

Review Paper:

The Role of GPT and Data Fusion in improving Disaster Prediction

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Abstract

The application of data fusion for disaster prediction using GPT (Generative Pre-trained Transformer) is covered in this study. Data fusion is the process of merging information from several sources including social media, sensor data, and simulation data, in order to increase the precision of catastrophe prediction models. Through the utilization of GPT, an artificial intelligence language model, data fusion enables a thorough examination and amalgamation of data from disparate fields, hence producing more resilient forecasts.

GPT models may be used to recognize geographical descriptions from social media postings and identify cell kinds using information about marker genes. Proactive communication with impacted people in times of catastrophe is made possible by the integration of GPT with social media monitoring. GPT models may significantly enhance disaster preparedness, response, prediction, and recovery by gathering pertinent data from many sources and modelling various situations.

Keywords: Disaster Prediction, GPT, Data Fusion, Social Media Integration.

Introduction

GPT stands for "Generative Pre-trained Transformer." It is a type of artificial intelligence language model developed by OpenAI. The GPT model is designed to understand and generate human-like text based on the patterns and information it has learnt from a diverse set of training data⁹. The GPT models are intended for challenges involving the creation and interpretation of natural language. A transformer neural network, which is skilled at identifying long-range relationships and contextualizing a given sequence of data such as a string of words in a phrase, is the key component of the GPT architecture. The model is pre-trained on a large corpus of diverse text data, enabling to learn grammar, facts, reasoning abilities, and even some aspects of world knowledge¹¹.

It is important to remember that there are many GPT versions and the version number corresponds to the model's size. For example, cut-off in January 2022, GPT-3 (Generative Pre-trained Transformer 3) was one of the largest language models built by OpenAI. It is the third

iteration. With 175 billion parameters, it is extremely strong and competent for a wide range of language-related jobs.

GPT models, particularly GPT-3, had gained widespread popularity and attention in the field of natural language processing (NLP)⁸. The popularity can be attributed to various factors, and it is important to note that the landscape may have evolved since then. Here are some aspects of GPT's popularity compared to other online web and application-based services in terms of user base, adaptability, and versatility. GPT models, including GPT-3, have garnered a large user base due to their accessibility through APIs⁸. Developers and businesses have integrated these models into various applications, expanding the reach of GPT-based services. The availability of OpenAI's API has facilitated broader adoption, enabling developers to leverage GPT's capabilities without the need for extensive expertise in natural language processing¹⁴.

GPT models are highly adaptable, allowing fine-tuning for specific tasks or domains⁶. This adaptability has led to their use in a diverse set of applications, ranging from chatbots and virtual assistants to content generation and language translation. The ability to fine-tune GPT models for specific use cases enhances their adaptability, making them suitable for a wide range of industries and applications. GPT models, with their pre-trained knowledge and language understanding capabilities, are versatile in handling various NLP tasks⁵. They can generate coherent and contextually relevant text across different domains. The versatility of GPT models has made them attractive for applications such as content creation, coding assistance, question-answering, and more.

In the similar note, GPT or similar language models can potentially play a role in predicting disasters by analyzing and interpreting textual data^{9,10}. By analyzing and interpreting textual data, GPT and other language models have the potential to enhance disaster prediction capabilities, leading to improved preparedness efforts and ensuring the safety and well-being of communities at risk³. Additionally, GPT or similar language models can also assist in disaster response and recovery by providing real-time information and guidance to affected individuals and organizations^{3,4}. These advancements in language models have the potential to revolutionize disaster management and mitigate the negative impacts of natural and man-made disasters.

Furthermore, GPT can be used to process and analyses real-time data from social media, news articles, and other online

sources to detect early warning signs of potential disasters¹⁰. GPT can help crisis management teams to make accurate forecasts and well-informed judgements by identifying keywords, trends, and sentiment analysis. Through the utilization of language models such as GPT, scholars and professionals may acquire significant knowledge from textual data to enhance disaster forecasting, readiness, reaction, and recuperation endeavors. Thus, the several applications of GPT in relation to planning and preparedness for disasters are examined in this research.

