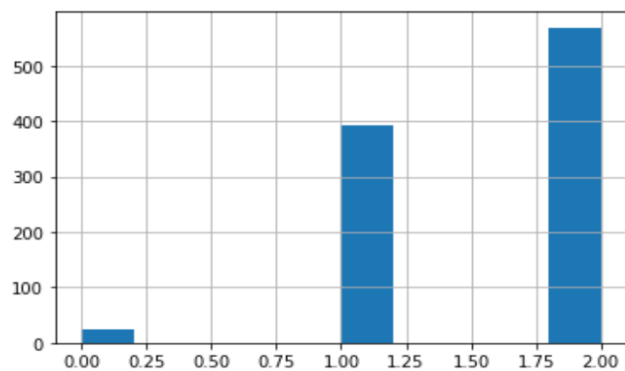

Figure 4: Histogram of brand product quality

As per Figure 4, the other attributes express the brand product quality. This chart represents how students want the quality of the brand's product. Here, 0 stands for a low-quality product, 1 stands for a medium-quality product, and 2 stands for a high-quality product. The highest number of students want to buy high-quality products.

Figure 5: Histogram of risk in buying products.

A Histogram of another attribute is depicted in Figure 5, which is risk in buying products. This histogram reveals the risk of buying brand products. Here, 780 people think online shopping is risky. On the other hand, 220 people do not consider the risk of online shopping. In this graph, 0 stands for Yes, and 1 stand for No.
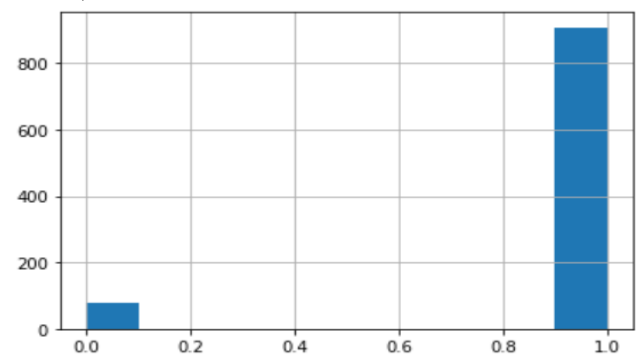
Figure 6: Histogram of discounts on online shopping.

As per Figure 6, the histogram expresses discounts on online shopping. In this figure, 92.2% of people expect discounts from online shopping. On the other hand, 7.8% of people want to avoid discounts from online shopping.

A comparison study is illustrated in Figure 9 for University Students' Purchase Intention prediction. Three different accuracy measures were determined using three different algorithms. The highest accuracy was obtained by the linear regression, which was 87%, the accuracy of the logistic regression was 82%, and the lowest accuracy was obtained by the SVM, which was 63%.

precision	recall	F1-score	support
0.82	1.00	0.90	112

Figure 7: Performance metric- logistic regression

In this study, we used a confusion matrix to find the performance of machine learning algorithms. Confusion matrix of Logistic regression:

```
[[14, 12],
[39, 73]]
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precision	recall	F1-score	support
0.86	0.65	0.74	112

Figure 8: Performance metric-SVM

Confusion matrix of Support Vector Machine:

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[[2, 24],
[0, 112]]
```

This study examines three distinct classification algorithms. The ensuing sections present the evaluation and comparison of the algorithms' performance.

Classifier	Accuracy	Precision	Recall	F1-score	Support
Linear regression	89.2%				
Logistic regression	82%	0.82	1.00	0.90	112
SVM	86%	0.86	0.65	0.74	112

Figure 9: performance comparison of different classifiers.

ROC (receiver operating characteristics) refers to a curve that plots the true positive rate against the false positive rate [20]. This curve is used to gauge the accuracy of a prediction model in distinguishing between classes. The performances of all three classifiers are visually represented using a curve to select the most suitable model for generating predictions.
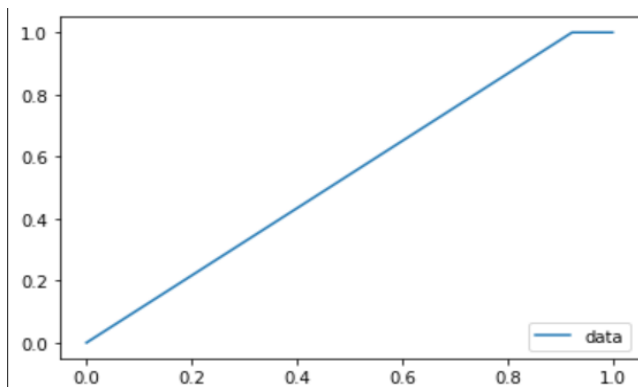
Figure 10: ROC curve for performance evaluation.

