**TEXT SUMMARIZATION FOR WEATHER FORECASTING USING MACHINE LEARNING**

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***Abstract***— This collection of research papers delves into the synergy between weather forecasting and machine learning, offering a diverse spectrum of insights and applications. The studies encompass a range of objectives, from enhancing text summarization techniques to revolutionizing weather predictions using deep learning models. Moreover, the authors employ a variety of datasets, including weather data, to develop and evaluate their models. These papers provide a comprehensive overview of the innovative approaches, advantages, and limitations within the intersection of machine learning and weather forecasting, with significant implications for meteorology, energy management, and natural language processing research.

# **INTRODUCTION**

# The use of machine learning in weather forecasting is an example of a rapidly developing field in science and technology. This anthology of research articles delves deep into the myriad ways in which these two disciplines are converging, exploring the advantages, drawbacks, and data sets that are integral to this phenomenon. This collection of papers covers a wide range of topics, from improving text summarization approaches to applying deep learning techniques to the field of weather prediction. Problems in natural language processing, renewable energy, and meteorology are just a few of the many that are tackled. This project aims to give a comprehensive analysis of the evolving intersection of data-driven approaches and meteorological inquiry, which has the potential to significantly advance our ability to understand and predict weather occurrences.

# **LITERATURE SURVEY**

**1. Learning to Summarize Time Series Data (Sowdaboina, P. K. V., Chakraborti, S., & Sripada, S., 2014)**

Goal: This study centers on the process of content selection for summarizing time series data through the utilization of Machine Learning methodologies. The objective of this study is to determine the optimal level of abstraction for summarization, which is a critical component in the development of automated natural language generation (NLG) systems.

Advantages: The application of Machine Learning is employed to derive rules for the purpose of text summary. The proposed approach has the potential to emulate human summarizing techniques. This study assesses various methodologies using a parallel corpus comprising weather forecast text and numerical weather prediction data.

Limitations: The conclusions of this study may not generalize to other types of data due to its narrow focus on time series. When attempting a summary, it may be difficult to pick up on nuanced linguistic nuances. Only data from weather forecasts will be used in the evaluation.

Datasets: Parallel corpus of human-generated weather forecast text corresponding to numerical weather prediction data.

**2. Summarization of Text and Image Captioning in Information Retrieval Using Deep Learning Techniques (Mahalakshmi, P., & Fatima, N. S., 2022)**

Goal: In order to construct a comprehensive model for information retrieval and text summarization, incorporating image captioning, it is imperative to employ deep learning techniques. The objective of this model is to enhance the efficacy and precision in the process of summarizing textual content and creating descriptions for images.

Advantages: This study employs deep learning methodologies for the purposes of information retrieval and text summarization. This study encompasses both text and image summarization. Demonstrates exceptional levels of precision, memory, and F-score during evaluations.

Limitations: It's possible that deep learning will require a lot of processing power. Depending on the complexity of the textual and visual aspects, the model's performance may vary. The field of information retrieval is directly affected.

Datasets: Giga word corpus and DUC corpus for evaluation.

**3. Automatic Amharic Text Summarization Using NLP Parser (Mekuria, G. T., & Jagtap, A. S., 2017)**

Goal: The objective is to create a domain-specific Amharic text summary system that incorporates both extractive and abstractive summarization techniques, for single and many documents.

Advantages: In this study, we examine the problem of summarizing texts written in Amharic. This method combines features of both extractive and abstractive summarization techniques. Sentence evaluation is performed using the PageRank algorithm.

Limitations: Restricted to use of the Amharic language only. These results may have limited applicability to languages other than English. Texts, as opposed to other forms of media, are the primary focus of the review.

Datasets: Utilizes text documents in Amharic language.

**4. A Survey of Recent Techniques in Automatic Text Summarization (Dhanya, P. M., Sreekumar, A., & Jathavedan, M., 2018)**

Goal: This paper presents an overview of recent advancements in the field of artificial text summarization, with a focus on extractive and abstractive techniques.

Advantages: This study presents a thorough analysis of recent research developments in the area of text summarization. The various methods of summarization used in this paper are extensive. This research focuses on the real-world applications of a wide range of technologies, including search engines and news summaries.

Limitations: Reviews previous approaches rather than presenting any new ones. It's possible that in-depth technical details on particular procedures are lacking. emphasizes summarization in general rather than any particular dataset.

Datasets: No specific datasets used as it's a survey paper.

**5. Weather Forecasting Using Machine Learning Algorithm (Singh, N., Chaturvedi, S., & Akhter, S., 2019)**

Goal: This study aims to design and implement a weather forecasting system utilizing machine learning techniques in order to enhance the precision and reliability of weather predictions. The primary emphasis lies on examining the influence of weather forecasts on several industries, including agriculture.

Advantages: This statement highlights the necessity of precise weather predictions within industries such as agriculture. The application employs machine learning algorithms, specifically random forest classification. Presents a cost-effective and easily transportable solution.

Limitations: The performance of a system could potentially be influenced by the caliber of the input meteorological data. The scope of evaluation may be constrained to particular geographical areas or specific weather conditions. Regular updating may be necessary in order to ensure accuracy is maintained.

Datasets: Utilizes weather data for prediction.

