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A Human Centric Approach to Data Fusion in Post-Disaster Management

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Abstract Providing full and accurate information is crucial to the post-disaster management to enable the affected people access and obtain the resources needed, in a timely manner. An effective post-disaster management system (PDMS) has to ensure distribution of emergency resources, such as hospital, storage and transportation in a reasonable time so that affected papulation are properly benefited from it during the post-disaster period. In this paper we describe the overall approach to this research survey paper, to include, the different technologies, models, information systems and strategies presented by different researchers as the result of their work. The need for careful PDMS field analysis, searching ways for individuals to obtain necessary resources from PDMS and how a high-quality platform and intelligent models can be provided to acquire the most efficient information for decision-making in post-disaster situations. Examples are given of the research in: techniques for data collection and generation, modeling of hospital decision-making operations, and initial IF-THEN rule based concepts. We believe that this study is unique because it has used classification that has classified this survey in relation to the importance of technologies and the scientific ways on how to manage disasters.

Keywords: *information fusion, information systems, technology, crisis management, disaster response*

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1. Introduction

The earth faces natural and manmade disasters on a daily basis. Most of these disasters such as hurricanes, earthquakes, floods, wild fires, and tornadoes cannot be stopped, controlled or predicted. Although researchers and emergency personnel may see them coming, nothing can be done to avoid natural disasters. Instead, governmental and private entities develop plans to deal with the aftermath of disasters. With an effective post-disaster management system (PDMS), the distribution of all emergency resources such as hospitals, storage and transportation will be much more efficient and helpful to the devastated areas.

Disasters have a devastating effect on the environment and on human survival. A disaster does not only have local effect, but also have global impact. Disasters can be classified as manmade and natural. [1] Mentioned the prominence of information technology (IT) in managing disasters. In this context, considering the case study of Singapore’s response to severe acute respiratory syndrome (SARS) and Asian Tsunami disasters, the authors have explained the role of IT in crisis response. After analyzing the case from different dimensions, the authors make it clear that the infrastructure of information technology, combined with leadership networks and present capabilities, such as the ability to construct and apply IT, the aptitude to identify signals, and the aptitude for a broad view, are all crucial aspects of disaster management and crisis response. IT and informational structures help in a vital manner in countering the adverse effects of a crisis, for example, to follow or monitor the movement of patients’ contact details and their health conditions, numerous IT applications are being utilized.

[2] Used a hierarchical approach for managing hurricane disasters and the distribution of goods to affected people in highly populated areas. It is essential to generate effective plans to provide aid after hurricanes, as well as after other severe weather events by utilizing Geographic Information Systems (GIS) and Spatial Optimization Strategies. Although not all storms cause serious damage to human life, all of them do, in some manner, impact urban systems, which in turn leave the population with either a lack of or insufficient food, water and other necessities.

[3]. highlight the importance of suitable related disaster data and its appropriate fusion to do spatial analysis. Fine-scale response and recovery data related to disasters for the purpose of doing spatial analysis are still very rare. Note that this is unfortunate as deep information with respect to spatial models of recovery is of high importance in envisaging the restoration of homes, streets and neighbourhoods. In this context, authors make recommendations to collect fine-scale geographic data in real-time for the transitional phase between response and recovery.

This information or the data are helpful as they can be utilized for assessing and analyzing the degree of damage, and at the same time, for creating a baseline for consequent monitoring of recovery. In this manner, a suggestion regarding a spatial video system has been made and used for collecting data from the post-disaster landscape of Tuscaloosa, which was affected severely by a large tornado. After processing, this video can be viewed easily within a Geographic Information System that amalgamates street-level images with the exact location. Additionally, such data can also be exploited for supporting in-progress recovery. Spatial video technology is very useful in different visible dimensions of recovery as it helps in capturing, mapping, geo-referencing and analyzing. In turn, these data are helpful for planners in designing more effective and sustainable recovery programs after disasters.

Just in 2011 alone, a number of huge disasters have occurred in various countries; some of these are mentioned below.

