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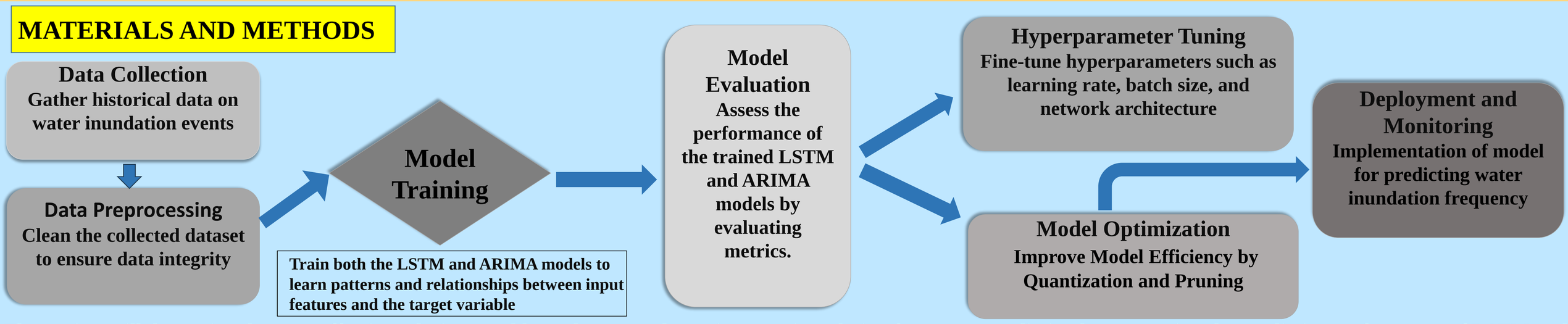
Comparative analysis of Auto Regressive Integrated Moving Average Algorithm and Long Short-Term Memory Algorithm in Prediction of Water Inundation Frequency with improved accuracy.

INTRODUCTION

- Water inundation is the flooding or overflow of an area with water, often due to excessive rainfall or overflowing bodies of water.
- The project aims to enhance flood prediction accuracy by improving forecasts of water inundation frequency through the utilization of deep learning techniques such as Long Short-Term Memory (LSTM) and Auto Regressive Integrated Moving Average (ARIMA).
- The significance of this project lies in its effort to enhance the accuracy of water inundation frequency prediction by comparing ARIMA and LSTM models.
- Potential applications include disaster management, urban planning, and infrastructure resilience.
- LSTM models excel in capturing long-term dependencies and temporal dynamics crucial for accurate flood prediction, while ARIMA models leverage time-series data analysis methods.
- The dataset utilized for this project is related to the 2018 Kerala floods and includes self-explanatory column names along with statistics on rainfall, warnings, casualties, and warnings broken down by district.

Water Inundation prone area

MATERIALS AND METHODS

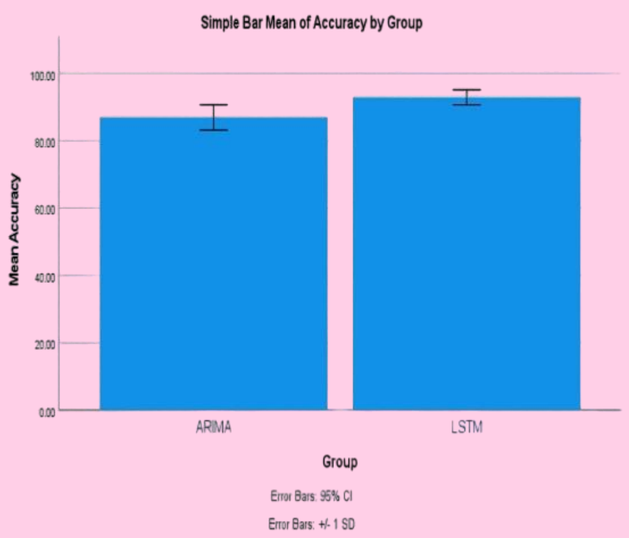


The project will determine the most effective solution to address the research gap in water inundation frequency prediction by comparing the predictive performance of LSTM and ARIMA architectures. Variables like computing efficiency, robustness, and the accuracy of the forecast for the frequency of water inundations will all be considered in this comparison.

RESULTS

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Accuracy	Equal variances assumed	2.01	0.164	6.380	38	0.000	5.45650	0.8552	3.7250	7.18793
	Equal variances not assumed			6.380	34.5	0.000	5.45650	0.8552	3.7193	7.19368

The Equal variances assumed and the Equal variances not assumed are provided for the independent sample t-test for equality of means.



Mean accuracy comparison between LSTM algorithm and ARIMA algorithm.

- A paired sample t-test was performed in SPSS to compare the 20 accuracies that were collected for each algorithm. For both LSTM and ARIMA, the mean accuracy and standard deviation were computed.
- A statistically significant difference in the mean accuracies of the two algorithms in predicting the frequency of water inundations is indicated by the computed significance value of 0.164.
- This implies that one approach performs noticeably better than the other, highlighting the need to select the algorithm with more accuracy for real-world application or future advancements in water inundation frequency analysis.

DISCUSSION AND CONCLUSION

- The outcomes of the study showed that the LSTM model outperformed the ARIMA model, which had a mean accuracy of 87.5530 and a standard deviation of 3.10432. The LSTM model had a mean accuracy of 93.0095 and a standard deviation of 3.24460.
- Future flood prediction techniques could benefit from the project's findings, which point to bright possibilities. A more robust approach to managing natural disasters may be encouraged by these findings, which may broaden the use of such techniques to infrastructure risk assessment, disaster planning, and climate modeling.
- But even with all of its apparent advantages, problems still arise. Predictive model accuracy is still dependent on the availability and caliber of previous flood data, and deep learning models such as LSTM and ARIMA have computing needs that further impede their use.
- In conclusion, the ability of LSTM to extract long-term dependencies from time series data offers a major benefit for water inundation frequency predictions, especially when considering past hydrological trends and natural disasters.

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