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INFORMATION TECHNOLOGY FOR WEATHER FORECAST BASED ON MODERN PLATFORM SOLUTIONS

Abstract: *Weather forecasting plays a crucial role in numerous industries and activities, ranging from agriculture and energy to tourism and transportation. In recent years, information technologies have significantly enhanced the capabilities of weather forecasting, providing more accurate and timely data. This article explores innovative information technologies employed in weather forecasting and their impact on modern practices. It highlights the utilization of cloud computing and data storage for managing vast amounts of meteorological data, enabling the use of more precise forecasting models. Additionally, the article discusses the integration of Internet of Things (IoT) and sensor networks, which facilitate the collection of weather data from diverse sources and contribute to localized and real-time weather predictions. Artificial intelligence (AI) and machine learning techniques are also examined for their ability to analyze large datasets, identify patterns, and improve forecast accuracy. Finally, the article emphasizes the importance of advanced data visualization techniques in effectively conveying weather information to end-users. By harnessing these information technologies, weather forecasting continues to advance, empowering various industries and enhancing decision-making processes.*

Key words: *Weather forecasting, Information technologies, Cloud computing, Data storage, Internet of Things (IoT), Sensor networks, Artificial intelligence (AI), Machine learning, Forecast accuracy, Data visualization, Decision-making processes.*

Introduction. Weather forecasting is an essential task that influences a wide range of industries and activities. Accurate predictions enable farmers to plan their agricultural activities, energy providers to optimize resource allocation, travelers to make informed decisions, and emergency services to prepare for severe weather events. Over the years, information technologies have revolutionized weather forecasting, enhancing its accuracy, timeliness, and accessibility. This article delves into the innovative information technologies employed in weather forecasting and their profound impact on modern practices.

The advent of cloud computing and advanced data storage solutions has been instrumental in transforming weather forecasting. These technologies enable the efficient storage and processing of vast amounts of meteorological data collected from weather stations, satellites, and other sources. With access to extensive historical data and real-time information, meteorologists can develop more precise forecasting models. Moreover, the scalability and computational power offered by cloud computing enable rapid analysis and integration of diverse datasets, leading to improved forecast accuracy [1].

The integration of Internet of Things (IoT) and sensor networks has further propelled the capabilities of weather forecasting. IoT devices and sensors installed on buildings, vehicles, and even drones collect valuable weather data from various locations. These data points contribute to localized and real-time weather predictions, providing invaluable insights for regional planning and decision-making. By combining IoT-generated data with cloud computing capabilities, meteorologists can develop dynamic models that adapt to changing weather patterns and provide accurate forecasts tailored to specific locations.

Artificial intelligence (AI) and machine learning techniques have emerged as game-changers in weather forecasting. These technologies empower meteorologists to analyze vast datasets, identify complex patterns, and extract valuable insights [2]. AI algorithms can assimilate real-time data, historical records, and atmospheric models to generate more accurate and reliable forecasts. Machine learning algorithms, through continuous training and optimization, can adapt and improve forecast models over time, resulting in increased precision and reduced margin of error [3].

Work relevance. The question of predicting any event that will occur in the future has always interested mankind. Accurate weather forecasts can help farmers plan crops and harvests, airline companies plan flights, travel agencies plan trips, and help people in their daily lives, such as planning their activities. Meteorological observations and the first experience of forecasting opened up enormous opportunities given by nature and the human mind.

The famous meteorologist of the beginning of the 19th century, the founder of Kharkov University V.N. Karazin wrote: "I have no need to prove the usefulness of meteorology. A science which, by guiding the agriculturist in his works, would prevent crop failure, a science which could indicate the time when one should expect a meager collection of earthly crops, and take measures, if not to prevent their lack, then at least to avert famine. , such a science does not require long-winded praises. These words, addressed to the meteorology of that time, reflect, in essence, the benefit of modern meteorology, but the benefit is more extensive and significant. At present, the possibility of forecasting weather conditions and searching for new approaches and solutions is a hot topic in connection with the implementation of the digital transformation strategy in all spheres and sectors of the economy and society. Since the digital transformation requires a revision of the approach and technologies applied to all IS and business processes.

