Chapter 4
Data Mining Techniques to Improve Early Warning Systems across the Bay of Bengal:
A Bangladesh Perspective

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ABSTRACT

This chapter is a conceptual contribution to this book on data mining applications upholding ethical issues related to two extremely important aspects of the Bangladeshi population: the early warning system and the disaster management system. The chapter tries to provide a few conceptual ideas to introduce ethical data mining application in these systems to support the agencies that are involved for an improved, efficient, and transparent support system in the country, especially across the Bay of Bengal. Resembling a triangular shape (deltaic), a major portion of the bay touches the southern portion of Bangladesh. Sediments from rivers have made the bay a shallow sea. Due to its shallowness and shape, monsoon rains and cyclone storms become destructive, causing great loss of life along the southern part of the country. Moreover, the three mighty rivers (Padma, Jamuna, and Meghna) form one of the largest river systems in the world. They have a large number of distributaries and tributaries, which cause a major portion of the country to be inundated by monsoon rain. In addition, being the lowest landing zone of the Himalayan water, Bangladesh becomes victim to floods almost every year. Loss of lives, destruction of properties, suffering of numerous people and hampering of economic development have become part and parcel of Bangladeshi communities. This chapter suggests that the newly emerged data mining techniques can be introduced to collect, synthesize, analyze, archive, disseminate, and even make future forecasts forming a reliable early warning system across the Bay of Bengal.

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INTRODUCTION

Bangladesh falls within a location exposed to the Bay of Bengal and crossed by extensive rivers which exposes it to a high risk of tsunami hits. The country is extremely vulnerable to the impact of cyclones, tidal waves, tornados, earthquakes and floods. These dangers have become very apparent since the catastrophic events of December 26, 2004 across the Indian Ocean. The country faces almost all forms of natural calamities, like floods; cyclones, storm and tidal surges; coastal and river bank erosions; earthquakes; tsunami; water logging; salinity; thunderstorm and tornadoes; droughts; landslides; sea level rise; coastal erosion; environmental degradation due to deforestation, agricultural practices (rather malpractices); environmental degradation due to exploitation of ground water, etc. (Al-Hussaini, Habib, & Hossain, 2005; Howladar, 2006; Choudhury, 2008; BDPC, 2008), rest apart from other forms of human made causes thus leading to aggregated disasters, such as water pollution due to land grabbing.

The country suffers from inherent vulnerability due to her low-lying and flat deltaic land, which is crossed by many rivers where two tectonic plates meet. Cyclones and tidal surges that often hit the coast often become intense and damaging[1]. Bangladesh faces additional natural hazards such as riverbank erosion and sedimentation leading to water logging. High levels of arsenic in the groundwater pose serious health risks to millions of people. Furthermore, due to its geographical location, it faces earthquake risks. In addition to these, global climate change may wipe out years of economic progress and seriously undermine Bangladesh's aspiration to become a medium-income country by 2030. It means that more and more areas will be prone to floods (affecting 70 million people) and droughts (affecting 12 million people), and parts of the country may be permanently flooded due to sea level rise (DFID Bangladesh, 2008).

However, a significant improvement in this aspect is that frequent and catastrophic disasters in many countries across the globe have increased the role of the public sector in managing disasters and emergencies (Kapucu & Van Wart, 2006), including the Bangladesh government (Govt. of Bangladesh, 2007a; 2007b). Furthermore, with the assumption that all disasters are local and that the major responsibility of managing disasters and emergencies, including informing and alerting the public, belong to the local government (MacManus & Caruson, 2006; Birkland, 2006), an effective management system at the local level of the governance level deserves attention from the highest tier of the government. In this context, early warning system is an important strategy to save lives and properties.

But, in reality the magnitude of the task of designing, implementing, and sustaining early warning systems in communities is diverse, multidimensional and huge. An effective system like that requires the early warning and risk reduction or mitigation be mainstreamed into the policy process and that governmental agencies have the capacity to be able to design and implement effective policy. An effective early warning system policy process also requires increased participation of local community to ensure that the public at risk is adequately informed and alerted. In this way, early warning systems can protect the public by combining scientific monitoring and detection systems with social design factors and components to notify the risk to the people at large. Therefore, early warning systems can be seen as having scientific, managerial, technological, and social components that are integrated with communication processes (Sorensen, 1993; Rahman, 2007; Collins & Kapucu, 2008). This research argues that in addition to these issues, ethical issues also need to be included in the system for increased acceptability, and transparency.

This research claims that incorporating data mining techniques in establishing an early warning