Reducing the effect of Natural Disaster in Bangladesh using Machine Learning Algorithm and Data Analysis

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As our country, Bangladesh, is extremely vulnerable to natural disasters, we hope to minimize the overall destruction and also number of people killed or injured by analysing data from past years. This paper will help us to have a better knowledge of the environment and how to react to it. All the study will assist us in preparing for any disaster. For this paper, we will use Systematic Literature Review technique and analyse numerous types of data that is based on the literatures that got studied. After doing this research, we will have all the essential knowledge on any type of disaster, as well as enough time to prepare for it in the future.

Index Terms: predictive model, machine learning algorithm, disaster, system, method

ACM Reference Format:
MD.NAIMUL HOSSAIN, NUR-A-MARZAN DIPRO, and S. M. NAHID. 2021. Reducing the effect of Natural Disaster in Bangladesh using Machine Learning Algorithm and Data Analysis. 1, 1 (December 2021), 7 pages. https://doi.org/10.1145/nnnnnnn.nnnnnnn

1 INTRODUCTION

Location wise, Bangladesh is placed in the northeast of Southeastern Asia. Now, this certain location almost every year counteracts a tropical monsoon climate with a lot of seasonal outrageous rainfall, towering heated temperature and excessive humid conditions. Not only with the geo-morphological reason, its demographic and socioeconomic nature, Bangladesh often experiences severe exposure. So natural disasters are one of the major problems for Bangladesh, and we are suffering various kinds of disasters throughout the year. According to Bangladesh's latest Natural Disaster Report, there were 31,444 floods between 1787 and 2000, of which 68 percent and 52 percent of Bangladesh's land were submerged in 1998 and 1988 [1]. To follow the latest research results in areas of Reducing the effect of Natural Disaster in Bangladesh using Machine Learning Algorithm and Data Analysis, we use extensive literature learning that summarize and structuring sum of knowledge. Here, we are utilizing the previously mentioned dimensions that too were relevant for predictive modeling in the section of disaster management, to reduce the devastation that got observed in the aftermath of a natural calamity by predicting it at an earlier predicament. This will help us to calculate the impact of the forecast class on the natural disaster and give the answer of the next possible outcome of the disaster[1].

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2 RESEARCH METHODOLOGY

An extensive literature review was utilized as the research methodology for our paper. For the purpose of this research, we utilized the thorough and comprehensive readings on various strategies, including the natural disaster that occurred or might occur, the hazards and the vulnerability of our continental location, disaster risks to be reduces on the basis of Bangladesh's perspective[3]. Sources like World Wide Web's library database, table of contents of various journals, online journals and research papers, e-books were used. The literature review was constructed and presented with different categories of natural hazards and risk reduction strategies that may occur in a scenario, developing in a dire situation of a natural disaster occurrence[2].

2.1 Research Objective

We did our research based on a study, that has been a hallmark for the evidence based software engineering (EBSE)[10]. We utilized the systematic literature review (SLR) system as our methodology. The main goal of our research is to find relevant data in order to utilize our previously mentioned dimension of predictive modelling. In order to manage the relevant data, we are utilizing the SLR method, that is composed of the reviewing section of topic, the article selection process, the attribute framework and finally the article assessment. What these processes will help to achieve is that the summary of the composed data will make the whole research progress on a check-list format and one by one from the basic term selection process to utilization and proposed finishing method will be gained[8]. Basically, the article selection was done under proper scrutiny and care with the steps like searching a broad area in order to find relevant data and that data was under a process of elimination where the abstracts were refined, then the reference were checked and whether that reference has previous mention or active on other people's work were also seen and re-verified. And in the attribute framework part, the process identification, generalization and attribute assignment were done, finalized with the characterization and answering research questions and discussion of the entire open areas. And at the end, the assessment were done, thus concluding the entire SLR process in order to successfully complete the steps of progress for this article.

2.2 Research Questions

Bangladesh is frequently mentioned in the world testaments as one of the most vulnerable countries geographically. That's why, Bangladesh is exposed to various types of natural disasters, like Tsunami, Cyclone, Over-Flooding, these are very common occurrences. So, the main purpose of this study is to find an approximation via using the data set, which will be relevant by the socio-economic structure and the impact of the outcome in our country's perspective, distinguishing the possible predictions by calculation done in an artificially intelligent machine[4].