- February 22, New Zealand's second largest city, Christchurch: An M6.3 earthquake killed many people and caused very serious damage. There were people trapped under collapsed buildings. The entire city was filled with the smell of gas in the air. The Christchurch Cathedral was partially destroyed.
- February, northeast of the United States: Certain areas suffered a big snowstorm and this disaster resulted in many deaths. Land and air transportation were seriously affected in parts of Washington, with snow thickness of over 1 foot (approximately 0.3 m), and several roads were blocked that caused difficulty for people to get to their destination. [Since the beginning of winter, New York City's snowfall record was nearly 140 cm, and then decreased to 96 cm in February.]
- On the afternoon of March 11, the Tohoku and Kanto regions: An M8.8 earthquakes, the largest in the history of the Richter scale, was registered. The source was located near the Miyagi Sanriku coastal. The earthquake triggered a tsunami in a wide range of areas, from Hokkaido to Okinawa (up to 10 m). Japan's defense ministry reported that in Minamisoma and Fukushima, about 1800 people died.
- May 25, eastern United States: The largest tornado hit. Joplin City, Missouri that also affected 11 other states. People stood on the ruins of their tornado-destroyed houses. Statistics showed that tornado disasters led to the death of 122 people.
- June 4, in Southern Chile, Puyehue Cordon Caulle: There were volcanic eruptions, profuse volcanic ash with the emergence of the phenomenon of volcanic lightning. There were also a large number of hot ashes and stones on the red sky leading to flights cancellations. Following the timely emergency information service, more than 3,500 people evacuated.

2. Understanding the Natural Disaster Problem

Floods, tsunamis, earthquakes and other natural disasters also raised the number of deaths, and the number of people indirectly affected is usually even larger [4]. The analysis of post-disaster casualties to the number of people affected directly by the world's major disaster situations in several countries are illustrated in Figure 1 and Figure 2. The number of people affected and the number of deaths are also illustrated (provided by datamarket.com). The analysis indicated that the majority of the people affected need a post-disaster management system (PDMS) to provide a strong and efficient support to people.

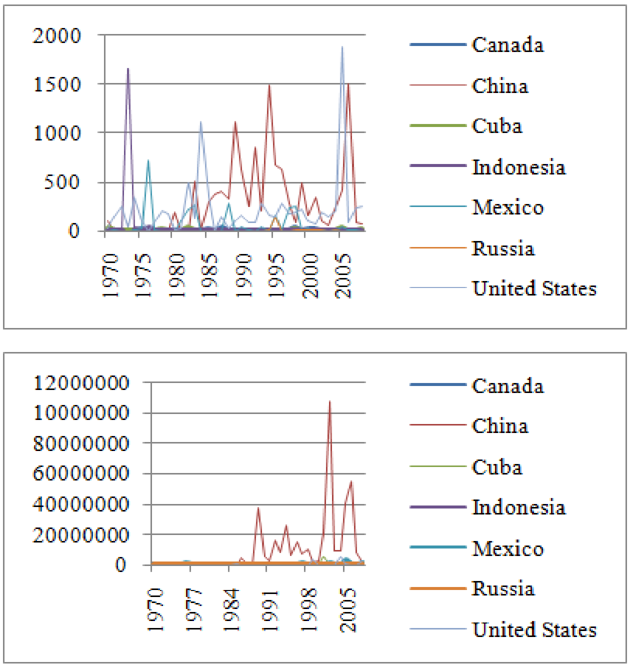

Figure 1. Casualties and Affected Population of Seven Countries From 1970 to 2008 Resulting From Eight Storms

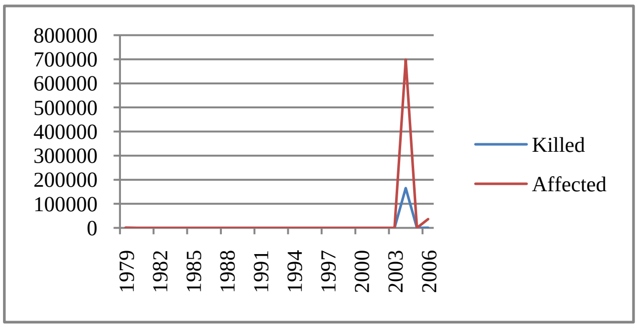

Figure 2. Casualties and Affected Population of Indonesia from 1979 to 2008 Resulting From Tsunamis

While it is true that an earthquake or a volcano cannot be stopped from occurring or from exploding, existing technical know-how and scientific knowledge can be used to offer early warnings, to increase the resistance of houses, bridges, poles, among others, against the wind and earthquakes and also to arrange appropriate community response to disasters. Over the last few years, technological expertise, technologies for confronting disasters and scientific knowledge in terms of the intensity and allocation of natural hazards have grown to a large extent. It will be fruitful to survey an array of technologies and other advances that can be used in managing, mitigating and responding to catastrophic disasters, and it will also be useful in post-disaster management. In this context, the classification scheme that has been generated in this study is to classify the post-disaster management related discussion to the advanced technologies and scientific knowledge, and identify the role that novel technologies and technologically advanced methods play in disaster response [5,6]. The study of post-disaster literature shows that there are many issues involved in PDMS like food distribution [2] and the economic and social impact in post-disaster situations [7]. For this, [5] introduced an improved Monte Carlo model to estimate the average annual loss from hurricane wind damage to residential properties in the state of Florida. Psychological impact was also assessed [8,9,10]. In general, pre and post-disaster management includes at least five phases [11] shown in Figure 3.