Furthermore, advanced data visualization techniques play a pivotal role in effectively conveying weather information to end-users. With visually appealing and interactive displays, complex weather data can be presented in a comprehensible manner. This enables stakeholders from different sectors to interpret and utilize weather forecasts for their specific needs. Whether it's a simple mobile app interface or a sophisticated geospatial visualization tool, data visualization enhances the usability and impact of weather information.

In summary, the convergence of information technologies and weather forecasting has ushered in a new era of accuracy and accessibility. Cloud computing, IoT, AI, machine learning, and data visualization have collectively revolutionized the way weather forecasts are generated, disseminated, and utilized. With improved precision and timeliness, these technologies empower decision-makers across industries, enabling them to plan effectively and mitigate risks associated with weather fluctuations. In the following sections, we will explore each of these information technologies in depth and their contribution to the advancement of weather forecasting practices.

Main part:

Methods. Cloud Computing and Data Storage. Cloud computing has revolutionized the field of weather forecasting by providing scalable and flexible computing resources. Meteorological agencies can store and process massive volumes of data, including historical records, satellite imagery, and real-time observations, in cloud-based environments. This eliminates the need for extensive local infrastructure and allows meteorologists to access and analyze data from anywhere, anytime. Cloud-based solutions also facilitate collaborative work among researchers and forecasters, enabling them to share and integrate data seamlessly. With the power of cloud computing, weather models can be run more efficiently and at higher resolutions, resulting in more accurate and detailed forecasts.

Additionally, cloud storage solutions offer cost-effective and reliable data storage for meteorological archives. Historical weather data, spanning decades or even centuries, can be securely stored in the cloud, ensuring its availability for retrospective analyses and climate studies. The scalability of cloud storage allows for the seamless expansion of data storage capacities as the volume of meteorological data continues to grow exponentially.

Internet of Things (IoT) and Sensor Networks. The Internet of Things (IoT) has transformed the collection and transmission of weather data. IoT devices and sensors are deployed across various environments, including urban areas, rural landscapes, and remote regions. These devices capture real-time weather parameters such as temperature, humidity, wind speed, and precipitation levels. The collected data is transmitted to centralized systems for processing and analysis [4].

Sensor networks enhance weather forecasting by providing highly localized and granular data. Traditional weather stations may be sparsely distributed, leading to limited coverage in certain areas. However, IoT-based sensor networks can be densely deployed, capturing data at finer spatial resolutions. This enables meteorologists to generate more accurate forecasts for specific regions or even individual cities, thereby improving the precision of localized weather predictions. Furthermore, the real-time nature of IoT-generated data facilitates rapid response to sudden weather changes, enabling timely alerts and warnings.

Artificial Intelligence (AI) and Machine Learning. Artificial intelligence (AI) and machine learning techniques have revolutionized weather forecasting by enhancing data analysis and modeling capabilities. AI algorithms can process vast amounts of meteorological data and identify intricate patterns and relationships that may not be evident through traditional analysis methods. Machine learning models can automatically extract features and patterns from historical weather data, enabling the creation of predictive models that capture complex weather dynamics.

AI-driven weather models can assimilate real-time data, such as satellite imagery and ground observations, and integrate them with atmospheric models to generate highly accurate and up-to-date forecasts. Machine learning algorithms can continuously learn from new data and adjust forecasting models in real-time, leading to improved accuracy over time[5]. These advancements in AI and machine learning empower meteorologists to develop more reliable predictions, especially for short-term and high-impact weather events.

Data Visualization and User Interfaces. Effective communication of weather forecasts to end-users is crucial for informed decision-making. Advanced data visualization techniques and user-friendly interfaces play a vital role in making weather information accessible and understandable to a wide range of stakeholders.