Integration of GPT in Early Warning System

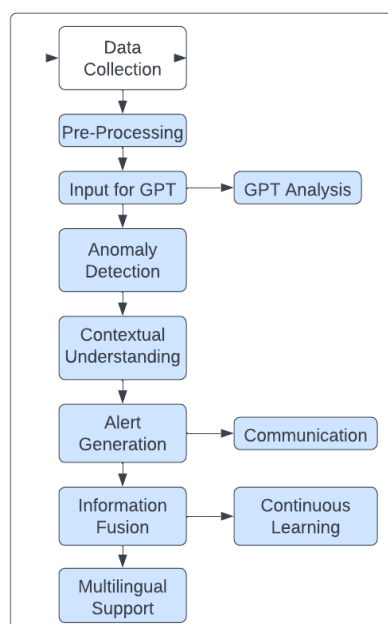


Fig. 1: Integration of GPT in Early Warning System

Integrating GPT (Generative Pre-trained Transformer) models with an Early Warning System (EWS) can enhance the system's ability to analyze and interpret textual data, providing valuable insights for disaster prediction and response^{10, 13}. The integration process is shown in fig. 1.

Data collecting is the process's initial phase. It is important to get textual information from a variety of sources including news stories, social media, Government reports, and weather updates. The information must be pertinent to the kinds of calamities that the early warning system seeks to forecast. To guarantee consistency and eliminate noise, the textual data must be cleaned and pre-processed at the pre-processing stage. After that, the text will be tokenized into appropriate units for examination.

The GPT model will receive pre-processed text as input. GPT is capable of analyzing the information, context, and linguistic patterns found in the data. GPT can be used to find patterns or abnormalities in the data that could point to a disaster's possibility. Anomaly detection techniques might include sentiment analysis, unusual word usage, or increased

keyword frequency. GPT is quite good in interpreting textual context. It can assist with the early warning system's interpretation of textual data, enabling more complex forecasts. GPT can help with alerts or notifications for impending calamities based on the analysis. The public, emergency services, and pertinent authorities can all get these warnings. Integrating the insights from GPT with other data sources such as sensor data or satellite imagery, will enhance the overall accuracy and reliability of the early warning system.

To enhance their prediction power and adjust to changing language trends, GPT models may be routinely re-trained on fresh data. By producing succinct and unambiguous messages for public dissemination, GPT may also be utilized to improve communication. This includes giving information on the type of crisis, safety guidelines, and evacuation protocols. Because of GPT's linguistic capabilities, the early warning system can interpret information from a variety of linguistic sources and handle multilingual data with ease.

It is crucial to remember that if GPT can be a useful tool, it should only be used in conjunction with an all-encompassing early warning system that uses a variety of technologies and considers a number of data sources for a well-rounded approach to catastrophe prediction and response. Furthermore, moral issues and the proper implementation of AI in vital applications like disaster relief prediction are crucial.

Social Media Monitoring by GPT to analyze Real Time Disaster Data

The use of GPT for real-time disaster data analysis through social media monitoring is a valuable approach in enhancing situational awareness and response efforts. By utilizing GPT for social media monitoring, disaster response teams can efficiently analyze real-time data to gain insights into the current status of the disaster, to identify affected areas to assess the severity of the situation, and to understand public sentiment and needs. This approach allows for timely decision-making and targeted resource allocation, ultimately improving the effectiveness of disaster response and management. By combining the power of GPT and social media monitoring^{2,12}, emergency agencies can leverage real-time data analysis to enhance disaster response efforts and to serve affected communities better¹.

This approach provides a more comprehensive understanding of the situation on the ground and enables quicker and more efficient responses, ultimately saving lives and minimizing damages. Additionally, the use of GPT in social media monitoring can facilitate the identification and containment of misinformation and rumors during a disaster^{2,10}.

By analyzing real-time social media data using GPT, emergency agencies can effectively identify false

information and counteract it with accurate updates. Furthermore, the integration of GPT with social media monitoring allows for proactive engagement with affected communities. Emergency agencies can use GPT-generated responses to provide timely and accurate information, address concerns, and offer support to individuals in impacted areas. The process of social media monitoring by GPT is shown in fig. 2.

First, real-time social media data on impending calamities must be gathered from many platforms including posts, tweets, and updates. The pre-processing stage guarantees data consistency. The GPT will get this pre-processed data in order to identify linguistic patterns. Subsequently, GPT will examine the information to comprehend the substance and setting of social media updates. GPT will eventually identify patterns or abnormalities in the language that could point to the impending tragedy. The linguistic pattern that

the GPT retrieved may also be used to determine the disaster's severity. If a major incident or disaster is indicated by the severity analysis, alerts or notifications will be produced. The information will be communicated to the relevant authorities, emergency services, and the public through appropriate channels.