The linear regression analysis showed the highest accuracy in predicting the purchasing behavior of university students. The accuracy of linear regression was 89.2%, and RMSE was 0.387. Thus, it is the algorithm that will be chosen for further work.

V. CONCLUSION

Styles and designs in the clothing business are changing quickly worldwide. The study showed that the branding of clothes significantly impacts the purchase intention of university students in Bangladesh, and machine learning can effectively predict their purchasing behavior. The entire procedure of applying machine knowledge to develop a model to predict the online purchase intentions of students is discovered in this paper. We created models that make it easier to make predictions about online purchasing. The main objective of this study is to develop a framework capable of presenting insights gained from data analysis. Additionally, various machine learning classification techniques will be implemented and compared to determine the most effective method for developing a high-performing model. Three unique algorithms have been selected and implemented to facilitate comparison to achieve this objective.

Thus, by analyzing the performance metrics of all the classifiers, it has been concluded that the best-performing algorithm is linear regression. The best-performing algorithm has an accuracy of around 89.2% and RMSE of around 0.387. So, linear regression is an efficient algorithm for predicting whether a customer will make a purchase or not. The results of the study provide valuable insights for fashion companies in Bangladesh to better understand the purchasing behavior

of university students and to design effective marketing strategies.

LIMITATION AND FUTURE WORK

According to the census report, 27% of Bangladesh's population is young, most of whom are university students. The majority of them are used to shop from online. Therefore, more research is needed on this topic. In this paper, we only conducted a survey by collecting data from university students, while data will be collected from rural areas and urban areas in our next study. Further study is required based on socioeconomic class, geographical location, cultural diversity, and a mix of urban and rural individuals to cover a bigger consumer market. Since various sectors of consumers have different judgments about specific features due to low data sets, our model may need to be updated if we want to work with massive data from surveys. If more students were included as responders, the results could be different. Thus, different methods may be used in the future to tackle bigger consumer markets and reduce the impact of unbalanced data for much better performance.

DECLARATION

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Availability of Data and Material/ Data Access Statement	Data collection using survey of individual student.
Authors Contributions	All authors have equal participation in this article.

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AUTHORS PROFILE

Md Mijanur Rahman is an Assistant Professor Dept. of Computer Science and Engineering, Director of the Center for artificial intelligence and Robotics at Southeast University, Dhaka 1213, Bangladesh. He received his Bachelor's in Computer Science and Engineering at East West University. He completed his Masters's degree in Computer Science and Engineering at East West University. In areas of publication blockchains, machine learning artificial intelligence, recommender systems, collaborative filtering, computer-aided instruction, computer science education, data mining, data privacy, database management systems, deep learning (artificial intelligence), diseases, educational administrative data processing, human resource management, medical computing, microorganisms, organizational aspects, pattern clustering, personnel, recurrent neural nets.

Md. Zahid Hasan received his Bachelor's in Computer Science and Engineering at Southeast University in 2023. He also completed a Bachelor of Theology and Islamic Studies at Islamic Arabic University in 2020. Her research interests are Artificial Intelligence, Deep Learning, Machine Learning, Computer Vision, and Big Data Analytics.

Md Golam Morshed received his Bachelor's in Computer Science and Engineering at Southeast University in 2023. Her research interests are Artificial Intelligence, Machine Learning, and Computer Vision.

Sanjida Karim received the Bachelor's Degree in Computer Science and Engineering at Southeast University in 2023. Her areas of interests are artificial intelligence, database systems, networking, and machine learning.

Mamunur Rashid Alex currently doing Master of Science in Computer Science and Engineering, North South University, Bangladesh. He completed his Bachelor Degree in Computer Science and Engineering, Southeast University, Bangladesh in the year 2020. His area of research interests are Machine Learning and Artificial Intelligence.