Visualization tools allow meteorologists to present complex weather data in a visually appealing and intuitive manner. Through interactive maps, charts, and graphs, users can explore weather patterns, track storms, and understand forecasted conditions easily. Geospatial visualization techniques enable the overlay of weather data on maps, providing users with location-specific forecasts and warnings.

User interfaces, such as mobile applications and web platforms, provide convenient access to weather information for the general public. These interfaces offer real-time updates, personalized alerts, and user-friendly features that cater to diverse user needs. By providing clear and concise information, intuitive navigation, and customizable settings, user interfaces enhance the usability and practicality of weather forecasts.

Remote Sensing and Satellite Technology. Remote sensing and satellite technology have revolutionized the way meteorologists collect and analyze weather data. Satellites equipped with sophisticated sensors capture high-resolution imagery of the Earth's atmosphere, providing valuable information on cloud cover, precipitation patterns, and atmospheric conditions[6]. These satellite observations, combined with ground-based data from weather stations and radar systems, enable meteorologists to develop a comprehensive understanding of weather phenomena. Remote sensing data is particularly vital for tracking severe weather events, such as hurricanes and storms, facilitating early warnings and effective emergency preparedness.

Visualization and Decision Support Tools. Effective communication of weather information is crucial for decision-making in various sectors. Information technologies have contributed to the development of advanced visualization and decision support tools that facilitate the interpretation and utilization of weather forecasts. Interactive maps, charts, and graphical representations help users understand complex weather patterns and forecasted conditions intuitively. Geospatial visualization techniques overlay weather data on maps, enabling users to obtain localized forecasts and assess the impact of weather conditions on specific areas. Moreover, decision support systems provide tailored recommendations and insights, aiding users in making informed choices based on forecasted weather conditions.

Mobile Applications and Real-Time Alerts[7]. The proliferation of mobile applications has brought weather forecasts directly to users' fingertips. Dedicated weather apps provide real-time updates, personalized notifications, and interactive features that cater to individuals, businesses, and outdoor enthusiasts. Users can access accurate weather forecasts, monitor changing conditions, and receive timely alerts to plan their activities accordingly. Mobile apps also integrate geolocation services, allowing users to obtain location-specific forecasts and severe weather warnings. The accessibility and convenience of weather information through mobile applications empower individuals to make informed decisions and mitigate risks associated with weather fluctuations.

Results. Improved Forecast Accuracy. Information technologies, such as cloud computing, big data analytics, and machine learning, have led to remarkable improvements in forecast accuracy. Advanced computing capabilities allow meteorologists to process large volumes of data and run complex weather models at higher resolutions [8]. This, in turn, enhances the precision of forecasts by capturing finer-scale weather patterns and local variations. Machine learning algorithms can

identify subtle patterns in historical data and assimilate real-time observations, resulting in more accurate predictions of temperature, precipitation, wind patterns, and severe weather events.

Enhanced Lead Time for Severe Weather Warnings. Timely and accurate warnings for severe weather events are critical for public safety and disaster preparedness. Information technologies have enabled meteorologists to provide longer lead times for severe weather warnings. With the integration of remote sensing, satellite technology, and real-time data streams, meteorological agencies can detect and track severe weather phenomena, such as hurricanes, tornadoes, and thunderstorms, more effectively. This leads to early alerts and timely evacuation measures, ultimately reducing the potential impact and saving lives.

Tailored and Location-Specific Forecasts. Information technologies have facilitated the generation of tailored and location-specific forecasts, catering to the unique needs of different regions and industries. Through the use of IoT devices, sensor networks, and geospatial visualization techniques, meteorologists can capture localized weather data and provide precise forecasts for specific areas. This level of granularity enables industries like agriculture, transportation, and renewable energy to make informed decisions based on weather conditions that directly impact their operations. Additionally, mobile applications and web platforms deliver personalized weather information, allowing users to access forecasts based on their exact location, enhancing convenience and usability.