Figure 3 Five Disaster Cases and Phases of Pre and Post-Disaster Management

3. Understanding Disaster Assessment

[12] Proposed a data collection method from an effective complement in pre-disaster including previous disaster activities' repository through open access of GIS or GPS data. Information from 'pre-disaster' will benefit the post-disaster management system [3] through the following:

- Early detection
- Prevention or advance warning
- Problem analysis and assessment of scope
- Public notification system and appropriate authorities
- Response mobilization
- Damage containment
- Relief and medical care service

Spatial video dataset will also assist in creating the primary database of PDMS. [3] Showed that scale geographic data can be collected effectively for the real-time intermediate phase between response and recovery. However, for the essential database, the problems on conflicting data, multi-source and multi-modal data need to be researched further; also, the knowledge base of the system with a dynamic ability is a key factor for PDMS, which should provide more efficient decision-making tools for individuals. The recent progress in the science and technology of natural disasters and associated management has made it possible over the period to introduce pertinent changes in the incorporated approach to the problems of natural disasters. The surveyed techniques that will be used in the paper with the above classification scheme are technologies that aid in comprehending the mechanism of atmospheric, biological, geological, and other related origins, and to evaluate how such disasters occur and what makes them develop from hazards into disasters.

The importance of PDMS also leads to worldwide organizations having to develop a more effective model to address this issue. The space-based disaster information management and emergency response system, hosted by United Nations, is a platform to promote space technology in disaster management and emergency response, and a program led by the United Nations office for outer space affairs. The platform uses existing space technology, such as Earth observation, meteorological satellites, and communication and navigation satellites, to provide accurate and timely information for decision-makers in support of disaster management. This plays an important role in knowledge acquisition, processing and transfer; they are the core elements of disaster activity monitoring.

4. PDMS Data Collection and Analysis

To establish effective collaboration and data sharing between PDMS and individuals or stakeholders, appropriate agreements with a timely response must be adopted. Such agreements will increase their willingness to participate in this process. Additionally, establishing the appropriate and specific relationship between governments, private and academic sectors will lead to better utilization of their capabilities (e.g. national mapping agencies) and allow PDMS to acquire numerous and relevant data from various disaster-response activities.

Data fusion regarding post-disaster management will help augment current available knowledge and experience, which in turn will be helpful in decreasing the overall cost of these activities. As a severe disruption in the normal working of a community, a disaster causes huge losses that go beyond a community's ability to recover [13]. Disasters also result in heavy monetary losses because financial resources originally allocated to development will be diverted to address disaster-related damages and in helping people to recover. Therefore, the proper management of disasters is a necessity since they impact the sustainable development of society. In this context, disaster management can be regarded as a series of tasks comprising of improvement, awareness, response, and recovery activities.

