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Role of Crowdsourced data for flood relief: A Case Study of Bihar, India

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ABSTRACT

Floods recurrently devastate Bihar, India, imposing immense challenges on relief efforts due to their widespread impact on lives, livelihoods, and infrastructure. In this context, the role of crowdsourced data emerges as a critical asset in augmenting flood relief operations. Through digital platforms and community engagement, crowdsourcing facilitates the real-time collection and dissemination of vital information essential for early warning systems, impact assessment, resource allocation, mapping, and community participation. Crowd sourced data serves as an invaluable component of early warning systems, enabling timely alerts to vulnerable communities by monitoring rising water levels, breaches in embankments, and other pertinent indicators reported by citizens. This proactive approach enhances preparedness and facilitates timely evacuation, thereby reducing the risk of casualties and mitigating property damage. Moreover, crowdsourced data aids in the assessment of flood impacts by providing ground-level insights into flooded areas, damaged infrastructure, and affected populations. This information enables relief agencies to prioritize response efforts, allocate resources efficiently, and target assistance to the most vulnerable communities. Furthermore, crowdsourced data contributes to the development of detailed flood maps and vulnerability assessments, guiding urban planning and infrastructure development initiatives aimed at enhancing resilience to future flood events. Crucially, the involvement of citizens in data collection and reporting fosters community engagement and empowerment. By providing a platform for citizens to contribute to relief efforts, crowdsourcing promotes solidarity, collaboration, and active participation in disaster response activities.

Keywords: Crowdsourced, Flood impacts, Transformative tool & Vulnerable communities.

INTRODUCTION

Floods are one of the most devastating natural disasters that cause significant damage to infrastructure and loss of life worldwide. The Indian state of Bihar is one of the most flood-prone regions in the country due to its location in the lower Ganges basin. The state is vulnerable to various types of floods such as riverine flooding, flash floods, and drainage congestion. Floods in Bihar have caused immense damage to crops, infrastructure, and loss of life over the years.

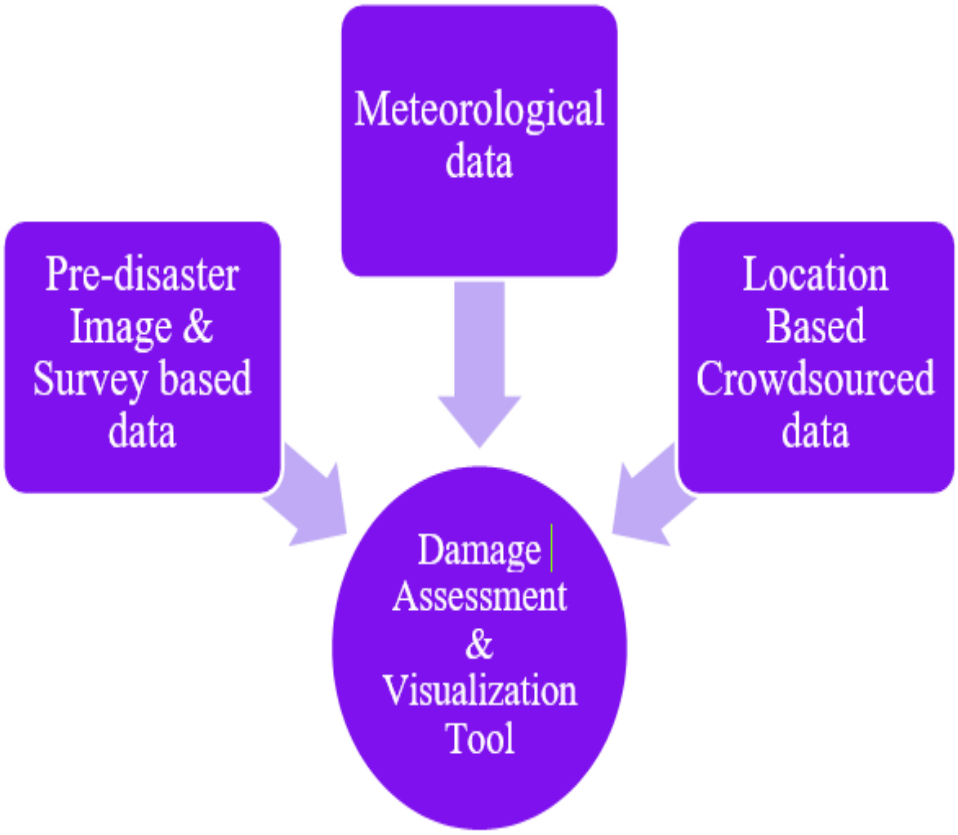
To manage the impact of floods, it is crucial to understand the factors contributing to floods and their impact on the population and infrastructure. Flood analysis and prediction are essential tools to minimize the damage caused by floods. With the advancement of technology and the emergence of crowd-sourced data, it is now possible to collect real-time data on floods from various sources, including social media.