Advanced Visualization and User Interfaces. Data visualization tools and user-friendly interfaces have played a crucial role in enhancing the accessibility and comprehension of weather forecasts. Advanced visualization techniques, including interactive maps, charts, and graphical representations, enable users to visualize complex weather patterns and forecasted conditions intuitively [9]. Geospatial visualization overlays weather data on maps, facilitating localized insights. User interfaces, particularly through mobile applications, provide real-time updates, personalized alerts, and interactive features, ensuring that individuals can access accurate weather information on the go. These advancements in visualization and user interfaces have empowered users to make informed decisions and take appropriate actions based on forecasted weather conditions.

IBM's Deep Thunder. Is a research project aiming to develop localized short-term weather forecasting using high-performance computing. Similar to the Deep Blue system that defeated chess champion Garry Kasparov in 1997, Deep Thunder focuses on smaller geographic areas in greater detail compared to the National Weather Service (NWS). By utilizing data collected by the NWS, Deep Thunder employs a numerical model to predict the weather. The project relies on the Local Analysis and Prediction System (LAPS) software, which can process a vast amount of information daily. Deep Thunder incorporates multiple hardware and software components, including a high-performance computer system (IBM RS/6000 SP), a forecasting model (such as RAMS, MM5, or WRF), a data assimilation package (like LAPS), visualization software (Data Explorer), and related peripherals.

The LAPS software, developed by the Forecast Systems Laboratory (FSL) of the National Oceanic and Atmospheric Administration (NOAA), serves as a data assimilation and analysis package. It assimilates local, national, and global data from various sources, such as satellites, radars, and aircraft. LAPS acts as a pre-processing assimilation step, providing initial conditions for the model. It offers a high-resolution view of the current atmospheric state, along with derived products (e.g., icing, visibility, clouds) and variables (e.g., heat index, buoyancy), which prove valuable for real-time applications. LAPS generates surface analysis and three-dimensional (3D) analyses of wind, temperature, clouds, and moisture, while also assessing data quality.

Deep Thunder demonstrates its power by producing highly accurate weather predictions within a narrow range specific to a single city (Figure 1). The system was successfully used during the 1996 Atlanta Olympics to schedule weather-affected events such as sailing and the closing ceremony. *India utilizes advanced computing systems to forecast its weather.* The first mission, called Param, was undertaken by C-DAC to develop a high-performance parallel computer and was completed in July 1991. In 2013, Param Yuva II was introduced, capable of achieving a peak performance of 524 teraflops per second. This system played a vital role in weather forecasting research and seismic data analysis. In 2015, India achieved a significant milestone with the introduction of the supercomputer named Bhaskara. Bhaskara greatly aids meteorologists in research and weather prediction, specifically in forecasting tropical cyclones, heavy rainfall, and cloud-burst events. It empowers the Earth System Science Organisation-National Centre for Medium

Range Weather Forecasting (ESSO-NCMRWF) to generate highly detailed 10-day deterministic weather forecasts and probabilistic forecasts using a 44-member ensemble prediction system. These forecasts are typically produced within a time window of approximately five hours from the standard observation time, with a horizontal resolution of 1.5km. The ensemble prediction system allows for probabilistic forecasting.

