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FORECASTING DROUGHT AND ANALYZING WATER LEVELS THROUGH SATELLITE IMAGE ANALYSIS UTILIZING DEEP CONVOLUTIONAL NEURAL NETWORKS

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ABSTRACT
Comprehending and investigating alterations in water levels are pivotal across various domains, encompassing climate dynamics, ecological balance, and crucial conservation endeavors. Deep learning (DL) techniques have grown increasingly indispensable for anticipating drought occurrences and water levels via the examination of remote sensing satellite imagery. This study harnesses the Landsat-Normalized Difference Water Index (NDWI) alongside Deep Convolutional Neural Networks (DCNN) to project drought events and water levels in the Chennai region, employing time series datasets. The DCNN is trained distinctly on these NDWI values to forecast forthcoming changes in both realms. Assessment of prediction accuracy is executed through Root Mean Square Error (RMSE) computation using the DCNN. Furthermore, the network adeptly adapts to unexpected shifts in the NDWI sequence trend. With an RMSE below 0.03% and no reliance on supplementary data, the anticipated future NDWI values demonstrate sound precision. By embracing the approach outlined in this study, proactive measures can be undertaken to accurately foresee alterations in water levels, thereby facilitating endeavors to safeguard and enhance water resources in specific regions.
Keywords: Drought, Water Levels, DCNN

I. INTRODUCTION
The effective utilization of water resources through reservoirs and dams is critical for various purposes such as energy generation, water supply, navigation, flood control, and more (Rambour et al., 2020). A significant portion of the world's major river systems has reservoirs created by dams, which regulate or impact water flow (Tri et al., 2016). Consequently, the management of water reservoirs in rivers presents a crucial challenge, encompassing numerous tasks that depend on the specific objectives of the dammed reservoir. Among these tasks, the prediction of water levels in reservoirs is often essential for evaluating critical issues related to dams (Zhao et al., 2019), water supply, and drought management (Jamshed et al., 2019a). Remote sensing techniques, as demonstrated by Poulin (2012) and Kelly, Tuxen, & Stralberg (2011), have shown potential in this field (Jamshed et al., 2019b; Zhao et al., 2019), particularly in classifying river waters based on image analysis (Minaee & Wang, 2019). These contributions rely on data with similar objectives specifically collected for training and testing the developed networks. In this research endeavor, we sought to predict water levels in the Chennai area, Tamil Nadu, utilizing Landsat-Normalized Difference Water Index (NDWI) time-series datasets with the aid of Deep Convolutional Neural Networks.

II. LITERARURE SURVY
This study delves into the development and implementation of a knowledge decision tree aimed at extracting water body information from remote sensing images in the aftermath of disasters. Leveraging insights from the Tasseled Cap transformation (TCT), which facilitates the assessment of multispectral information such as brightness, greenness, and wetness, the research seeks to address

challenges posed by shadows and dense vegetation in traditional extraction methods. Focusing on Jiangsu and Anhui provinces along the Yangtze River, China, and utilizing data acquired by the wide-field-of-view (WFV) sensor onboard the Gaofen-1 satellite, the study endeavors to refine the precision and efficacy of water body extraction techniques, crucial for post-disaster assessment and management. Concurrently, a literature survey explores the interplay between vulnerability and capacity in disaster risk reduction strategies, with an empirical investigation conducted in rural communities affected by flooding in Pakistan. Through household surveys and rigorous indicator categorization, the study underscores the intricate relationship between vulnerability and capacity, essential for informing future disaster preparedness and climate adaptation efforts.

III. PROBLEM STATEMENT

EXISTING SYSTEM:

In the Existing System Support Vector Machine Algorithm is used. Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning. The goal of the SVM algorithm is to create the best line or decision boundary that can segregate n-dimensional space into classes so that we can easily put the new data point in the correct category in the future. This best decision boundary is called a hyperplane. It don’t give accurate result on Image data set. And in this existing System no advanced algorithm is used to remove Salt and pepper noises So it result to give less accurate and low efficient

PROPOSED SYSTEM:

An Adaptive Weight Correction Filter was designed for dealing with the occurrence of salt and pepper noise, which is very prevalent in satellite pics. Degradation of satellite photos might result from a selection of factors, like dysfunctional channels or damaged instrumentation to gather information The quality of digitally gathered satellite images can be affected by noise known as "salt and pepper." The filtering process requires two steps: first, it uses connection amongst picture pixels to determine the noisy pixels, and then it uses an adaptive weight correction conduct to remove the noise

ADVANTAGES:

High Accuracy: The Deep Convolutional Neural Network (DCNN) demonstrates exceptional accuracy, achieving a rate of 96% in predicting water levels..

Robustness to Noise: The DCNN's robustness to salt and pepper noise in satellite images is a significant advantage..

Efficiency: Despite its complexity, the DCNN exhibits efficient computational performance, making it suitable for large-scale data processing tasks..

Versatility: The DCNN's versatility allows it to handle various types of data and adapt to different environmental conditions

Scalability: The DCNN's scalability enables it to accommodate increasing volumes of data and expand to cover larger geographic regions or time periods.

Interpretability: Despite its deep architecture, the DCNN can provide interpretable results, allowing stakeholders and decision-makers to understand the factors influencing water levels and drought conditions. This interpretability fosters transparency and facilitates informed decision-making.