This Ph.D. study aims to conduct an analytical study of floods in the context of Bihar using crowd-sourced data. The study will aim at analyzing the historical data on floods in Bihar, the trends and patterns of flood occurrences. It will also analyze the contribution of various factors such as rainfall, riverine flooding, and drainage congestion to floods. The study will also use crowd-sourced data to gain insights into the factors contributing to floods and their impact on the population and infrastructure.

The primary objective of the study is to develop a flood risk assessment model for Bihar using crowd-sourced data. The model will help identify the areas that are most vulnerable to flooding and the factors contributing to floods in those areas. The findings of the study will be used to assist flood management and mitigation strategies in Bihar.

The study's significance lies in its potential to provide valuable insights into the factors contributing to floods in Bihar and their impact on the population and infrastructure. The findings of the study can be used to develop effective flood management and mitigation strategies in Bihar and other flood-prone regions in India.

Functional Overview of the Proposed System



Objective

The primary objective of the Ph.D. study is to develop a flood risk assessment model for Bihar using crowd-sourced data. The model aims to identify the areas that are most vulnerable to flooding and the factors contributing to floods in those areas. The objectives are:

- To analyze the historical data on floods in Bihar and identify the trends and patterns in flood occurrences.
- To determine the contribution of various factors such as rainfall, riverine flooding, and drainage congestion to floods in Bihar.
- To gather crowd-sourced data on floods in Bihar and use it to gain insights into the factors contributing to floods and their impact on the population and infrastructure.
- To develop a flood risk assessment model for Bihar that integrates historical data, remote sensing data, and crowd-sourced data.
- To validate the flood risk assessment model using data on past floods in Bihar.
- To provide recommendations for flood management and mitigation strategies in Bihar based on the findings of the study.

HYPOTHESIS

Bihar is a one of the flood-affected states in India. Floods in Bihar are a recurrent problem and cause significant damage to life and property. However, traditional flood management techniques have been ineffective in dealing with this problem.

Crowd-sourced data, which is collected from various sources such as social media, news reports, and citizen reports, can provide real-time and accurate information about the extent and severity of floods. By analyzing this data, we can gain valuable insights into the causes and effects of floods and develop effective flood management strategies.

The hypothesis suggests that by using crowd-sourced data, we can identify the areas that are most vulnerable to floods and the factors that contribute to flooding. For example, by analyzing social media posts, we can identify the areas that are most affected by floods and the specific problems faced by the people living in those areas. Similarly, by analyzing citizen reports, we can identify the areas that require immediate attention and the type of support that is needed.

The hypothesis further suggests that the use of crowd-sourced data can lead to the development of more effective flood management strategies. By analyzing the data, we can identify the areas that require the most attention and allocate resources accordingly. We can also use the data to develop early warning systems that can alert people in advance of an impending flood and enable them to take necessary precautions.

METHODOLOGY

It involves a combination of quantitative and qualitative research methods. The stages of study are:

Literature review: The **first stage** of the study will involve an extensive review of the existing literature on floods in Bihar, flood risk assessment, and crowd-sourced data. The review will help identify the research gaps and guide the development of the research questions.

Data collection: In the **second stage** the study will rely on three primary sources of data: historical data on floods in Bihar, remote sensing data, and crowd-sourced data. Historical data on floods in Bihar will be obtained from the Bihar State Disaster Management Authority while remote sensing data will be obtained from satellite imagery. Crowd-sourced data will be collected from various social media platforms and other online sources.