Data Fusion by GPT for Disaster Prediction

The application of data fusion by GPT has shown promise in the field of catastrophe prediction. This methodology integrates data from several sources including social media, sensor data, and simulation data, to enhance the precision and dependability of catastrophe prediction models. Data fusion makes it possible to thoroughly analyse and synthesize information from several fields in order to provide more accurate and complete disaster forecasts by utilizing the power of GPT.

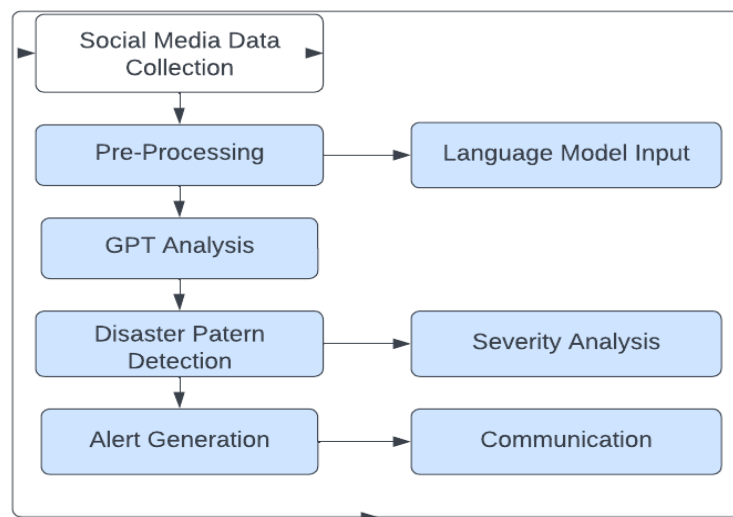


Fig. 2: Social media Integration with GPT

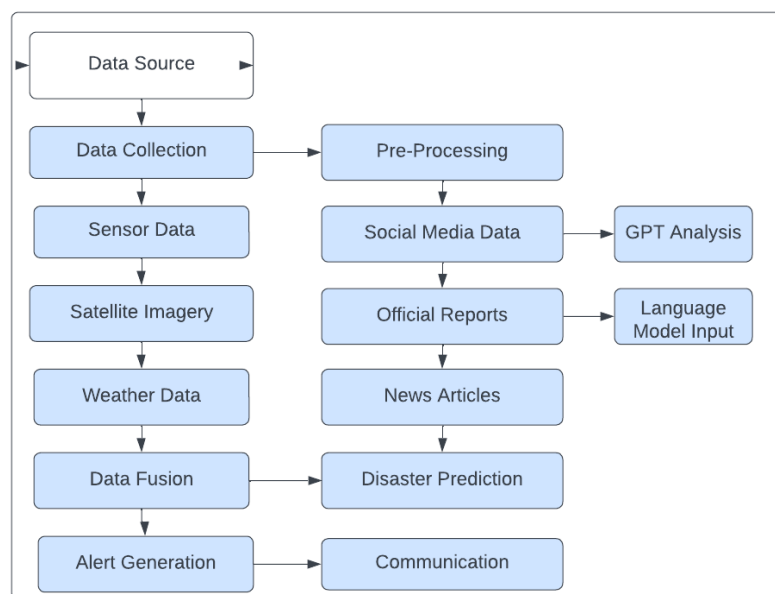


Fig. 3: Data Fusion by GPT for disaster prediction

By offering precise and timely forecasts, this method has the potential to completely transform disaster response operations by facilitating improved resource coordination and preparedness. With GPT's ability to generate human-like text based on user-provided contexts, it can effectively identify cell types using marker gene information^{6, 14}. Similarly, in the context of disaster response, GPT models can be utilized to recognize location descriptions from social media messages¹⁰. GPT models may be used to identify geographical descriptors from social media postings in the context of disaster response. In emergency circumstances or during natural catastrophes, for example, where standard methods of location identification may be limited or unavailable, this capacity is especially helpful.

Disaster response teams may increase efficiency and make better decisions based on fast and accurate information by utilizing the power of GPT models. Fig. 3 illustrates in a simplified flowchart fashion how GPT might provide data fusion for catastrophe prediction. Numerous sources of pertinent data for catastrophe prediction are included in the data source. This might include news stories, Government reports, satellite photos, social media postings, sensor data, and meteorological data. Data is gathered from each of these sources, and pre-processing is finished. Subsequently, GPT analysis is performed to examine linguistic patterns and contextual information found in unstructured data including news articles and social media messages.

