Scientists develop AI models able to predict future drought conditions with high accuracy

AI is slated to alleviate disastrous effects of drought and its aggravating economic and social consequences

SHARJAH, UNITED ARAB EMIRATES, September 19, 2024 / EINPresswire.com/ -- Scientists say they have developed new AI models with the ability to predict future drought conditions with almost unerring accuracy.

Their research, published in the journal Scientific Reports, highlights the substantial advantages of using AI models over conventional drought indices in predicting the causes and onslaught of conditions leading to scarcity of rain and water. (The study can be found at: https://www.nature.com/articles/s41598-024-70406-6)

“The results were promising. The AI models were able to predict future drought conditions with high accuracy. The AI models demonstrated strong correlations with multiple drought indicators and consistently outperformed existing indices, said Dr. Mohamed Abdallah, University of Sharjah’s Associate Professor of Civil Engineering, and the study’s lead author.

The authors attribute the absence of reliable drought forecasts to the complex nature of the phenomenon and varying hydroclimatic conditions. Credit: Pixabay/CCO Public Domain

“This breakthrough holds critical implications for securing economic stability and environmental resilience in arid regions increasingly threatened by climate change.” Credit: Pixabay/CCO Public Domain

The research's significance lies in its potential to enable authorities to monitor the drought and provide proper response strategies. The authors integrated AI into drought prediction, providing what they present as more reliable forecasts than hitherto available.

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They write, "As a result of the inherent complexity of drought phenomena and hydroclimatic condition differences, no universal drought index is available for effectively monitoring drought across the world. Therefore, this study aimed to develop a new meteorological drought index to describe and forecast drought based on various artificial intelligence (AI) models."

The authors underscore in their study the limitations of traditional drought indices. To identify these drawbacks, they trained several advanced artificial intelligence (AI) models using historical climate data and soil moisture levels to enhance drought prediction accuracy.

"We compared the developed AI-based indices with multiple conventional drought indices based on their correlations with various drought indicators. Our AI models proved to be particularly efficient in capturing extreme climatic changes, with enhanced forecasting accuracy," said Dr. Abdallah.

"This capability is vital in regions where increasing water scarcity and more severe climatic fluctuations pose significant challenges. Our AI models can help in planning water resources more efficiently and mitigating the impacts of droughts on ecosystems.

"Implementing this data-driven approach is especially important as it allows for better adaptation to the challenges posed by climate change, particularly in regions most susceptible to its effects."

The research substantiates that AI can be a powerful tool in drought assessment, potentially paving the way for more effective and proactive management strategies on how to combat water scarcity.

"Overall, the findings proved that soft computing models could be considered robust approaches for the rapid and accurate modeling of drought," the authors write. "This paper presented novel high-performing drought indices that can provide decision-makers with a reliable tool for drought management and monitoring."

Dr. Abdallah said the findings he and colleagues arrived at were not merely theoretical but carried considerable implications. "These advancements are not merely academic; they represent a transformative step toward revolutionizing drought preparedness and response, ensuring communities can better withstand and adapt to the evolving climate realities.

“The significance of this project lies in its potential to revolutionize drought management practices. By providing more accurate and timely predictions, the developed AI-based drought indices can help policymakers, rural planners, and farmers make better-informed decisions, potentially mitigating the adverse effects of droughts on agriculture and water resources.”

“For the Middle East, for instance, where water resources are precariously poised, the ability to predict and mitigate drought impacts can steer the region away from potential socio-economic and geo-political crises and promote stability in agricultural output and water management,” said Abdulrahman Abdeljaber, a research assistant at the University of Sharjah’s Department of Civil and Environmental Engineering, and a co-author.

“This breakthrough holds critical implications for securing economic stability and environmental resilience in arid regions increasingly threatened by climate change.”

The research develops a methodology that can be tailored for the specific needs of different regions in accordance with the available climate and environment data. “This approach provides practical implications by enhancing drought monitoring systems, which enable earlier warnings. Such advancements allow governments and farmers to optimize water usage and storage strategies during dry spells.”

The innovative AI tool the authors develop is even designed to aid in better resource allocation, agricultural planning, and disaster management, ensuring that water and food security are not compromised as climate changes intensify.

The tool has the capacity of providing early warnings and more precise data, empowering arid regions to effectively prepare for and address the harsh realities of climate-driven drought.

The study’s lead author Mhamd Oyounalsoud, a research assistant at the University of Sharjah’s Department of Civil and Environmental Engineering, said the study was testimony of AI being an efficient tool for drought assessment and monitoring, furnishing experts with means to adopt “mitigation strategies in water-scarce regions.”

AI-based drought indices like the ones the authors develop are projected to enable more optimized water management strategies, which are crucial for maintaining food security particularly in a world in the throes of a severe climate crisis.

“By integrating AI into drought monitoring, we offer a transformative approach that enhances decision-making in resource allocation, critical for regions facing persistent water scarcity,” said Dr. Abdullah Yilmaz, a senior lecturer at the Australian La Trobe University’s School of Computing, and a co-author.

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