1) **Project Title:** The Use of Artificial Intelligence in Disaster Management

**Authors:**

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**Abstract:**

Whenever a disaster occurs, users in social media, sensors, cameras, satellites, and the like generate vast amounts of data. Emergency responders and victims use this data for situational awareness, decision-making, and safe evacuations. However, making sense of the generated information under time-bound situations is a challenging task as the amount of data can be significant, and there is a need for intelligent systems to analyze, process, and visualize it. With recent advancements in Artificial Intelligence (AI), numerous researchers have begun exploring AI, machine learning (ML), and deep learning (DL) techniques for big data analytics in managing disasters efficiently. This paper adopts a systematic literature approach to report on the application of AI, ML, and DL in disaster management. Through a systematic review process, we identified one relevant hundred publications. After that, we analyzed all the identified papers and concluded that most of the reviewed articles used AI, ML, and DL methods on social media data, satellite data, sensor data, and historical data for classification and prediction. The most common algorithms are support vector machines (SVM), Naïve Bayes (NB), Random Forest (RF), Convolutional Neural Networks (CNN), Artificial neural networks (ANN), Natural language processing techniques (NLP), Latent Dirichlet Allocation (LDA), K-nearest neighbor (KNN), and Logistic Regression (LR).

**Drawbacks:**

1) Converse the risk and its uncertainty.
2) The drawback of AI in disaster response is that it's very challenging to properly train the models to accurately interpret a disaster.

**2) Project Title:** Facilitating adoption of AI in natural disaster management through collaboration

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**Abstract:**

BolognaAcute events of natural origin (e.g., atmospheric, hydrologic, geophysical, oceanographic, or biologic) can result in disruption and devastation to society, nature, and beyond. Such events, which disproportionately impact certain regions (e.g., least developed countries) and populations (e.g., women and children), are often referred to as natural disasters by experts in the geoscience and disaster risk reduction communities, as reflected in the scientific literature and in Sustainable Development Goals and Recently, interest has grown in leveraging innovative technologies such as artificial intelligence (AI) to bolster natural disaster management. In many fields, such as medicine and finance, AI has gained traction due to advances in algorithms, a growth in computational power, and the availability of large data sets. Within natural disaster management, it is hoped that such technologies can also be a boon: capitalizing on a wealth of geospatial data to strengthen our understanding of natural disasters, the timeliness of detections, the accuracy and lead times of forecasts, and the effectiveness of emergency communications.

**Drawbacks:**

Unfortunately, operating in a silo is not limited to geoscience and machine learning experts in an academic setting. Non-academic organizations dealing with DRR will also need an open-mindedness to new technologies and interaction with other experts (including the geoscience and machine learning experts in an academic setting) and stakeholders to reap the benefits of improved detection and forecasting for informed decision-making.

**3) Project Title:** Disaster Management Project Using Wireless Sensor Networks and artificial intelligence.

**Authors:**

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**Abstract:**

There are numerous projects dealing with disaster management and emergency response that use wireless sensor networks technologies. Indeed, WSNs offer a good alternative compared to traditional ad hoc networks. Air pollution monitoring, forest fire detection, landslide detection, natural disaster prevention, industrial sense and control applications, dangerous gas leakage, water level monitoring, vibration detection to prevent an earthquake, radiation monitoring are examples of the WSN applications related to disaster management. This paper presents an overview of the recent projects using WSN to collect data in disaster areas.

**Drawbacks:**

A big disadvantage of AI is that it cannot learn to think outside the box. AI is capable of learning over time with pre-fed data and past experiences, but cannot be creative in its approach.

**4) Project Title:** Disaster management using Internet of Things

**Authors:**

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2) Supratim Auddy- Deptt. Of Computer Science & Engineering, Institute of Engineering & Management, Kolkata

**Abstract:**

A disaster is a serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental loss and impacts, which exceeds the ability of the affected community or society to cope using its own resources. Researchers have been studying disasters for more than a century, and for more than forty years disaster research. When discussing disaster management, there are a few processes that form the links in the chain and work in tandem to complete the emergency management lifecycle. The process starts with identification of risks, disaster preparedness, emergency response, resources allocation, reaction planning, and lastly disaster recovery. Fortunately, iot has the solution to help the disaster management agencies at every stage of the process.

**Drawbacks:**

However, technology is still an ally in disaster risk analysis and an essential instrument for scientists, industries, and policy-makers involved in DRR. AI is a fast-analysis instrument that has not seen its full application in the aftermath of disasters yet.