GPT's analysis is used as input by language model input to incorporate unstructured text insights into the larger data collection. Next, information from unstructured (social media, news) and structured (sensor, weather) data sources is combined using data fusion. GPT's study can offer further background information and understanding. To provide more accurate catastrophe forecasts, machine learning models, statistical analysis, or other prediction techniques are applied to the fused data. After that, GPT will utilize the combined data from several sources to create alerts or notifications based on the predictions. These alerts will be sent via the proper channels to the public, emergency services, and the necessary authorities.

The use of GPT to unstructured text data analysis facilitates data fusion by offering a more sophisticated comprehension of linguistic patterns, sentiment, and context associated with possible calamities. When paired with structured data sources such as Government reports and sensor measurements, this can improve the overall prediction skills. It is critical to remember that the efficacy of this strategy is contingent upon the relevance and quality of the data, the precision of the prediction models, and the seamless incorporation of GPT insights into the larger data fusion procedure. Prioritizing ethical issues and the proper application of AI in catastrophe prediction is also necessary.

Public Awareness and Education on Disaster Preparedness by GPT: Natural or man-made disasters have

the power to devastate large areas and upend whole populations. It is impossible to exaggerate the value of public education and awareness campaigns in catastrophe preparedness. Even while they work well, traditional information-dissemination techniques could find it difficult to keep up with the quickly changing technological environment. Conventional methods of teaching people about disaster preparedness include distributing brochures, making public service announcements, and holding community workshops. Despite their value, these approaches could not provide the dynamic and tailored interaction required for the best retention of knowledge. Modern language models like GPT have shown impressive powers in language production and interpretation. GPT, which has been trained on a variety of datasets, has the potential to make a substantial contribution to the development of customized, contextually appropriate disaster preparedness material.

Use of GPT in Content Generation to enhance Public Awareness and Education: GPT can be harnessed to generate informative content on disaster preparedness topics including evacuation plans, emergency supplies, and safety guidelines. The model's ability to understand context ensures that the generated content is coherent and relevant⁴. GPT undergoes a two-step process: pre-training and fine-tuning. During pre-training, the model learns language patterns and context from a vast and diverse dataset. Fine-tuning allows developers to adapt the model for specific tasks or domains, enhancing its effectiveness in content generation for particular applications. GPT is autoregressive, meaning it generates text one word at a time, conditioning each word on the preceding context¹⁴. This autoregressive approach allows GPT to capture long-range dependencies and produce coherent and contextually rich content.

The strength of GPT lies in its contextual understanding⁷. It not only predicts the next word based on the given context but also maintains an internal representation of the entire input sequence. This enables GPT to generate text that is consistent and contextually appropriate. GPT is capable of creative text generation. It can go beyond mere repetition of learned patterns and produce novel and diverse content. GPT's pre-training involves learning to understand the structure and semantics of natural language⁶. This understanding allows it to generate text that not only follows grammatical rules but also captures the nuances of human language, making the generated content sound more natural and human-like⁶.

Researchers and developers can exert control over the content generated by GPT. Through careful design of prompts and techniques, they can guide the model to produce text that adheres to specific criteria such as a particular writing style, sentiment, or topic. The GPT architecture allows for model scaling by increasing the number of parameters. Larger models such as GPT-3 with 175 billion parameters, exhibit improved performance in various

language tasks and can generate more contextually rich and diverse content. GPT's versatility allows for the adaptation of content to different audiences, considering factors such as regional variations, cultural nuances, and language preferences.

Contextual Understanding and Message Clarity of GPT on Public Awareness and Education on Disaster Preparedness

GPT's contextual understanding ensures that the generated content aligns with the specific needs and circumstances of the target audience. This helps in delivering information in a way that resonates with individuals and communities. Public awareness and education on disaster preparedness require more than just the dissemination of information; it demands a nuanced understanding of the context in which this information is received⁷. GPT, with its advanced language processing capabilities, plays a pivotal role in enhancing both contextual understanding and message clarity in the realm of disaster preparedness. GPT excels in generating content that is contextually relevant. By analyzing vast datasets, it has learnt to adapt its language generation to specific situations and contexts. This capability allows disaster preparedness messages to be crafted with sensitivity to the unique needs, risks, and challenges faced by different regions and communities.