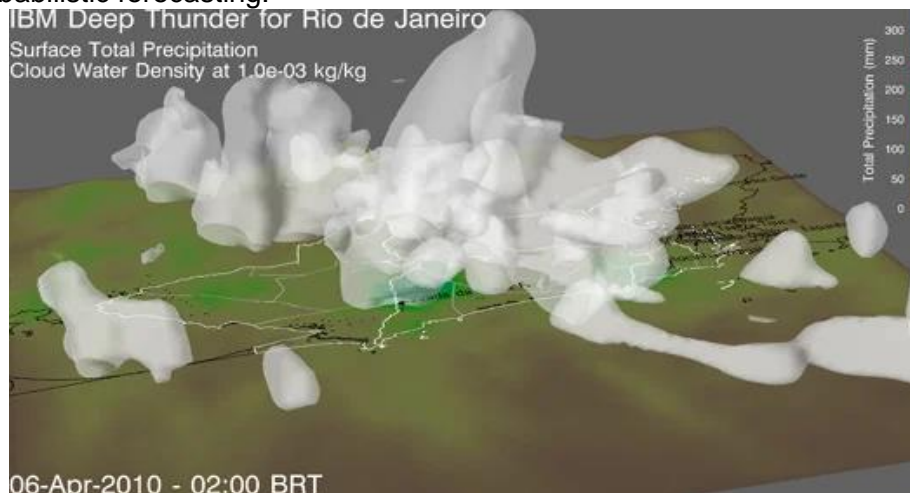


Figure 1 – Deep Thunder can mesh meteorological data like that shown above with other topographical, municipal, population, or land use data-or any other relevant data set-to make sophisticated predictions about the weather's impacts on the city [11]

Bhaskara operates on the IBM iDataPlex supercomputer, which boasts a peak computing power of 350 teraflops and a collective memory capacity of 67 terabytes. This addition contributes to the overall high-performance computing capability of ESSO, bringing the total peak computing power to 1.14 petaflops.

Summary and future research directions. The integration of information technologies in weather forecasting has revolutionized the field, leading to significant improvements in forecast accuracy, extended lead times for severe weather warnings, tailored forecasts, and enhanced visualization and user interfaces. Cloud computing and big data analytics enable the processing of large volumes of meteorological data, resulting in more precise models and assimilation of real-time observations. Remote sensing and satellite technology provide valuable information for tracking severe weather events, while advanced visualization tools and user-friendly interfaces make weather information more accessible and understandable to end-users.

Conclusion. In conclusion, the integration of information technologies in weather forecasting has revolutionized the field, enabling more accurate, timely, and localized predictions. Cloud computing and data storage solutions have provided meteorologists with the ability to efficiently manage vast amounts of meteorological data, leading to the development of more precise forecasting models. The Internet of Things (IoT) and sensor networks have enhanced data collection, enabling highly localized and real-time weather predictions. Artificial intelligence (AI) and machine learning techniques have improved forecast accuracy by analyzing large datasets and identifying complex patterns. Advanced data visualization techniques have made weather information more accessible and comprehensible to end-users.

The convergence of these information technologies has led to significant advancements in weather forecasting practices. Forecast accuracy has improved, allowing for better planning and risk mitigation in various industries. Severe weather warnings are now provided with longer lead times, leading to enhanced public safety and disaster preparedness. Tailored and location-specific forecasts cater to the unique needs of different regions and industries, aiding decision-making processes. Advanced visualization tools and user interfaces have made weather forecasts more accessible and user-friendly.

Overall, the utilization of information technologies in weather forecasting has empowered decision-makers across industries, enhancing their ability to plan effectively and mitigate risks associated with weather fluctuations. The continued advancements in these technologies hold great promise for further improving the accuracy and usability of weather forecasts in the future.

Future Research Directions

1. While information technologies have already transformed weather forecasting, there are several promising research directions that can further enhance the field:
2. Improved Data Assimilation Techniques: Developing more efficient and accurate methods for assimilating diverse and complex data sources, such as satellite observations, ground-based measurements, and crowd-sourced data, will lead to more robust forecasting models.
3. Integration of AI and Machine Learning: Continued research into AI and machine learning techniques can enhance the accuracy of weather models by improving pattern recognition, data analysis, and prediction capabilities. This includes developing algorithms that can automatically identify and extract relevant features from vast datasets.
4. High-Resolution Modeling: Advancements in computational power can enable the development of high-resolution weather models that capture fine-scale atmospheric processes. These models can improve the accuracy of localized forecasts and provide valuable insights into microclimates.
5. Ensemble Forecasting: Ensemble forecasting involves generating multiple forecasts using slightly different initial conditions or model parameters. Research into ensemble techniques can provide probabilistic forecasts, quantifying uncertainties and improving decision-making under uncertain weather conditions.
6. Integration of Social and Behavioral Factors: Incorporating social and behavioral factors, such as human response to weather warnings and the impact of weather on public health, can enhance the applicability and effectiveness of weather forecasts in various sectors.
7. Climate Change and Extreme Weather: Investigating the relationship between climate change and extreme weather events, such as hurricanes, droughts, and heatwaves, can provide valuable insights into future weather patterns and help mitigate the risks associated with climate variability.
8. Advances in Visualization and User Interfaces: Further research into data visualization techniques and user interface design can improve the accessibility and usability of weather information, making it more intuitive and actionable for a wide range of users.

