Venue: 48th Annual Climate Diagnostics and Prediction Workshop & the **21st Annual Climate Prediction Applications Science Workshop.**
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- **Theme 4: Bridging climate forecasts and application in support of a Climate Ready Nations for service delivery**
- Tools and techniques that bridge climate forecasts with climate applications and service delivery in support of a Climate Ready Nation, including methods to foster resilience to impactful weather, water, and environmental hazards, including drought, floods, extreme heat, and fire weather.

Title: Generative AI Enabled Disaster Scene Computing for Climate Risk-Informed Communication

Keywords:

For the public to be climate-ready and for stakeholders to make informed decisions together to achieve a climate-resilient nation, it is crucial to communicate climate risk comprehensively. The advent of generative AI (GAI) brings a significant opportunity to broaden climate risk-informed communication, and one possibility is to use both climate forecast information and data from past climate events (e.g., disasters) to produce tailored climate risk content.

This talk will explore the feasibility of GAI tools (GPT4, Gemini, etc.) to generate disaster content based on climate forecast information (e.g., expected more frequent extreme storms). We will demonstrate two-way generations with a focus on severe tornadoes. In one way, we revealed that given input images with tornado disaster scenes from past tornado events, the GAI tool can provide excellent captions and/or descriptions, showing a human-like understanding of built objects, granular features of housings, vehicles, and other visual features, and how they are affected or damaged by the tornado events. The tool promises to have an acceptable understanding of damage levels associated with the EF scales. With such performance, we argue that the communities can benefit from using GAI to accelerate post-disaster response or using disaster scene data to enhance pre-disaster preparation. For instance, insurance agencies can use GAI tools to automate disaster loss generation. In another way, considering that the GAI tool understands the EF scales and their descriptions, GAI tools were used to generate community scenes with residence buildings and structural damage. At various EF scales based on user requests, the results show significant randomness in visual patterns of damage. In many cases, the results display the pareidolia effect, i.e., hallucinated rendering of tornado disaster scenes, implying its limitations in zero-shot learning capabilities in a textual-to-visual generation.

These contradicting results underscore the research gap in generating physics-informed climatic disaster scenes for objective risk communication. We state that the possibility of generating misinformation and disinformation using GAI can not only influence the climate-sensitive decisions of stakeholders but also exacerbate the vulnerability of the same communities that need to be prepared to reduce climate impacts. Considering the fast-advancing GAI technologies and domain-knowledge-enabled AI, which may mitigate the research gap, the legal and ethical implications need to be examined from different user and stakeholder perspectives. We argue that human experts should be in the loop who oversee content generation, including correcting and tuning the AI models in the flight and making the final call on the objectiveness of generated content.

Short version:

To achieve a climate-resilient nation, it is crucial to communicate climate risk comprehensively. The advent of generative AI (GAI) brings a significant opportunity to broaden climate risk-informed communication, and one potential is to use both climate forecast information and data from past climate events (e.g., disasters) to produce tailored climate risk content. This talk will explore the feasibility of GAI tools (GPT4, Gemini, etc.) to generate disaster content based on climate forecast information (e.g., expected more frequent extreme storms). We will demonstrate two-way generations with a focus on severe tornadoes. First, we revealed that GAI tools can provide accurate descriptions for input images with tornado disaster scenes from past tornado events, showing a human-like understanding of complex disaster scenes. With such performance, we argue that the communities can benefit from using GAI to accelerate post-disaster response or to enhance pre-disaster preparation. Second, at various EF scales based on user requests, GAI tools show significant randomness in generating visual damage patterns. In many cases, the results display the pareidolia effect, i.e., hallucinated rendering of tornado disaster scenes, implying its limitations in zero-shot learning capabilities in a textual-to-visual generation.

We state that the possibility of generating misinformation and disinformation using GAI can not only influence the climate-sensitive decisions of stakeholders but also exacerbate the vulnerability of the same communities that need to be prepared to reduce climate impacts. Considering the fast-advancing GAI technologies and domain-knowledge-enabled AI, which may mitigate the AI hallucination effect, the legal and ethical implications must be examined from different user and stakeholder perspectives. We argue that human experts who oversee content generation should be in the loop, including correcting and tuning the AI models in the flight and making the final call on the objectiveness of generated content.