Disaster preparedness is inherently linked to cultural and regional nuances. GPT's ability to comprehend these subtleties ensures that the generated content respects cultural norms, addresses specific challenges, and is more likely to resonate with diverse audiences. GPT's adaptability enables it to respond dynamically to emerging situations. Whether it is a region-specific threat or a sudden change in environmental conditions, the model can incorporate real-time data to provide contextually relevant information, ensuring that educational content remains current and actionable⁴.

Communicating difficult ideas like evacuation protocols, emergency protocols, and risk assessments is a common part of being prepared for disasters. By reducing these ideas' complexity without compromising accuracy, GPT's language model can increase information accessibility for a wide range of users. GPT creates information that is clear and cohesive because of its training on a variety of language patterns. This is especially crucial in emergency scenarios as perplexity may quickly turn into fear. Effective communication during times of crisis is facilitated by the model's capacity to provide communications that are clearly logically organized and comprehensible. GPT understands that language is not a one-size-fits-all subject. Depending on who the target audience is, the model can modify its tone and style. Whether speaking with members of the public, first responders, or legislators.

GPT adapts its vocabulary to the situation at hand while preserving the message's relevancy and clarity. GPT can

help produce content that considers a variety of audiences and employs inclusive language. Reaching disadvantaged groups and making sure that educational resources are accessible to people with different levels of literacy and language competency, depend on this inclusion. The language processing capabilities of the model help to ensure that complicated ideas pertaining to disaster preparedness are expressed in an understandable and straightforward way.

Communication and Public Awareness on Disaster Preparedness by GPT: Disaster preparedness relies heavily on effective communication and widespread public awareness. In this era of advanced technology, integrating GPT into communication strategies offers a novel approach to tailor information, improve message clarity, and reach diverse audiences. GPT's proficiency in generating human-like text allows for the creation of informative and engaging content specifically tailored to disaster preparedness^{6, 7, 9}. The model can dynamically adapt its output to suit different audiences, regions, and cultural contexts, ensuring a personalized and effective communication approach. GPT's unique ability to understand and generate contextually relevant content plays a pivotal role in enhancing message clarity⁷.

GPT makes ensuring that information about disaster preparation is communicated in a way that is accurate and understandable to a variety of audiences by examining linguistic patterns and context. To increase outreach, the produced material may be shared via a variety of communication platforms. Websites, social media networks, smartphone apps, and conventional media channels can become effective channels for reaching specific audiences with messages. GPT has a more significant function than just disseminating information; by allowing two-way conversation, it promotes community participation. GPT-powered chatbots can respond to inquiries, offer real-time information, and interact with the public to encourage community involvement in disaster preparedness initiatives. GPT's multilingual capabilities support diversity and accessibility.

Multiple language content generation ensures that linguistic variety will not be a barrier in comprehending important information about catastrophe preparedness. During catastrophic scenarios, GPT's real-time data analysis and comprehension capabilities may be leveraged to provide warnings and updates. By doing this, the public is guaranteed to obtain pertinent and timely information which improves their capacity for effective response. User privacy and ethical ramifications must be carefully considered before integrating GPT into emergency communication plans.

To gain the public's trust, a balance must be struck between the advantages of cutting-edge AI and the appropriate use of sensitive data. Iterative feedback mechanisms in conjunction with regular updates and continual refinement of GPT

models allow the system to adjust over time to changing communication demands, new dangers, and shifting language patterns.

Because of GPT's multilingual capabilities, it is easier to create material in many languages which reaches a wider range of people and guarantees inclusion in public awareness campaigns. Engaging with various populations may be approached in a new way with the inclusion of GPT into public awareness and communication campaigns about disaster preparation. We can develop a more comprehensive, contextually appropriate, and successful communication plan by utilizing GPT's language processing skills. In the end, this will help to build a society that is more equipped and resilient to unanticipated crises.

Disaster Risk Assessment by GPT

Although GPT models, such as GPT-3, are not primarily intended for disaster risk assessment, they may be applied in conjunction with other methods to collect, process, and provide disaster risk-related data. GPT models may be used to extract pertinent information about impending or current disasters from vast amounts of textual data including news articles, reports, and social media updates. They can generate concise summaries of the extracted information, providing a quick overview of the situation. GPT models can understand and interpret natural language queries, making them useful for processing user inquiries related to disaster risk assessment⁹. They can answer questions, provide context, and assist in decision-making by extracting relevant information from diverse sources. By training GPT models on historical data related to disasters, they can be used to predict potential risk factors for specific regions or scenarios.