The prediction determined by the machine learning algorithm, is solely based on the collected data set, vastly relying on the aftermath regarding the ability to utilize the prediction on the contrary to our illiterate citizens.

(1) What are the main backdrops in order to collect the dataset from Bangladesh Meteorological Department ?
(2) How can we use classification, clustering, forecast, time series models to analyse our data set?
(3) What necessary steps to take before various kinds of catastrophe hits?
(4) How can we implement this solution in Bangladesh?
(5) Identify the risk and key areas for the highest possibility of occurring disaster.

2.3 Article Selection

Here, we are selecting the relevant paper that is related to Natural Disasters in Bangladesh[6]. From those papers, we collected information about the article type, year of publication, what type of field and reason behind a topic, algorithm model, algorithm bug. We also collect details about data source, method tools implemented by the relevant paper to Natural Disaster and finally the outcome or the validation process that is found by these papers.

2.3.1 ***Keywords and Search String:*** For the keywords, as the topic is about the natural disaster in Bangladesh so the base keyword that is used is ' natural disaster' and with addition there is Machine Learning Algorithm that is implemented inside the papers to calculate the impact of the forecast and give the answer of the next possible outcome of the disaster[8].

2.3.2 ***Digital Libraries to Search:*** In this section, keywords are used to search in the libraries. The third author of this article was responsible for the search process. Various digital libraries were searched : Google Scholar; Science Direct; Springer Link, Floss hub; library genesis; are the most popular open sources for research papers. Search varies from libraries to libraries; but we only select the relevant topic that worked on the natural disaster using machine learning[10].

2.3.3 ***keyword search and Manual Selection:*** We carried out the keyword search to get the original set of articles, but present libraries did not give us a great quantity of information about our topic. The duration of this search was from January 2005 to June 2021. From this we pointed out 151 articles and from those sets of paper we carried out manual selection(second and third author). We have also done reference checking for any missing article. Using the help of keywords and by going through the paper's title, abstract, we select necessary papers to conduct this study.

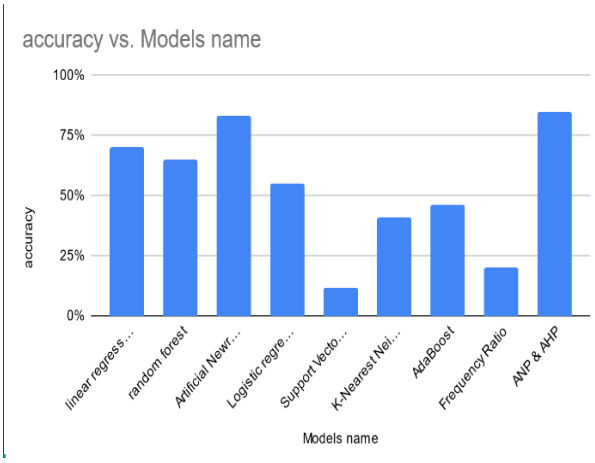
2.3.4 ***Final set of Articles:*** After the keyword search and manual selection as a result, 95 papers were selected (24 journals, 71 conferences). For this study requirement, we only pick 9 papers.

3 DISCUSSION

This report includes a systematic literature review approach on the natural disaster prevention sector. In order to suffice the needs to carry out this study, we created a suitable analogy that prevents us stockpiling on the proper guidelines that are inclusive of the conditions necessary[1][10]. An article set of 45 in number (11 conference articles and 34 journals) were included to conduct the review part of the research. The part where the attribute framework was done, participated in the sufficient specificity to randomly reclassify the chosen articles in answering the research based queries that were involved in the research proposal as an agreement to the finding of the research.