**5) Project Title:** Automated Disaster Monitoring From Social Media Posts Using AI-Based Location Intelligence and Sentiment Analysis

**Authors:**
1) Fahim K. Sufi, Federal Government, Melbourne, VIC 3000, Australia.
2) Ibrahim Khalil, School of CS & IT, RMIT University, Melbourne, VIC 3000, Australia.

**Abstract:**
Worldwide disasters like bushfires, earthquakes, floods, cyclones, and heatwaves have affected the lives of social media users in an unprecedented manner. They are constantly posting their level of negativity over the disaster situations at their location of interest. Understanding location-oriented sentiments about disaster situation is of prime importance for political leaders, and strategic decision-makers. To this end, we present a new fully automated algorithm based on artificial intelligence (AI) and natural language processing (NLP), for extraction of location-oriented public sentiments on global disaster situation. We designed the proposed system to obtain exhaustive knowledge and insights on social media feeds related to disaster in 110 languages through AI- and NLP-based sentiment analysis, named entity recognition (NER), anomaly detection, regression, and Getis Ord Gi* algorithms. We deployed and tested this algorithm on live Twitter feeds from 28 September to 6 October 2021. Tweets with 67 515 entities in 39 different languages were processed during this period. Our novel algorithm extracted 9727 location entities with greater than 70% confidence from live Twitter feed and displayed the locations of possible disasters with disaster intelligence. The rates of average precision, recall, and $F_1$-Score were measured to be 0.93, 0.88, and 0.90, respectively. Overall, the fully automated disaster monitoring solution demonstrated 97% accuracy. To the best of our knowledge, this study is the first to report location intelligence with NER, sentiment analysis, regression and anomaly detection on social media messages related to disasters and has covered the largest set of languages.

**Drawbacks:**

1. Inaccuracy in classifying a disaster related tweet
2. Limited support of language
3. Limited support of disaster types
4. Inaccuracy in identifying disaster location

6) **Project Title:** A Comparative Analysis of Machine Learning Techniques for Disaster-Related Tweet Classification

**Authors:**

1) Abhinav Kumar- Department of CSE, National Institute of Technology Patna, Patna, India
2) Jyoti Prakash Singh- Department of CSE, National Institute of Technology Patna, Patna, India
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**Abstract:**

Disaster-related tweets on Twitter during emergencies contain various information about injured or dead people, missing or found people, infrastructure and utility damage that can help government agencies and humanitarian organizations to priorities their help and rescue operations. Because of the huge volume of these tweets, it is essential to construct a model that can classify these tweets into different classes to better organize rescue and relief operations and save lives. In this paper, we have compared various conventional machine learning and deep learning algorithms for classifying disaster-related tweets into six different classes. The models are tested with four different disaster events such as hurricane, earthquake, flood, and wildfire to see the efficiency of the models. The range of F1-score varies from 0.61 to 0.88 for deep neural network-based models whereas it varies from 0.16 to 0.80 for the conventional machine learning classifiers. From this result, it is evident that the deep neural network models are performing significantly well in classifying disaster-related tweets even for imbalanced datasets.

**Drawbacks:**

1. Used only English language tweets for the classification task whereas during disaster several tweets are posted by the users in their regional languages. So a multi lingual system can be made or future work.
2. One other limitation is that for all the deep neural network-based model we performed the experiments with fixed batch size, learning rate, and optimizer.
3. Hyper-parameters can be tuned further to get better performance from the deep neural models.

7) **Project Title:** RoboCup Rescue: Search and Rescue in Large-scale Disasters as a Domain for Autonomous Agents Research.

**Authors:**

Kitano, H., Tadokoro, S., Noda, I., Matsubara, H., Takahashi, T., Shinjou, A., & Shimada, S. (n.d.).

**Abstract:**

Disaster rescue is one of the most serious social issue which involves very large numbers of hetergenious agents in the hostile environment. RoboCup-Rescue intends to promote research and development in this socially significant domain by creating a standard simulator and forum for researchers and practitioners. While the rescue domain intuitively appealing as large scale multi-agent domains, it has not yet given through analysis on its domain characteristics. In this paper, we present detailed analysis on the task domain and elucidate characteristics necessary for multi-agent systems for this domain.

**Drawbacks:**

1. RoboCup is designed to ensure smooth transfer of technologies developed in current RoboCup soccer, as well as promoting innovation by itself as it complements features missing in soccer.
2. RoboCup-Rescue has both simulation and real robot aspects, each of which initially focus on different aspects of overall activities.
3. This paper focused on overall strategy planning aspect using a simulation. As it is clearly illustrated, RoboCup-Rescue is a rich source of research, and direct contribution to the society is expected.