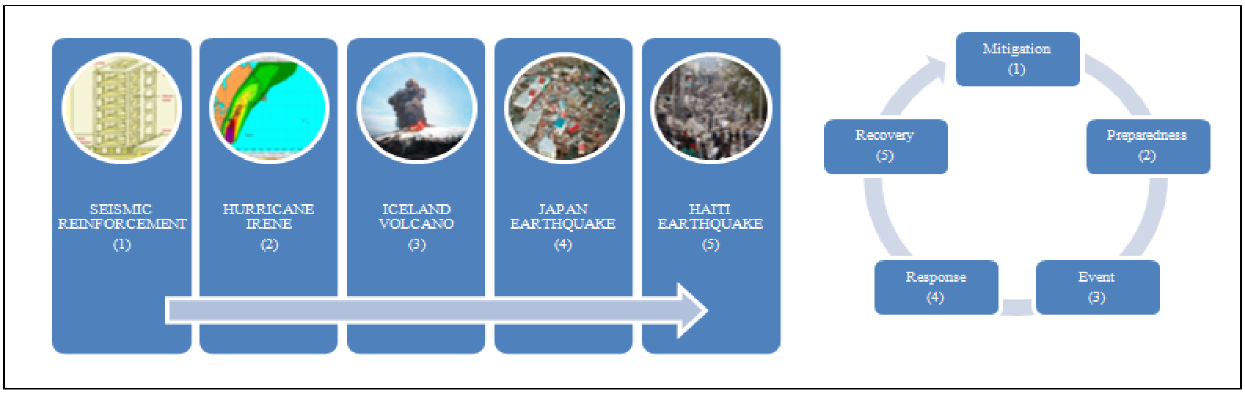

Figure 3. Five Disaster Cases and Phases of Pre and Post-Disaster Management

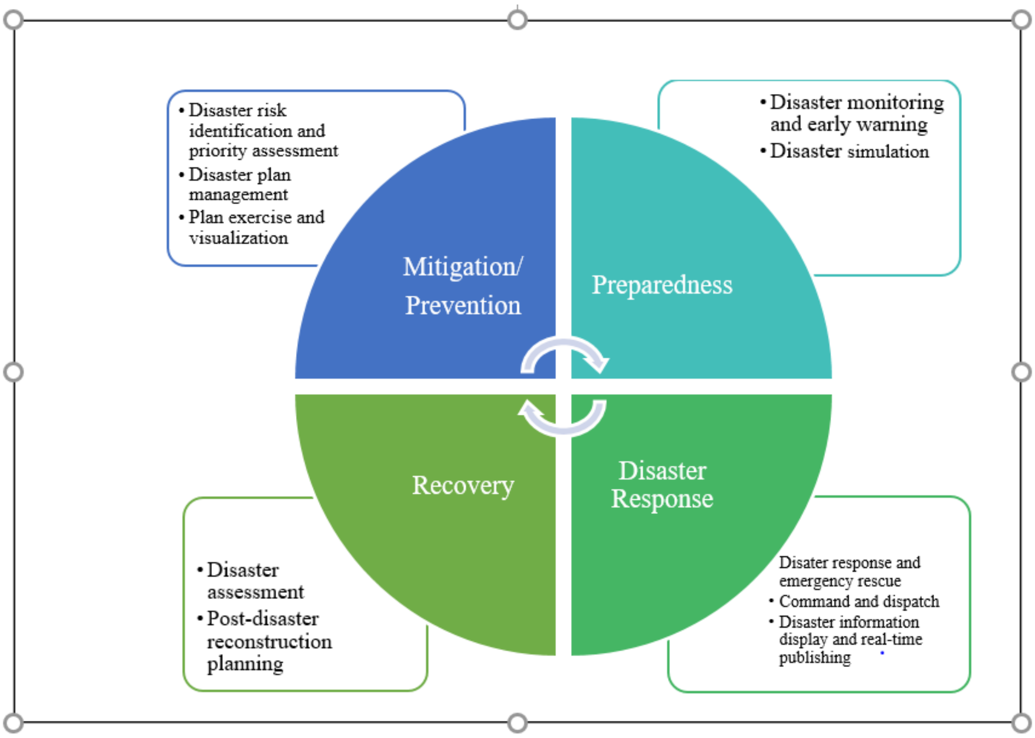

Figure 4. GIS Benefits in Disaster Management

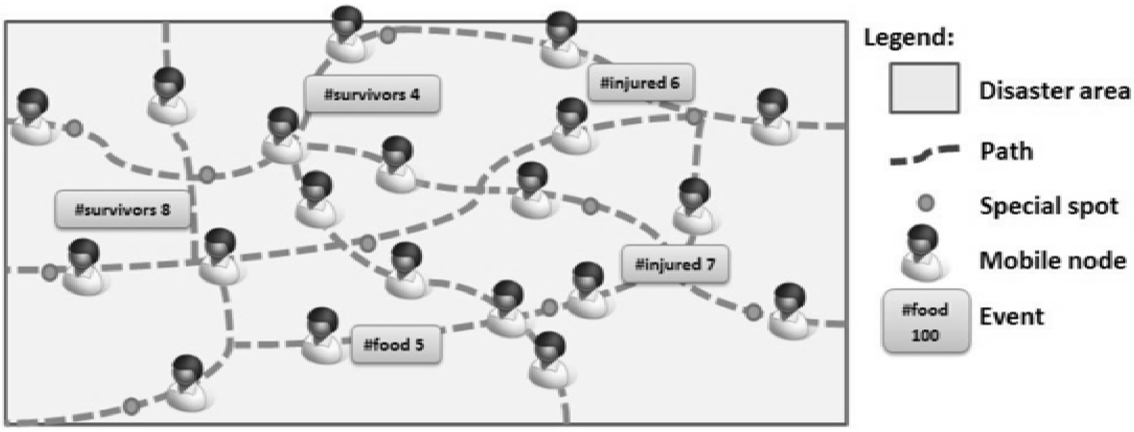

Figure 5. Individuals' Situation and Their Relations in Post-Disaster

[14] Established a formal structure using GIS and spatial data affairs at the group and organizational levels of disaster management community. They showed the benefits of GIS data, particularly how spatial data application in PDMS works (Figure 4).