3.1 RQ1

What are the main backdrops in order to collect the dataset from Bangladesh Meteorological Department? After studying all the relevant articles, a significant number of paper and journals mentioned their difficulties of not finding the appropriate research data from Bangladesh Meteorological Department (BMD). An in depth analysis points to the vague number of data that was available in order to conduct through research on Bangladesh's environment



3.2 RQ2

How can we use classification, clustering, forecast, time series models to analyze our data set? In this section, from our researched data, we measured the accuracy of the models represented. Here the test results indicate which models were more accurate at predicting the forecast more than the other methodology that are included in this section. Plenty of papers and journal publishers utilized multiple types of variable models and found out their prediction algorithms success rate. We calculated the overall success found in the articles and journals that utilized various models, and developed an accuracy based predictive modeling that has been done to make it easier to find a suitable modeling.

3.3 RQ3

What necessary steps to take before various kinds of catastrophe hits? After analyzing the journals and articles selected for our topic, we found various ways of resolving the meta system to prevent a massive catastrophe. The dimension includes undertaking various projects and also maintaining a good nature friendly mentality, avoiding hostility and the carbon emission rate redundancy. Construction of a particular economic zone to subdue the pollution and creating a bio bubble to mitigate the out spreading immiscible solvents might also help reduce the catastrophic catalyst, that being said, we must ensure the derailing of overly using CO2 based products and the industrial facilities should also become aware of the dire consequences. Massive projects like rehabilitation centers and also buildings for the affected program should be initiated as a result of the catastrophe that might hit.

3.4 RQ4

How can we implement this solution in Bangladesh? Avail opportunities to NGO and UNO, also the local area organizations should come forward to help the people know about the consequences of the devastation that comes with the disasters. The journals and the articles that we covered, in order to research, all point to the direction that knowledge about the problem might help reduce the effect of natural disaster that could take place at any time.

3.5 RQ5

Identify the risk and key areas for the highest possibility of occurring disaster. The journals and articles were conclusive of all types of risk identifying measures and the possibility that may come with the occurrence.To understand the measures,

we thoroughly studied the outcomes, and in conclusion, we found out the argent preparedness and governmental donation to open ended projects might give the risk reduction parameters a boost, also providing a safety net in the upcoming disastrous co-incident,

4 FUTURE RESEARCH DIRECTIONS

The final stage of the examination is about the paper that we review[10]. After going through all papers we point out the crack, mismatch results and search for the most effective and minimum research proposal in all respects.

4.1 Topic 1

Open long term implementation. So not just implements for short term, try to implement algorithm for long term usability that will provide us to make prediction with numerous amount of data.

4.2 Topic 2

To reduce the effect of financial losses that occur owing to a natural disaster, implement a predictive analysis on previously occurred financial losses. The concluding effect will create preparedness among the victims and lessen the damage that comes with it.

4.3 Topic 3

Implement a wide range of areas. With the help of new technology, engineering and physical measures constructed outside the economic area.

5 VALIDITY THREAT

As no research done can be a full accurate one, ours has definitely some limitations and issues regarding the whole work done. The limited time was not in our favour, as much as thorough research our project required, we did as per our time schedule. Also, the free libraries were only insufficient in number, we needed money to access to the premium quality content (papers, journals, articles). Besides, our report is a non-funded one, so we could not find any sources of finance that could help us. Also, the number of participants were smaller than we originally anticipated. To make it more reliable and more understandable and more accurate, research funding and more participant is required. Also, the amount of data that has been used, is not sufficient to predict for a larger environment or system. If more data could be collected, the parameters could suffice in order to find a greater solution to our problem that has been recurring.

6 CONCLUSION

The nation has confronted an expanding number of catastrophic events — a considerable lot of which are in all probability incited by anthropomorphic environmental change[9]. The complete number of people influenced by cataclysmic events has increased step by step. This study aims to put an in- depth exploration on climate and its natural disaster and also identify the facts to gather information for better development. As a development country if we are able to implement all possible solution it will make us one step ahead to take necessary steps before any kind of natural disaster occur. Identify the most probable disaster risks and key areas. Journals and articles were decisive about all kinds of risk detection measures and the potential associated with their occurrence. Sovereignty in projects may induce support risk mitigation parameters and provide a safety net against future catastrophic accidents.

