Chapter 20
Survey on DL Methods for Flood Prediction in Smart Cities

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ABSTRACT

The government has focused to maintain the needs of the populace's health and hygienic standards; numerous initiatives are involved, such as flood forecasting, water management, and sewage management. To prevent damage throughout the city, flood prediction must be done early on. "Smart" refers to artificial intelligence or machine learning methods, either directly or indirectly. To comprehend the general pattern and depth of the rainfall and to forecast the occurrence of floods, artificial intelligence techniques like deep learning are applied. To extract key properties for forecasting heavy rains and floods, many deep learning approaches, including CNN and deep belief networks, are applied. As a result, there is less harm done to both city infrastructure and human life. The study done on flood forecasting utilizing AI, ML, and deep learning techniques will be covered in this chapter. This review research will provide a thorough analysis based on the many types of deep learning models, the input datatypes for forecasting, the model effectiveness, real-time application, etc.

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INTRODUCTION

Natural catastrophes have caused extensive harm to both the infrastructure and the mortality rate. The majority of the time, early warning and forecasting of catastrophic tragedies are needed to preserve lives nearby. These calamities include floods, earthquakes, etc. It is simple to limit the harm caused to people by doing pre-flood scans in any place. Flood control management needs to analyze the data at the earliest to reduce the harm caused. To manage and process enormous amounts of data, artificial intelligence algorithms are deployed. Whether it is texts, integers, or image data, this data can be of any data type. Any difficulty relating to data processing can be resolved using AI approaches. This is the cause of the boom in AI across many sectors, including the medical, e-commerce, disaster management, and data mining industries. Any sort of data may be understood by AI, which can also learn from its parameters and visualize and forecast outcomes. By studying the historical data records of the various disasters, prediction for disaster management may be carried out. The ability of AI to learn from historical data sets and forecast future disasters is made possible by its supervised and unsupervised learning capabilities.

The numerous ML/DL architectures created by researchers for precise flood prediction are shared in this article. The article is organized in the following subsections: background, related works, conclusion, and future scope.

BACKGROUND

The outputs of artificial intelligence technology have always been cutting edge. Pattern recognition, detection, segmentation, reconstruction, and prediction are the main uses of these approaches. The major issue is deciding which class of AI approaches to apply to which kind of data. For instance, SVM, logistic regression, CNNs, and GANs can be utilized for object detection, segmentation, augmentation, and reconstruction, as well as for pattern matching and prediction. Deep learning is the subset of Artificial intelligence and machine learning that imitates human behavior by essentially creating a network of multiple layers based on the knowledge it has in the form of data. CNN, Convolutional Neural Network, is a neural network that is used to identify images and objects. In deep learning, it is widely used to get image identification and classification. Another extremely important artificial neural network is the generative adversarial network (GAN). GAN is used to replicate training data and create similar instances. For example, if we have the MRI scans of a human, the GAN can create a more similar sort of photograph that would look like a real MRI scan, but it won't belong to any human as it is created by the computers. These types of models can be very useful when the training set data is limited. The flood can be considered one of the most damage-causing natural disasters. During a flood, a massive amount of water enters the dry area of land and submerges the habitation in that area.

LITERATURE REVIEW

Deep learning models have been proven to be very effective in various different sectors for example healthcare, business analysis, agriculture, food, etc. and as these industries have advanced the technology has also been improvised a lot and vice versa. Deep learning techniques are now also being used to help predict natural disasters like earthquakes, wildfires, cyclones, floods, etc. Flood prediction using deep