Data fusion can substantially assist in disaster management as information collected has a spatial component and without it, disaster management cannot be done effectively and efficiently. Although disaster management is rapidly gaining attention from different researchers, it is difficult to collect information related to the data management and evaluation of disaster management. Given the importance of accurate and timely information on the disaster area, [15]. Utilized a delay tolerant network (DTN) architecture to make people's phones more effective in serving as sensing nodes in post-disaster situations (Figure 5) [4].

Data fusion in post-disaster management also helps in analyzing, discovering, and organizing all pertinent information. From 2002 to 2011, 4130 natural disasters have been recorded, which in turn have caused approximately more than 1 million deaths and property loss worth billions [15].

However, authors highlight the fact that telecommunications infrastructure and related buildings and other structures are also damaged during disasters. It is significant that responders depend on information regarding affected areas so they are able to assess the situation, and during such time, even in the absence of communication infrastructure, information must be collected that covers a large disaster area so as to deal with the critical need [16]. This indicates that different authors have relied on various technologies or techniques for the purpose of data collection, and thus, enable assessment of the different data collection methods that researchers have utilized in post-disaster management to help in providing a rich blend of relevant data.

Some scholars focused on the human-interactive interface of PDMS through Geospatial Semantic Web (GSW) technologies and natural language interfaces, in which it will search geospatial features automatically from multiple semantically heterogeneous source interfaces [17,18,19,20]. Also introduced a GIS-based approach including representation, organization and access of PDMS, including logical data model presentation of disastrous events, database implementation techniques, and database queries and report-generating methods.

A huge project that will help create a basic database for data collection of PDMS is a weather-bug system. This GIS-based weather-bug system will also benefit disaster risk management given the focus on observations from a real-time emergency management disaster scenario [21]. Some PDMS data collection works were based on Earth Network Project (ENP). (Figure 6) shows the weather site distribution of North America and (Figure 7) shows the worldwide sites' distribution.

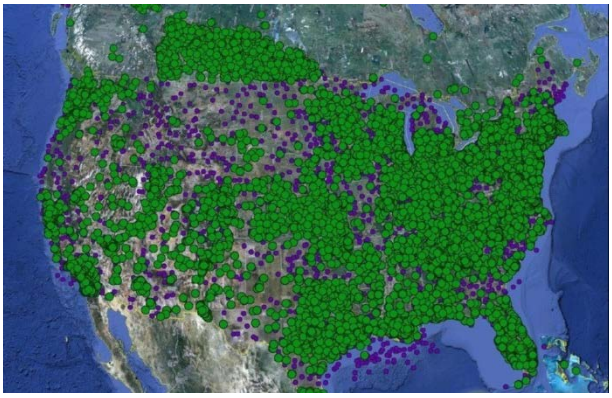

Figure 6. Weather Network and Sites of the Unites States

Figure 7. Earth Network Project-Weather Site Distribution in the World

5. Infrastructure Sensors

Remote sensor and wireless sensor networks also collect necessary data based on the current GIS system [22], such as satellites. In 1998, Russia used this type of satellite during severe spring floods and summer forest fires in Northern Russia [3]. Furthermore, radars and mobile devices can also be accessed in post-disasters. Thus, it is important to study the mechanism of information sharing (IS) and the simplicity of presentation method in the area affected by disaster [23]. Figure 8 shows a project on radar data collection for a weather prediction system in Orlando, FL.

[24] Applied a remotely sensed data for prediction and monitoring, and thus, this survey technique will be helpful for the data fusion in post-disaster management. The utilization of remote sensing data as input to flood management applications will help in managing disasters and their use will continue to be increased because of the growing number of satellites and data providers. It is worth to consider that this will enhance accessibility to information, which in turn will augment the exploitation of remote sensing as input in flood management applications. Earth observation satellites for managing flood disasters have been used by authors, along with flash flood analysis and prediction [25].

[26] On the other hand suggest a different framework for post-disaster management and use wireless networks for disaster management. They added significant data in post-disaster management by using hybrid networks of cellular and sensor networks in disaster management. Nevertheless, it is of due consideration that these base stations of cellular networks also get damaged during disasters as what had happened in the 1995 earthquake in Japan. Base stations became inaccessible. In light of these shortcomings, the technique suggested by the authors is an updated framework that will help in collecting data from sensor networks and in managing disaster situations [11].

To disseminate data from sensor networks during disasters, Adhoc Relay Station (ARS), in which cells are mainly divided into three parts, can be used. Disaster management requires a real-time efficient framework, and because of this, an updated hybrid framework is essential. A wireless sensor network for disaster management (WSNDM) is vital as it disseminates entry over the network by using its multi-hop routing technique along with customized hybrid networks.