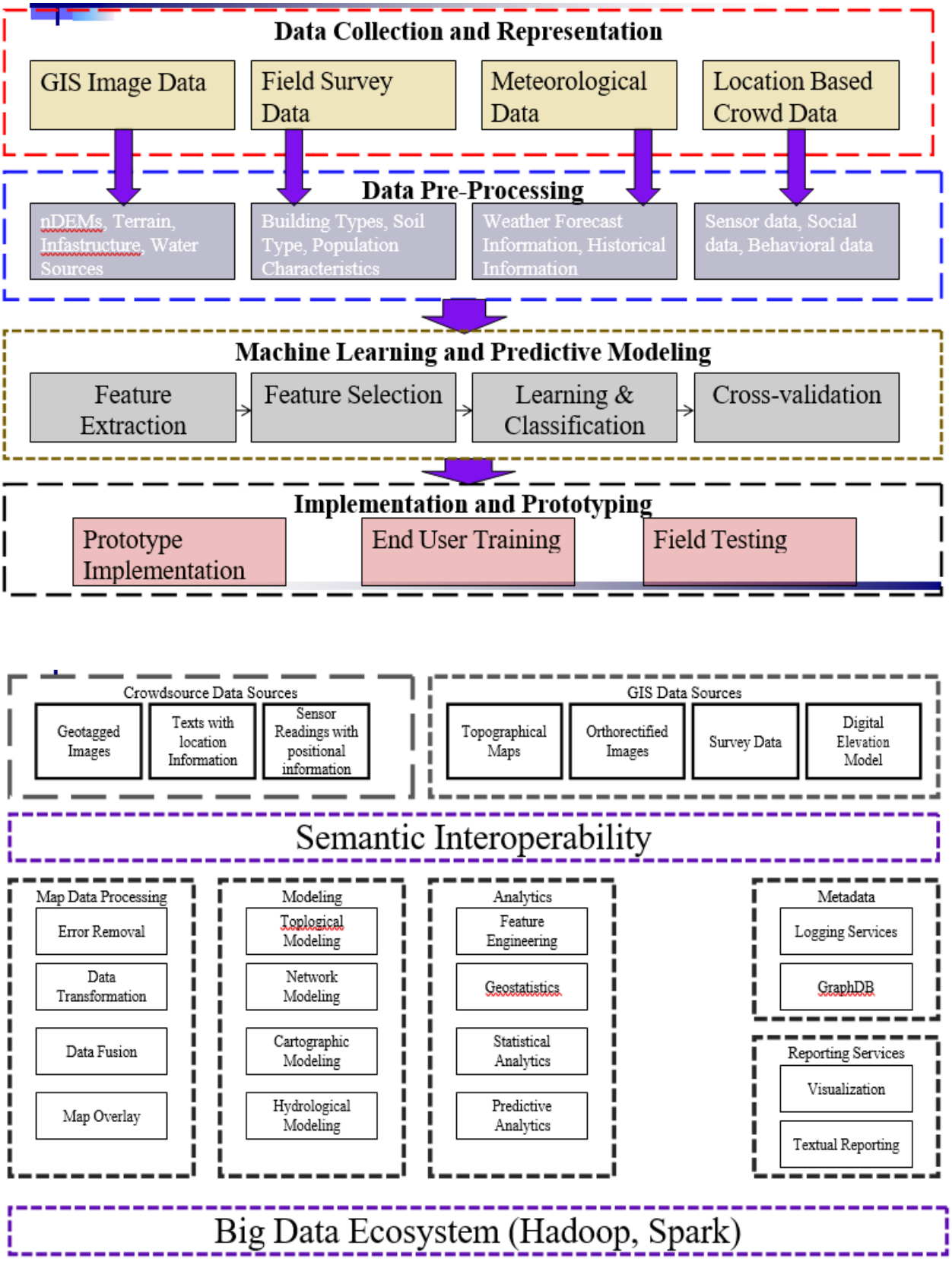
Data analysis: In the **third stage,** the study will employ various data analysis techniques such as statistical analysis, geospatial analysis, and machine learning techniques. The historical data on floods will be analyzed to identify the trends and patterns in flood occurrences. Remote sensing data will be used to map the flood extent and identify the areas that are most vulnerable to flooding. The crowd-sourced data will be analyzed using text analytics and sentiment analysis techniques to gain insights into the factors contributing to floods and their impact on the population and infrastructure.

