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Review of Energy Generation Optimization Techniques Using AI Models

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Abstract: The importance of renewable energy is underscored by the existing energy deficit, which poses significant challenges to the sustainable development of the human population. In this research article, the authors have developed a renewable energy resource optimizer using a simple random forest classifier, achieving an impressive accuracy of 95% during the testing phase. The study analyzes CSV data that includes features such as latitude, longitude, elevation, wind speed, solar radiation, temperature, humidity, existing energy consumption, and available area to predict energy generation and modify consumption accordingly. This research project is specifically focused on predictive analysis to enhance energy optimization. It offers valuable insights into the future potential and limitations of renewable resources. Additionally, the authors have designed a frontend for improved data visualization, incorporating a map component to identify areas where the predicted energy can be effectively utilized.

Keywords: CNN, Random forest, Machine learning, Sustainable development, AI, Renewable energy.

I. INTRODUCTION

Due to an increase in the need for renewable energy resources in recent years, it has become practical to create reliable predictive analysis models in order to improve the effective management of resources. This work offers a complete guide for creating a final application that works with the IA impulse that predicts the management of renewable energy resources. The methodology combines the use of automatic learning algorithms for database and current standards for market software engineering to ensure that the proposed and effective solution is precise and efficient.

There are two segments throughout the process: creating models and software development. In the creation of models, the goal is to develop a predictive model that has a high degree of accuracy using automatic learning algorithms and structured S.

II. LITERATURE SURVEY

Vikaз Agarwal, Jyoti Vimal. Et al. [11] the optimization of the form process parameter was found on the basis of the extruded extruded method by analyzing the relational method and the Taguchi. The work of Re due is carried out by a breath process in the extrlation to produce a plaster container of the denidad of polyethylene B6401 (HDPE) and the experimental execution in an L9 orthogonal matrix of the TAGUY method. The Taguchi method was carried out in the flat material and the process was the blown temperature, the wind time and the cooling / cooling time.

AI could be created as a change in the game in the sector for renewable energies, especially in the forecast and design of energy systems. This literature overview aims to combine the conclusions of several studies on the scope of the AI and its effects on renewable energy systems.

The selection of the characteristics is important to improve the efficiency of ML models for renewable energy purposes. He was from Salcedo-Sanz et al. (2018) that a significant increase in the precision of the prediction is used using extreme learning machines if the selection of the characteristics is used on the basis of an envelope. The authors observed the role of selecting the features in the forecast systems of renewable energy sources when they have shown that their new optimization algorithm for coral reefs improved the estimates of the wind speed by about 20%.

Use automatic learning to search for new materials for renewable energy sources. Gu et al. (2019) dealt with the problem of using automatic learning in solar cells, batteries and catalysis during their studies on renewable materials. They said that, for example, automatic learning could be used to accelerate the discovery of new materials that can revolutionize conversion and energy storage systems. In the analysis, certain remarkable weaknesses were emphasized and the development of new

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approaches to deepen the role of automatic learning in material innovations was requested. [3]

Alabi et al. (2022) analyzed the integration into the multicoral of automatic learning and its optimization methods in integrated energy systems (IES) and their optimization with ML. They said that some of the relevant research areas were largely neglected, including the development of scenarios and the hyperparameter adjustment through automatic learning techniques. In their review, they presented an IES model that was proposed for carbon neutrality and asked to carry out more research to improve this field. [4]

Lai et al. (2020) provided a comprehensive examination of the automatic learning forecast models for renewable energies as well as their application parameters and their data before treatment. Their results have shown that automatic learning techniques exceed conventional forecast methods while configuration and performance evaluation have been included in the image. The study also underlined the possible addresses for future research, especially those that relate to variability within the renewable production and a stronger improvement in interpretation capacities [5].

Yao et al. (2023) characterized certain progress that were aligned in factories such as energy survey, storage and management. They spoke about the challenges of integration of automatic learning techniques into intelligent networks and electrocatalysis and proposed considerable performance parameters for comparative research on ML applications for energy purposes. His work offers a roadmap for future research on sustainable energy, which is activated by automatic learning [6].

Benti et al. (2023) evaluated automatic learning and in the depths of learning techniques that are intended for the prediction of the production of renewable energy resources. The document has been demolished for the forecasting models that the DL superiority was provided to overcome the problem of recording non -linear models and strategies for estimating the data level and the variability of data. This review focused on the need for robust automatic learning algorithms to improve the participation of renewable energies in the network [7].

Due to the concentration on renewable energy systems, Schweidtmann et al. (2021) also analyzed the interdisciplinary problems of using automatic learning for chemical engineering. In order to promote chemical energy efficiency processes, its research has declared six key problems, in particular the integration of physics into ML models and effective optimization of decisions [8].

Zhang et al. (2019) demonstrated the application of profound reinforcement conversion within the IES. His model has shown that the effectiveness of the DRL in active energy management through different energy conversion relationships using the optimization of the proximal guideline that has reduced the operating costs [9].

Sharma et al. In 2022 he examined the application of automatic learning in systems with nanoflide heat transfer. You have the need for predictive models for the thermophysical properties of materials and how modern automatic learning XGBOOST and CATBOOST design sets could help. The optimization goals was to achieve better efficiency in the study. [10].