[27] Put forth an imaging technique for managing natural disasters so that they can be mitigated or responded to if they happen again. The technique they used is synthetic aperture radar (SAR), which is capable of producing fine-resolution pictures of the earth terrain unimpeded by weather and illumination situations. Although observing natural disasters by using radar images is a difficult task, the authors, in their research work, have dealt with scrutinizing and detecting alterations that take place in subsidence because of natural disasters. To examine this technology, the City of New Orleans in the USA was considered as the testing area. It is pertinent to mention that on raw SAR data, minimum ratio detector (MRD) was applied, while on complex data, D-InSAR was applied so that change can be observed. Different forms of satellite data sets were used for evaluation. The disaster information suggested by authors is highly significant in the post-disaster management because of the fact that it will help in sharing all forms of disaster information automatically, whether related to the number of injured or the number of people who died. This system will include safety information, as well as a mass of information in a wireless base satiation apparatus and this will be exchanged with the information stored in a microcomputer. Therefore, basic data acquisition will be based on a variety of open systems, although some stations or communication devices are destroyed by the impact of disasters, incomplete data can be recovered. In [13] revealed the characteristics of online social networks and then proposed socio-technical design principles to address the communication challenges under an uncertain emergency.

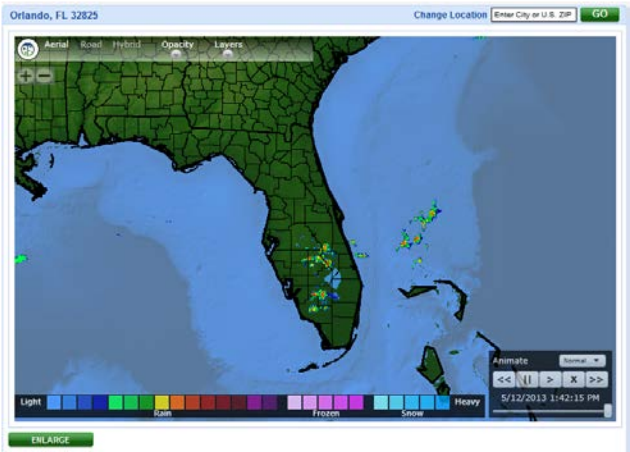

Figure 8. Radar Data Based Weather Prediction System

GIS dataset is a big data that we can acquire from a public website or some open system such as the Federal Emergency Management Agency (FEMA) and Google maps; the dataset from different sources needs to be preprocessed. As we know, what is of importance is not how to get the dataset but how to deal effectively with such big dataset, such as how to scale the dataset under minimal loss.

6. Data Fusion Technologies in PDMS

PDMS data come from different sources and also appear in different modes, thus, data fusion technologies need to be applied in PDMS. Although the concept of data fusion began in the early 1970s, the real technical progress and development started in the 1980s. With the increase in PDMS complexity, it is insufficient to rely on a single source of data. Therefore, in the fault diagnosis system that using a multi-source technology has the ability to monitor a range of features quantity making the data fusion operations improves the accuracy and reliability of the system.

Earlier applications of PDMS ran on wearable PC's [28]. Normally, data fusion technology entails the use of computer-generated chronological observation information; certain criteria are automatically analyzed and synthesized to complete the necessary decision-making, evaluation tasks, and information processing.

Data fusion in post-disaster management aids in analyzing the rich amount of data that different scholars have submitted. This survey will in turn be helpful in understanding the impact of disasters with regard to the physical, intellectual, emotional, psychological and other facets of human lives. Besides this, data fusion in post-disaster management will also submit distinctive approaches that authors have used to manage post-disaster situations and ways they have suggested to manage future disaster situations or areas that can be affected by disasters [29].

Data fusion also acquires information from multiple sensors. Under the inference engine, knowledge features and knowledge base are matched to make the fault diagnosis decisions available to users. Fault diagnosis system based on information fusion can be added to the self-learning module. The fault decision gives feedback to the knowledge base for updates through the modification of the corresponding confidence factor. At the same time, the dynamic response between the knowledge base and the users' self-learning module creates a reasoning process. Expert system achieves self-learning functions, such as the ability to acquire new knowledge, sum up new experiences, and constantly expand the knowledge base. The three layers of fusion are as follows:

- Data level fusion: This is about where to collect the original data, with the integration of the synthesis and analysis of the data in the original forecast of a variety of sources, without keeping it pretreated. Data fusion generally uses a centralized system for the fusion process. This is a low-level of integration, such as imaging sensors, which is the integration of data layers containing a blurred image of a pixel image and processing the same to confirm the target attribute.
- Feature level fusion: This is the middle level of integration. At first, it takes feature extraction of the original information from the sources. Second, a comprehensive analysis of the characteristics of information is processed. The advantage of feature level fusion is it achieves a considerable compression by conducive real-time processing and decision analysis based on the extracted features; thus, fusion results provide decision analysis with more elements of information. Feature level fusion is generally a distributed or centralized fusion system which can be divided into two categories: one is the integration of the target state; the other is the target characteristics of fusion.
- Decision level fusion: This is for observing the same goal by different types of sources. Basic processing of each source is done locally including preprocessing, feature extraction, recognition or judgment to establish preliminary observations on the monitored target, and then related processing decision fusion judgment and ultimately, the mutual outcome is obtained. Table 1, illustrates the methods of different level fusions.

Table 1. Fusion Levels and Relative Methods

Level	Data Level	Feature Level	Decision Level
Method	• Least Squares • Maximum Likelihood Estimation • Kalman Filter • Neural Networks	• Parameters Based Classification Statistics • Classical Inference, Bayesian Inference • D-S Theory • Information Theory Neural Networks • Clustering Analysis • Logical Template Methods • Recognition Model Based Voting • Fuzzy Set Voting	• Bayesian Inference • D-S Theory • Neural Networks • Fuzzy Logic

Using data level fusion, Christopher Stiller integrated various automotive sensors such as radar and video, to improve safety and traffic efficiency. Simultaneously, it is supported by information on the causes of disasters, divided into four major areas, namely, by human errors and technological malfunctions, by deliberate malevolence, by force of nature (earthquakes, tornados, hurricanes, floods, and droughts) and by amalgamation of some or all the preceding causes [30].

7. Summary of the Surveyed Techniques with the Above Classification Scheme

The classification scheme that has been used for the survey has categorised the disaster related discussion to the advancement of technologies and different technological methods. The recent progress in the science and technology of natural disasters and associated managing means has made it possible over the period to introduce pertinent changes in the incorporated approach to the problems of natural disasters.

7.1. The GIS Dataset Collection for PDMS

The technologies manage and collect data at the time of disasters in distinct forms and are also useful in presenting data in an evaluative manner so that emergency planners and people associated with disaster management can easily interpret that data for designation and planning ways with respect to disaster management. Moreover, the role of technologies is pertinent in sorting data apart from its fusion, as they present the distinguishing data in common forms generated from different sources so that it will be easy to interpret it. Techniques like information extraction (IE), information retrieval (IR), information filtering (IF), data mining and decision support will be of complete help and facilitate emergency planning in a significant manner.

7.2. Management System for Disaster Response Organizations

It is substantial to underline that information overload and mismanagement is a challenge for disaster response organizations because irrelevant information can distract and result in incorrect outcomes, and thus, through advanced technology it's filtering or formatting is necessary. If information systems are exploited for filtering and formatting disaster related information, then it can possibly diminish the perception of users for its support in their tasks and planning. In addition to this, it has been identified that large numbers of researchers have proposed their own formulated models and strategies for the purpose of coping with the disasters and managing it in an effective and efficient manner. With the help of research and testing in areas that are more disaster prone or have suffered any disasters, researchers have formulated models for assessing risk of the disasters to issue warnings regarding them and to develop ways in which timely warning of serious disasters can be offered, which will help governments and people to be able to handle the disaster situation.

7.3. Social Networks and Internet Issues for PDMS

Social networks and the internet will be of enormous help in collecting and distributing information at the time of disaster occurrence and provide updated information about the situation. In this manner, such networks are highly useful in generating factual information related to the disaster affected areas and people. It is noteworthy that if systems are designed carefully and used effectively then these will be of great help in disaster management, and this information will be helpful in future disaster management. Overall, it can be stated that the trends that have been identified from the surveyed techniques are assisted by recently generated science and technology that have made life easier for those responsible for responding to disaster and planning disaster management. It is clear from the discussion that information systems and technologies are exceedingly supportive in not only managing the disasters, but also in managing the data related to disasters.

7.4. Evaluation Issues on Risks of Disasters

Furthermore, another recognized trend is the formulation of models in terms of different technologies that aid in assessing risks of disasters. It is the advances in technologies that the authors have highlighted which have not strengthened before time warning capabilities for lessening natural hazards, but also utilize their aftermath for future management. The trend has been identified that expansion of spatial technologies, global communication and new information technologies has extended the availability and accessibility of information on natural disasters.