**6. Weather Forecasting Using Deep Learning Techniques (Salman, A. G., Kanigoro, B., & Heryadi, Y., 2015)**

Goal: This study explores the application of deep learning methodologies, specifically Recurrence Neural Network (RNN) and Convolutional Network (CN) models, in the domain of weather prediction.

Advantages: This study investigates the possibilities of deep learning techniques in the field of weather forecasting. This study aims to conduct a comparative analysis of various deep learning models in the context of prediction. This discussion highlights the significance of weather forecasting in diverse domains.

Limitations: The performance of the model may exhibit variability based on factors such as the dataset utilized and the geographical region under consideration. Deep learning necessitates significant computational resources. It is possible that in certain scenarios, machine learning algorithms may not exhibit superior performance compared to conventional forecasting techniques.

Datasets: Uses weather datasets from BMKG and ENSO data.

**7. Machine Learning Applied to Weather Forecasting (Holmstrom, M., Liu, D., & Vo, C., 2016)**

Goal: This study investigates the utilization of machine learning methodologies in the field of weather forecasting, with a specific emphasis on the accurate prediction of maximum and lowest temperatures over a span of seven days.

Advantages: This paper presents the utilization of machine learning techniques in the context of conventional weather forecasting. This proposition posits that machine learning models have the capacity to surpass conventional methods when it comes to forecasting over extended timeframes. This analysis emphasizes the significance of linear regression and functional regression models.

Limitations: In comparison to expert forecasting services, model performance may not always be greater. A system's performance can shift based on how far into the future it is expected to work. This investigation is limited to temperature forecasting and does not include other aspects of weather prediction.

Datasets: Uses past weather data for temperature prediction.

**8. Predicting Solar Generation from Weather Forecasts Using Machine Learning (Sharma, N., Sharma, P., Irwin, D., & Shenoy, P., 2011)**

Goal: This study aims to construct site-specific prediction models for solar power generation by utilizing forecasts from the National Weather Service (NWS) and employing machine learning techniques.

Advantages: This study aims to tackle the issue of accurately forecasting solar power generation based on weather predictions. This study assesses multiple regression techniques for the purpose of constructing prediction models. This paper presents various strategies for the seamless integration of solar power into the existing electrical infrastructure.

Limitations: The performance of the model could potentially be influenced by the precision of weather forecasts. The applicability of site-specific models to different locales may be limited in terms of generalizability. Access to historical weather and sun intensity data is necessary.

Datasets: Utilizes NWS weather forecasts and solar intensity readings.

**9. Predicting Weather Forecast Uncertainty with Machine Learning (Scher, S., & Messori, G., 2018)**

Goal: This study examines the application of machine learning techniques, particularly deep learning utilizing convolutional neural networks, in the estimation of weather forecast uncertainty. The focus is on utilizing atmospheric circumstances at the time of initialization to make accurate predictions.

Advantages: helps with the problem of predicting how uncertain the weather will be. An approach to anticipate confidence prediction that is computationally efficient is proposed. demonstrates the usefulness of machine learning in this context.

Limitations: The skill of individual weather prediction models may be lower than that of ensembles. There may be efficiency constraints due to the availability of historical estimates. Instead of pinpointing specific meteorological elements, the focus is on the inherent unpredictability of weather forecasts.

Datasets: Uses past weather forecasts for training machine learning models.

**10. Machine Learning for Applied Weather Prediction (Haupt, S. E., Cowie, J., Linden, S., McCandless, T., Kosovic, B., & Alessandrini, S., 2018)**

Goal: In this paper, we'll look at how machine learning is being used in weather forecasting, with a special emphasis on the Dynamic Integrated foreCasting (DICast®) System. It investigates how this system might be applied in a wide range of fields, from renewable energy and surface transportation to wildfire prediction.

Advantages: This research exemplifies the realistic use of machine learning methods to the problem of weather forecasting. In this paper, we'll take a look at how DICast® has been used in the real world. In this paper, we take a look at how weather impacts a wide range of industries in a variety of ways.

Limitations: It focuses on real-world scenarios instead of explaining algorithms in great depth. Expertise in a certain field may be needed for implementation. Comparing the effectiveness of the paradigm against more conventional approaches is barely touched upon.

Datasets: Utilizes datasets relevant to specific applications, such as weather and energy data.

**11. Weather Forecasting for Renewable Energy System: A Review (Meenal, R., Binu, D., Ramya, K. C., Michael, P. A., Vinoth Kumar, K., Rajasekaran, E., & Sangeetha, B., 2022)**

Goal: This paper presents a comprehensive examination of weather forecasting methodologies, with a particular focus on their application in the domains of solar and wind power generation. The analysis is conducted within the broader framework of smart grids and renewable energy systems.

Advantages: This paper examines the pivotal significance of weather forecasting in the context of renewable energy systems. This paper examines a range of forecasting models, encompassing machine learning and deep learning approaches. This paper examines the inherent issues associated with the integration of renewable energy sources into the existing power grid infrastructure.

Limitations: The emphasis is placed on the evaluation and analysis of established methodologies rather than the introduction of novel findings. This study may not offer comprehensive technical analyses pertaining to certain models. The text examines the many difficulties but refrains from presenting novel solutions.

Datasets: No specific datasets used as it's a review article.

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