GPT models can simulate different disaster scenarios and help to assess the potential impact on communities and infrastructure. GPT models can generate human-like responses for communication purposes, aiding in the creation of public awareness campaigns and messages related to disaster preparedness. They can assist in crafting clear and informative messages for dissemination through various channels⁵. Large datasets may be analyzed using GPT models to find patterns and trends that could serve as indications of impending catastrophe risk. They can help identify early warning indicators and elements that contribute to the occurrence of catastrophes.

In order to help emergency responders and legislators make educated choices during catastrophes, GPT models may be included into decision support systems. Based on the examination of real-time data, they are able to offer suggestions and context-aware information. It might be argued that even if GPT might not evaluate catastrophe risk directly, integrating it with the current system will improve the system's ability to do so. Integrating GPT with existing system will provide valuable insights and guidance for mitigating potential risks and ensuring the safety of

communities. Through the analysis of various risk factors and their potential impacts, the disaster risk assessment conducted by integrated GPT system will aid in identifying vulnerable areas, understanding the underlying causes of disasters, and formulating effective strategies for risk reduction and response⁴. Through the integration of data from several sources, including socioeconomic characteristics, climatic forecasts, and historical disaster information, the GPT Disaster Risk Assessment will offer a thorough picture of the possible dangers that a certain town or area may face.

Then, with this information, decision-making procedures may be improved by setting infrastructure investment priorities, creating emergency response plans, and putting resilience-boosting measures into action. Additionally, the GPT Disaster Risk Assessment will support the creation of national and regional disaster management policies.

To successfully plan and implement actions to prevent future disasters, it is imperative to accurately identify and analyze risks. Decision-makers may strategically deploy resources and make well-informed decisions to reduce vulnerabilities and improve readiness for disasters by utilizing the comprehensive GPT disaster risk assessment. The ultimate objective is to advance sustainable development while building a society that is safer, more resilient, and capable of withstanding and recovering from natural calamities. Ensuring the safety and resilience of communities in the face of future catastrophes and implementing effective risk reduction measures depend on an accurate evaluation of disaster risks utilizing GPT's approach. Using GPT's robust risk assessment tools, decision-makers can strategically deploy resources and make well-informed decisions to reduce vulnerabilities and improve readiness for disasters. Furthermore, the GPT disaster risk assessment will contribute to the development of disaster management policies at regional and national levels

Conclusion

In comparison to other AI language models, GPT models like GPT-3 offer a number of benefits for text production including the capacity to comprehend context, develop original material, maintain control over the content that is generated, be versatile and adaptable, have a broad user base, and be easily accessible.

Because GPT models are good at understanding context, they may produce content that is both logical and pertinent to the situation. Their ability to maintain an internal model of the complete input sequence and grasp long-range relationships leads to more relevant and accurate text creation. GPT models are capable of producing unique and varied information in addition to just repeating previously learnt patterns. They can produce writing that adheres to grammatical rules and captures the subtleties of human language because they have been trained to comprehend the structure and semantics of natural language. Content

produced by GPT models is subject to control by researchers and developers.

By carefully crafting prompts and procedures, users may direct the model to generate content that satisfies particular requirements such as a specific topic, writing style, or mood. GPT models may be adjusted for certain tasks or domains and are quite flexible. Their versatility enables their use in an extensive array of uses, encompassing chatbots, virtual assistants, content creation, and language interpretation. Because GPT models are accessible through APIs, a significant number of users have adopted them, notably GPT-3. These models are simple for developers and companies to incorporate into their apps, increasing the accessibility of GPT-based services.

GPT models may be demonstrated to be useful instruments in the realm of catastrophe preparedness. Their capacity for language processing aids in the accessibility and clarity of messages, making instructional materials easily comprehended by people with a range of literacy and language competence levels. GPT models may also improve communication by producing succinct and understandable messages for the general public and provide crucial details regarding the types of catastrophes, safety precautions, and evacuation routes. GPT models may also help in prediction and decision-making by pulling pertinent data from a variety of sources and modelling various situations. GPT models can provide a wide range of contextually relevant knowledge which might significantly enhance catastrophe preparedness, response, recovery, and prediction.

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