REFERENCES

[1] Kishan Kumar Ganguly, Nadia Nahar and B M Mainul Hossain, A Machine Learning-Based Prediction and Analysis Flood Affected Households: A Case Study of Floods in Bangladesh, International Journal of Disaster Risk Reduction, https://doi.org/10.1016/j.ijdrr.2018.12.002

[2] Kulatunga, Udayangani, Wedawatta, Gayan, Amaratunga, Dilanthi, Parvez, A. and Biswas, R. (2012) Disaster risk reduction measures n Bangladesh. In: Global Challenges in Construction Industry: World Construction Symposium, 28 – 30 June 2012, Colombo, Sri Lanka.

[3] Afsana Haque,Sarwar Jahan Natural Disasters in Bangladesh: Impact Analysis through Input-Output Model,Journal of Bangladesh Institute of Planners Vol. 8, 2015

[4] Achut Manandhar, Alex Fischer, David J. Bradley, Mashfiqus Salehin,M. Sirajul Islam, Rob Hope and David A. Clifton,Machine Learning to Evaluate Impacts of Flood Protection in Bangladesh, 1983–2014

[5] R. Madhuri, S. Sistla and K. Srinivasa Raju :Application of machine learning algorithms for flood susceptibility assessment and risk management,Journal of Water and Climate Change 12.June 2021

[6] Mahfuzur Rahman,Chen Ningsheng, Md Monirul Islam, Ashraf Dewan, Javed Iqbal,Rana Muhammad Ali Washakh,· Tian Shufeng:Flood Susceptibility Assessment in Bangladesh Using Machine Learning and Multi-criteria Decision Analysis:Earth Systems and Environment 21 September 2019

[7] Manzhu Yu, Chaowei Yang and Yun Li :Big Data in Natural Disaster Management: A Review :5 May 2018

[8] Rashed Uz Zzaman, Sara Nowreen, Maruf Billah, Akm Saiful Islam :Flood hazard mapping of Sangu River basin in Bangladesh using multi-criteria analysis of hydro-geomorphological factors 25 February 2021

[9] Fahmida Khatun, Syed Yusuf Saadat, Climate Change in Bangladesh: A Sustainable Development Perspective, 2021, Dhaka.

[10] M.M. Mahbubul Syeed, Imed Hammouda, Tarja Syst¨a : Evolution of Open Source Software Projects: A Systematic Literature Review JOURNAL OF SOFTWARE, VOL. 8, NO. 11, NOVEMBER 2013

A CONTRIBUTION RECORD

A.1 Paper Assessment

Student id & name	Paper No frm Ref	Paper Title
Md. Naimul Hossain	[4][5][6]	[4]Machine Learning to Evaluate Impacts of Flood Protection in Bangladesh, 1983–2014 [5]Application of machine learning algorithms for flood susceptibility assessment and risk management [6]Flood Susceptibility Assessment in Bangladesh Using Machine Learning and Multi-criteria Decision Analysis.
Nur-A-Marzan Dipro	[7][8][9]	[7]Big Data in Natural Disaster Management: A Review. [8]Flood hazard mapping of Sangu River basin in Bangladesh using multi-criteria analysis of hydro-geomorphological factors. [9]Climate Change in Bangladesh: A Sustainable Development Perspective.
S. M. Nahid	[1][2][3]	[1]A Machine Learning-Based Prediction and Analysis of Flood Affected Households: A Case Study of Floods in Bangladesh. [2]Disaster risk reduction measures in Bangladesh. [3]Natural Disasters in Bangladesh: Impact Analysis through Input-Output Model.

Table 1. Paper collected and read by the group member

A.2 Paper writing contribution

Student id & name	Section No	Section Title
Md. Naimul Hossain	2.3.2, 2.2, 3.3 , 3.4 , 4, 2.3.4	Digital Libraries to Search Research Questions RQ3,RQ4 FUTURE RESEARCH DIRECTIONS Final set of Articles
Nur-A-Marzan Dipro	2, 2.1, 3 , 3.1 , 3.2, 3.5, 5	Abstract RESEARCH METHODOLOGY Research Objective DISCUSSION RQ1,RQ2,RQ5 VALIDITY THREAT
S. M. Nahid	1 , 2.3 , 2.3.1, 2.3.3 , 2.3.4 , 6	INTRODUCTION Article Selection Keywords and Search String keyword search and Manual Selection Final set of Articles CONCLUSION

Table 2. Section(s) Written in the paper by the group member