7.5. Big Data Issues on PDMS

On the other hand, big data always being connected to mobile computing (MC) is an issue that makes data more effective for application in disaster management. MC involves mobile communications, the internet, databases, distributed computing technology; it enables a computer or other information intelligent terminal equipment in the wireless environment to achieve data transfer and resource sharing. Its role is to be useful, accurate, and make timely information available at any time, any place and to any customers. This will dramatically change the way people communicate in post-disaster situations. We also introduced some improvement in the disaster management field for the future. For example, emergency data collection methods for post-disaster needs to be considered; big data fusion technology applied for constructing a database, visualization tools developed for mobile client, output for providing information to emergency management or first responders, and how general public access the information.

7.6. IF-THEN Rules Based Concepts.

Fuzzy Set Theory (FST) was utilized in conjunction with classical methods to enhance the reliability and utility of disaster efforts while we focus on various forms of natural or man-made disasters [31], also there are some Fuzzy Set methods applied in PDMS, such as, fuzzy quantities [32], fuzzy logic programming [33], and fuzzy relation concepts for risk management [34]. [32] introduced a chaotic differential evolution algorithm to solve a fuzzy clustering iterative model for evaluating flood disaster [35,36], while [37] and [38] represented the diffused-interior-outer-set model (DIOSM) to obtain the possibility-probability distribution (PPD) for risk calculation.

Fuzzy evaluation model also was applied in supervised learning process for PDMS and compared with non-supervised process, supervised or semi-supervised process, it resulted in much more accurate results through evaluation the outputs and continue to adjust the inputs.

On the other hand, unsupervised learning is based on training samples of the category unknown (not marked) to solve various problems in pattern recognition, such as clustering analysis. Sometimes, the lack of prior knowledge is difficult to manually label the category while artificial category label is too costly. Naturally, we hope that the computer on our behalf (partially) will help us to complete these tasks. These works include selecting some representative samples of the classifier from a huge collection of data [39,40,41]. First of all, samples automatically are divided into different categories marked by humans. The most common unsupervised learning based automatic classification is calculated based on the similarity.

The similarity measure also can be defined based on human experience. By clustering objective function of the squared error, such as various types of samples to the class mean vector distance and minimum variance criteria, it can be divided into:

- K-means algorithm
- Fuzzy K-means algorithm (K-means variant 1)
- Iteration K-means algorithm (K-means variant 2)
- Consolidation Act (also known as clustering)
- Secession Law (also known as decomposition clustering)

Some fuzzy set model based algorithms for semi-supervised learning were developed and improved by previous scholars, such as, fuzzy Petri net [42], and active fuzzy constrained clustering (AFCC) [43,44,45,46] proposed a new heuristic semi-supervised fuzzy co-clustering algorithm (SS-HFCR) for categorization of large web.

From the background review we found out that, fuzzy evaluation makes the knowledge presentation more exact, but the shortcomings of fuzzy evaluation are in the complexity of calculation. So a fuzzy inference system needs to be developed to reduce the complexity. Combining with SSL for post disaster management (PDMS) is an innovative method that will make the PDMS provide more effective information for decision-making for individuals in post-disaster. Simulation on IF-THEN Rules Presented Graph Using Survey Data-Set [3].

8. Conclusion

In our paper it is apparent that scientific knowledge and technical knowledge plays a vital role in disaster management and data related to this can become a significant part of data fusion related to post disaster management. It has been found out that even technological advances cannot stop these disasters, but they can aid in post disaster management, i.e. response, mitigation and monitoring of disasters. The classification scheme that has been used in our study is to categorise the conversation related to post disaster armament to the data technologies, information systems and models that helps in managing disasters and disastrous situations that arise after natural disasters, such as earthquakes, floods, droughts, tsunamis, landslides, tornados and many more, which occur every year and puts human life in trouble. It is apparent from the discussion that disaster related information should be quick and should be updated at the time of disaster and after disasters, because it offers updated information to relative victims and help planners and responders to plan out ways of managing disasters. Social networks and internet are also providing enormous help in collecting and distributing information at the time of disaster occurrence and updated information about the situation. These social networks are highly useful in generating factual information related to the disaster affected areas and people. It is substantial to underline that information overload and MIS- management is a challenge for disaster response organizations because irrelevant data can distract and result in incorrect outcomes, as a result, advanced filtering technology formatting of data is necessary. If information systems are exploited for filtering and formatting disaster related information than it can possibly handle, it will diminish the effectiveness of the disaster information system that usually designed to support users and officials for planning of disaster. The critical analysis of different papers highlights the surveyed techniques of different researchers and then the trends have been identified which have been found in the surveyed techniques. It can be mentioned that the disaster management organisations or emergency planners should work down closely with computer scientists and providers of technology so that new technologies can be incorporated and post disaster management can be done in an effective manner. Ultimately, we can say that this study has made a distinctive contribution in already available literature as it has brought down a different aspect of disaster and disaster management.

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