8) **Project Title:** Multi-task Multimodal Learning for Disaster Situation Assessment.

**Authors:**

Wang, T., Tao, Y., Chen, S.-C., & Shyu, M.-L. (2020).

**Abstract:**

During disaster events, emergency response teams need to draw up the response plan at the earliest possible stage. Social media platforms contain rich information which could help to assess the current situation. In this paper, a novel multi-task multimodal deep learning framework with automatic loss weighting is proposed. Our framework is able to capture the correlation among different concepts and data modalities. The proposed automatic loss weighting method can prevent the tedious manual weight tuning process and improve the model performance. Extensive experiments on a large-scale multimodal disaster dataset from Twitter are conducted to identify post-disaster humanitarian category and infrastructure damage level. The results show that by learning the shared latent space of multiple tasks with loss weighting, our model can outperform all single tasks.

**Drawbacks:**

1. In this paper, a novel deep learning framework is proposed based on multi-task and multimodal learning for social media disaster situation assessment. Furthermore, a loss weighting method is proposed to automatically adjust the loss weights for each task after every training cycle.
2. The proposed model is evaluated on a multimedia natural disaster dataset collected from Twitter, and the experimental results showed that multi-task multimodal learning can improve the model performance by simultaneously learning the related tasks. Moreover, the proposed automatic loss weighting method is able to further improve the model performance.
3. In future work, the loss weighting method can be improved by updating the loss weight after each training epoch, and our proposed method will be tested on non-disaster datasets.

**9) Project Title:** Distributed Event Detection in Wireless Sensor Networks for Disaster Management

**Authors:**
Bahrepour, M., Meratnia, N., Poel, M., Taghikhaki, Z., & Havinga, P. J. M. (2010).

**Abstract:**
Recently, wireless sensor networks (WSNs) have become mature enough to go beyond being simple fine-grained continuous monitoring platforms and become one of the enabling technologies for disaster early-warning systems. Event detection functionality of WSNs can be of great help and importance for (near) real-time detection of, for example, meteorological natural hazards and wild and residential fires. From the data-mining perspective, many real world events exhibit specific patterns, which can be detected by applying machine learning (ML) techniques. In this paper, we introduce ML techniques for distributed event detection in WSNs and evaluate their performance and applicability for early detection of disasters, specifically residential fires. To this end, we present a distributed event detection approach incorporating a novel reputation-based voting and the decision tree and evaluate its performance in terms of detection accuracy and time complexity.

**Drawbacks:**

1. For fast and accurate detection of disastrous events using WSNs, in this paper we propose a distributed event detection technique. Our proposed approach is based on detecting events using decision tree classifiers running on individual sensor nodes and applying a voting to reach a consensus among detections made by various sensor nodes. The motivation behind choosing decision trees is their simplicity and explicit form of expression as if-then-else rules that full fill the requirements posed by resource limitations of WSNs.
2. The experimental results on residential fire datasets show that this approach not only achieves a high detection rate but also has a low computational overhead and time complexity.

**10) Project Title:** Analysis of satellite images for disaster detection

**Authors:**
Amit, S. N. K. B., Shiraishi, S., Inoshita, T., & Aoki, Y. (2016)

**Abstract:**
Analysis of satellite images plays an increasingly vital role in environment and climate monitoring, especially in detecting and managing natural disaster. In this paper, we proposed an automatic disaster detection system by implementing one of the advance deep learning techniques, convolutional neural network (CNN), to analysis satellite images. The neural network consists of 3 convolutional layers, followed by max-pooling layers after each convolutional layer, and 2 fully connected layers. We created our own disaster detection training data patches, which is currently focusing on 2 main disasters in Japan and Thailand: landslide and flood. Each disaster's training data set consists of 30000~40000 patches and all patches are trained automatically in CNN to extract region where disaster occurred instantaneously. The results reveal an accuracy of 80%~90% for both disaster detection. The results presented here may facilitate improvements in detecting natural disaster efficiently by establishing automatic disaster detection system.

**Drawbacks:**

1. The input datasets (pre-disaster aerial image, postdisaster aerial image and ground truth for disaster detection) used in our research has been undergone alignment before training process. This is to ensure no misdetection occurred due to misalignment even though alignment of satellite images is a challenging task.
2. The datasets have similar color variation, mostly taken on sunny day. Combination of different color variation (sunny day, rainy day, snow etc.) will be a challenging task.
3. Pre-processing of the images before undergone training will be needed to increase the variation (able to detect precisely and robust to all kind of weather) and reliability of our disaster detection system.