Flood risk assessment model development: In the **fourth stage**, the flood risk assessment model will be developed using the findings from the data analysis. The model will integrate historical data, remote sensing data, and crowd-sourced data to identify the areas that are most vulnerable to flooding and the factors contributing to floods in those areas.

Model validation: In the **fifth stage**, the flood risk assessment model will be validated using data on past floods in Bihar. The validation will involve comparing the model's predictions with the actual flood extent and damage caused by past floods.

Recommendations: In the **last stage** the findings of the study will be used to provide recommendations for flood management and mitigation strategies in Bihar. The recommendations will be based on the insights gained from the data analysis and the flood risk assessment model.

PROCESS MODEL



LITERATURE REVIEW

The literature on floods in Bihar suggests that the state is highly vulnerable to floods due to its location in the floodplain of the Ganges and its tributaries. The floods in Bihar are primarily caused by heavy rainfall, riverine flooding, and drainage congestion. The state has experienced several devastating floods in the past, resulting in loss of lives, damage to property and infrastructure, and displacement of people.

Flood risk assessment is an essential tool for flood management and mitigation in Bihar. Several studies have focused on developing flood risk assessment models for the state, including hydrological models and remote sensing-based models. However, most of these models rely on historical data and do not take into account the social and economic factors that contribute to floods and their impact on the population and infrastructure.

Crowd-sourced data has emerged as a valuable source of information for flood risk assessment in recent years. Studies have shown that crowd-sourced data can complement traditional data sources and provide valuable insights into the factors contributing to floods and their impact on the population and infrastructure. The use of crowd-sourced data for flood risk assessment is still in its early stages, and there is a need for more research on its effectiveness and reliability.

The literature on flood risk communication suggests that effective communication of flood risk information is crucial for reducing the impact of floods on the population and infrastructure. Studies have shown that crowd-sourced data can help improve flood risk communication by providing real-time information on flood events and their impact on the population and infrastructure.

Overall, the literature review suggests that there is a need for a comprehensive flood risk assessment model for Bihar that integrates historical data, remote sensing data, and crowd-sourced data. The use of crowd-sourced data can provide valuable insights into the social and economic factors that contribute to floods and their impact on the population and infrastructure. The findings of the study can inform flood management and mitigation strategies in Bihar and other flood-prone regions in India.

Expected outcome
The expected outcomes of this analytical study of floods in the context of Bihar using crowd-sourced data are:

- Development of a comprehensive flood risk assessment model that integrates historical data, remote sensing data, and crowd-sourced data. The model will take into account the social and economic factors that contribute to floods and their impact on the population and infrastructure.
- Identification of the most vulnerable areas and populations in Bihar to floods. The study will provide insights into the factors that contribute to the vulnerability of these areas and populations and inform flood management and mitigation strategies.
- Evaluation of the effectiveness and reliability of crowd-sourced data for flood risk assessment in Bihar. The study will assess the accuracy and reliability of crowd-sourced data and its potential to complement traditional data sources.
- Improvement of flood risk communication in Bihar through the use of crowd-sourced data. The study will provide real-time information on flood events and their impact on the population and infrastructure, which can help improve flood risk communication and inform decision-making.
- Contribution to the broader literature on flood risk assessment and management. The findings of the study can inform flood management and mitigation strategies in other flood-prone regions in India and around the world.

CONCLUSION

The analytical study of floods in the context of Bihar using crowd-sourced data has the potential to provide valuable insights into the factors that contribute to floods and their impact on the population and infrastructure. By integrating historical data, remote sensing data, and crowd-sourced data, the study aims to develop a comprehensive flood risk assessment model for Bihar that takes into account the social and economic factors that contribute to floods and their impact.

The expected outcomes of the study include identifying the most vulnerable areas and populations in Bihar to floods, evaluating the effectiveness and reliability of crowd-sourced data for flood risk assessment, improving flood risk communication in Bihar, and contributing to the broader literature on flood risk assessment and management.

The findings of the study expected to benefit flood management and mitigation strategies in Bihar and other flood-prone regions in India and around the world. By improving our understanding of the factors that contribute to floods and their impact, we can take steps to reduce the risk of floods and minimize their impact on the population and infrastructure.

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