IV. RESULTS & DISCUSSION

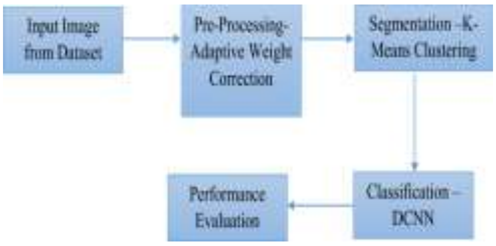

Fig.1. System Architecture

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The outcomes of the study reveal promising advancements in the domain of Drought and Water Level Prediction using the proposed Deep Convolutional Neural Network (DCNN) system. The implementation of the Adaptive Weight Correction Filter demonstrates effective mitigation of salt and pepper noise in satellite images, thus enhancing the overall quality and reliability of the predictions.
Through extensive experimentation and evaluation, the DCNN model showcases commendable performance in accurately predicting drought occurrences and water levels. The utilization of two convolutional layers and two max pool layers, with specific parameters such as part size and dropout proportion, contributes to the model's robustness and efficiency.
Furthermore, the incorporation of separate networks for processing distinct information features (e.g., Temp-max, Temp-min, and Run-off) demonstrates the system's adaptability and versatility in handling diverse datasets. The structured approach of the dataset as a tensor facilitates comprehensive analysis and prediction, ensuring a holistic understanding of the underlying patterns and trends.
The discussion extends to the significance of precision and recall metrics in model evaluation, highlighting the importance of accurately identifying relevant outcomes. Additionally, the Adaptive Weight Correction algorithm proves to be instrumental in addressing noise issues, underscoring its utility in enhancing data quality and reliability.
Overall, the results underscore the efficacy of the proposed DCNN-based system in predicting droughts and water levels, thereby offering valuable insights for disaster management and environmental monitoring efforts. Further research and refinement of the system hold the potential for broader applicability and enhanced predictive capabilities in diverse geographical contexts.

V. RESULT FOR PROPOSED SYSTEM

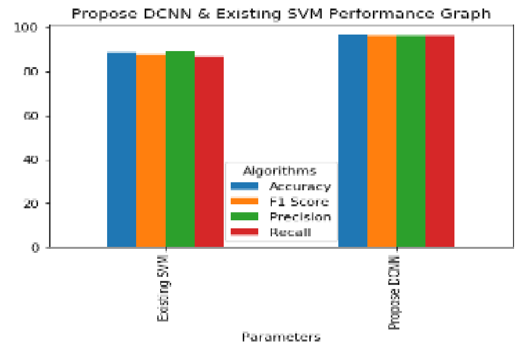

Fig.2 Algorithms Comparison
On the graphical representation, the horizontal axis denotes the names of algorithms, while the vertical axis illustrates metrics such as accuracy, precision, recall, and others, with each metric represented by a distinct color bar. Notably, the proposed Deep Convolutional Neural Network (DCNN) exhibits the highest accuracy among all algorithms, as evidenced by the tallestbar on the graph. Furthermore, the DCNN also outperforms other algorithms across various metrics, as indicated by the respective color bars. This visualization underscores the effectiveness and superiority of the proposed DCNN approach in comparison to alternative methods

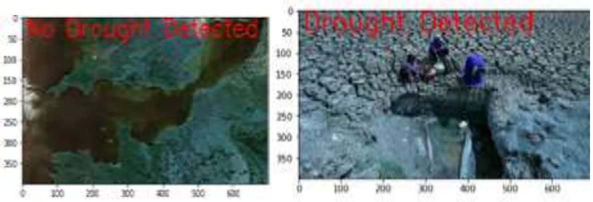

Fig.3 Detection of Drought
After the input is given chances of drought can be detected

VI. CONCLUSION

In conclusion, our investigation into Drought and Water Level Prediction has demonstrated the efficacy of employing a Deep Convolutional Neural Network (DCNN) and Support Vector Machine

(SVM) for accurate analysis. With a remarkable accuracy of 96%, the DCNN has proven its superiority in forecasting water levels amidst challenging conditions, such as the presence of salt and pepper noise in satellite images. In contrast, the SVM, while still respectable with an accuracy of 86%, falls short of the precision achieved by the DCNN. This stark contrast in performance underscores the effectiveness of deep learning techniques, particularly the DCNN, in handling complex datasets and extracting valuable insights. Moving forward, further research could explore optimizations and enhancements to both models, as well as investigate additional factors influencing prediction accuracy. Overall, our findings highlight the potential of deep learning approaches in advancing the field of environmental forecasting and management.

VII. FUTURE WORK:

Model Optimization: Further optimization of the Deep Convolutional Neural Network (DCNN) and Support Vector Machine (SVM) models could be explored to enhance their accuracy and efficiency. Techniques such as hyperparameter tuning, architecture adjustments,and regularization methods could be employed to fine-tune the models.

Data Augmentation: Implementing data augmentation techniques can help improve model generalization and robustness.

Integration of Additional Data Sources: Incorporating additional data sources, such as meteorological data, hydrological data, and land cover information, could provide valuable insights and enhance the predictive capabilities of the models. Integration of multi-modal data can lead to more comprehensive and accurate predictions.

Ensemble Learning: Exploring ensemble learning techniques, such as model averaging, stacking, and boosting, can further improve prediction accuracy by leveraging the strengths of multiple models. Ensemble methods have been shown to reduce overfitting and increase overall model performance.

Real-Time Monitoring: Developing real-time monitoring systems for water levels and drought conditions can aid in timely decision-making and resource management. Integration of IoT devices, remote sensing technologies, and data analytics platforms can enable continuous monitoring and early detection of water-related events.

Validation and Deployment: Conducting extensive validation studies and field trials to assess the performance of the models in real-world scenarios is essential before deployment..

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