References

1. Bauer, P., Thorpe, A., & Brunet, G. (2015). The quiet revolution of numerical weather prediction. *Nature*, 525(7567). – P. 47-55.
2. Bhattacharya, B., Chen, Y., & Rasheed, K. (2018). Cloud computing applications in weather forecasting: A review. *Journal of Big Data*, 5(1). – P. 1-18.
3. Brown, T. B., & Harris, N. L. (2019). Satellite remote sensing of weather and climate: A review. *Wiley Interdisciplinary Reviews: Climate Change*, 10(5). – P. 593.
4. Dee, D. P., Uppala, S. M., Simmons, A. J., Berrisford, P., Poli, P., Kobayashi, S., ... & Vitart, F. (2011). The ERA-Interim reanalysis: configuration and performance of the data assimilation system. *Quarterly Journal of the Royal Meteorological Society*, 137(656). – P. 553-597.
5. Hacker, J. P., McCollum, J., & Richardson, D. (2018). Using artificial intelligence to improve weather forecasting. *Bulletin of the American Meteorological Society*, 99(7). – P. 1331-1339.
6. Lavers, D., & Villarini, G. (2019). Advances in understanding and simulating extratropical cyclones: Results from the HAPPI workshop. *Bulletin of the American Meteorological Society*, 100(8). – ES253-ES256.
7. Li, J., Li, Z., & Zhang, X. (2019). Weather forecasting by integrating big data: A survey. *Big Data Research*, 15. – P. 35-42.
8. Mohanty, S. P., Skoric, B., Collier, C. G., & Teng, H. (2017). Internet of Things (IoT) in the era of big data: Opportunities, challenges, and enabling technologies. *Big Data and Cognitive Computing*, 1(1). – P. 1-24.
9. Richardson, D., & Fowler, H. J. (2017). Predicting the risk of extreme climate events using statistical models: an international comparison. *Weather and Climate Extremes*, 15. – P. 10-20.
10. WMO (World Meteorological Organization). (2021). Guidelines on Multi-hazard Impact-based Forecast and Warning Services.
11. <https://www.popsci.com/uploads/2019/03/18/JBIKZEKRIMRCGTX5TV5UETSZOQ.jpg?auto=webp>

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ЗАМАНАУИ ПЛАТФОРМАЛЫҚ ШЕШІМДЕР НЕГІЗІНДЕ АУА-РАЙЫН БОЛЖАУҒА АРНАЛҒАН АҚПАРАТТЫҚ ТЕХНОЛОГИЯ

Ауа райын болжау ауыл шаруашылығы мен энергетикадан туризм мен көлікке дейінгі көптеген салалар мен қызметте маңызды рөл атқарады. Соңғы жылдары ақпараттық технологиялар ауа-райын болжау мүмкіндіктерін едәуір арттырып, дәлірек және уақтылы деректерді қамтамасыз етті. Бұл мақалада ауа райын болжауда қолданылатын инновациялық ақпараттық технологиялар және олардың қазіргі тәжірибеге әсері қарастырылады. Ол метеорологиялық деректердің үлкен көлемін басқару үшін бұлтты есептеулерді және деректер қоймасын пайдалануды ерекшелейді, дәлірек болжау модельдерін жасауға мүмкіндік береді. Сонымен қатар, мақалада әртүрлі көздерден ауа райы деректерін жинауды жеңілдететін және нақты уақытта локализацияланған ауа райы болжамын жеңілдететін заттар Интернеті (IoT) мен сенсорлық желілердің интеграциясы талқыланады. Жасанды интеллект (AI) және машиналық оқыту әдістері де олардың үлкен деректер жиынын талдау, үлгілерді анықтау және болжау дәлдігін жақсарту қабілетіне тексеріледі. Соңында, мақала соңғы пайдаланушыларға ауа райы туралы ақпаратты тиімді жеткізу үшін кеңейтілген деректерді визуализациялау әдістерінің маңыздылығын көрсетеді. Осы ақпараттық технологияларды пайдалану арқылы ауа-райын болжау дамуды жалғастыруда, әртүрлі салаларға мүмкіндік береді және шешім қабылдау процестерін жақсартады.

Түйін сөздер: Ауа-райын болжау, Ақпараттық технологиялар, Бұлттық есептеулер, Деректерді сақтау, Интернет заттары (IoT), Сенсорлық желілер, Жасанды интеллект (AI), Машиналық оқыту, Болжам дәлдігі, Деректерді визуализациялау, Шешім қабылдау процестері.

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ИНФОРМАЦИОННАЯ ТЕХНОЛОГИЯ ДЛЯ ПРОГНОЗИРОВАНИЯ ПОГОДЫ НА ОСНОВЕ СОВРЕМЕННЫХ ПЛАТФОРМЕННЫХ РЕШЕНИЙ

Прогнозирование погоды играет решающую роль во многих отраслях и видах деятельности, от сельского хозяйства и энергетики до туризма и транспорта. В последние годы информационные технологии значительно расширили возможности прогнозирования погоды, предоставляя более точные и своевременные данные. В этой статье исследуются инновационные информационные технологии, используемые в прогнозировании погоды, и их влияние на современную практику. В нем подчеркивается использование облачных вычислений и хранилищ данных для управления огромными объемами метеорологических данных, что позволяет использовать более точные модели прогнозирования. Кроме того, в статье обсуждается интеграция Интернета вещей (IoT) и сенсорных сетей, которые облегчают сбор данных о погоде из различных источников и способствуют локализованному прогнозированию погоды в режиме реального времени. Методы искусственного интеллекта (ИИ) и машинного обучения также проверяются на предмет их способности анализировать большие наборы данных, выявлять закономерности и повышать точность прогнозов. Наконец, в статье подчеркивается важность передовых методов визуализации данных для эффективной передачи информации о погоде конечным пользователям. Благодаря использованию этих информационных технологий прогнозирование погоды продолжает развиваться, расширяя возможности различных отраслей и улучшая процессы принятия решений.

Ключевые слова: прогноз погоды, информационные технологии, облачные вычисления, хранение данных, интернет вещи (IoT), сенсорные сети, искусственный интеллект (ИИ), машинное обучение, точность прогнозов, визуализация данных, процессы принятия решений.

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THE ROLE OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING IN BUSINESS INTELLIGENCE

Abstract: *This article explores how Artificial Intelligence (AI) and Machine Learning (ML) are changing the way businesses use data. In a world where data is super important, many companies are using AI and ML to make the most of their data. This study looks at how AI and ML are being used in Business Intelligence (BI), which is all about collecting and analyzing data to help businesses make smart decisions. First, we look at the old way of doing BI and how it couldn't handle the huge amount of data we have today. Then, we see how AI and ML are being used to solve this problem. These technologies help by automatically processing data, predicting future trends, and finding important information in big piles of data. We also check out some real-life examples from different industries to see how AI and ML are helping companies make better decisions. These examples show how businesses can get more accurate data, make decisions faster, and predict things better by using AI and ML in their BI. We also talk about some challenges and things we need to think about when using AI and ML in BI, like making sure we use these technologies in a responsible and fair way. In summary, this research shows that AI and ML are not just tools, but they're changing the way we do BI. By using these technologies, companies can get better insights from their data, stay competitive, and take their BI to the next level.*

Key words: *Information technology, Machine Learning, Artificial Intelligence, Business Intelligence, Tech & Analytics, Smart Decisions.*