In 2021 Lan et al. Present an MT-based strategy for micro-renewal energy management through renewable energies. In his model, vectors and optimization techniques were used, which pointed out that ML has the potential to reduce operating costs by meeting the effects of the freight requirements based on hybrid electric vehicles. [15]

III. METHODOLOGY

In order to develop a sophisticated model for the prediction analysis of the management of renewable energy resources, we use a simple iterative approach that consists of several steps to get an effective module. In order to develop a final application, we divide the process into two substances: the life development cycle and the software for the complex application basis.

A) Development of the model

At this stage we developed the full model to predict the necessary properties using the existing features in CSV format. The data was collected with various online resources such as Kaggy and also collected in real time. To make the model more precise and useful, we do more sub -process, which is as follows:

B) Data acquisition and preparation

The authors have compiled the structured data in CSV format with the following properties, which are latitude, length, heights, wind speed, solar radiation and temperature. Air humidity, existing energy consumption, available space and energy production index. We use a monitored learning method

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using data marked in the tabular format.

In order to make data useful enough, several pretreatment techniques were used, such as: B. standardization, atypical detection using cash diagrams, void value filling using simple statistical methods and a single coding for the conversion of alphabetical information into categorical values.

In summary, the preparation process collects and pretreatment using several automatic learning techniques.

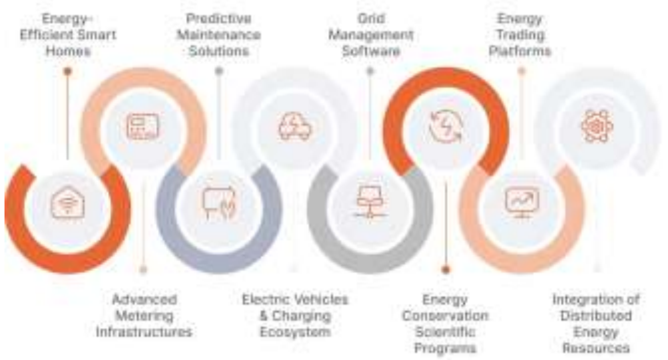

Figure 1: Energy Generation Insights

C) Model training and testing

As in this study, the authors used simple automatic learning algorithms that offer sufficient precision and precision compared to the latest generation of the latest algorithms on the market. The authors used random forest algorithm such as classification and prediction technology.

For the training, the developers divided the data of the error in the size of the TUPLA into small ten thousand data Tuli at the same time. Then these pilots feed on the random forest model with a thousand painting to achieve effective results.

Since the data is already marked, the classifier has the lightness, the model in the data input data and the perfect function.

After the developers had found the scheme after the end of the training process, after which a training and validation accuracy of 99%was achieved after the end of the training process, the developers of the life cycle of the development of the model turned.

Since the data were divided into a relationship 1: 4 for all five data points, we are recorded for evidence. This corresponds to 20% of the total data given to the classifier without talking to the classifier of the initial variables. With this regressive test process, we found that it results in correct accuracy for all 20 data data, which finally helped the developer to claim 95% of the accuracy of the test as final accuracy.

D) Creation of complete software regulations

At this point, the developers pursued a simple iterative approach for the software development process. In it, the model is integrated into the backend in the Python language.

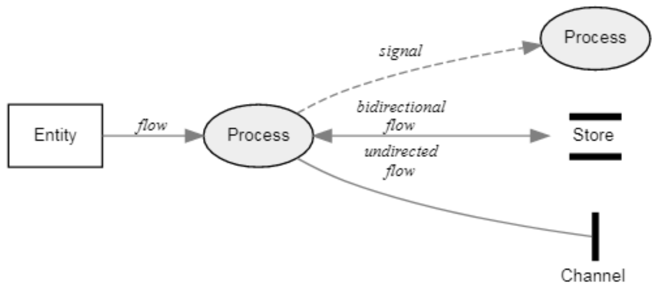

Figure 2: Data Flow Diagram

Then I used Python Flask for the integration process and the migration of Python data such as the backend to a JavaScript web application as an interface.

The customer architecture was used, which the JavaScript -Fetch -API used for data integration.

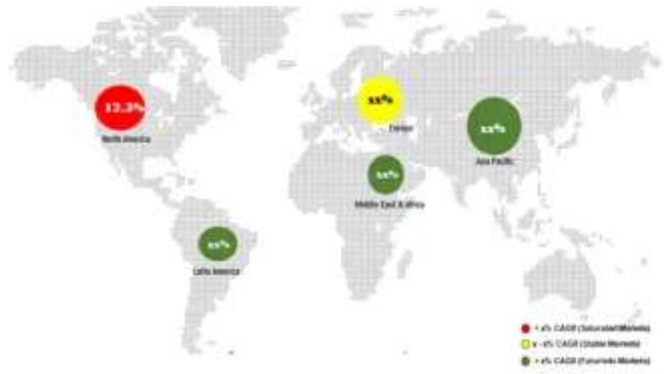

Figure 3: Map view

In order to develop the previous application, the data flow is developed using API documents and then used for SRS documentation purposes (specification of the software requirements). Then provide the developers of the application for the coding part.

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After completing the code -end -Dcodes, the entire application will be treated even more in the test phase for the weak position test and find humanized errors.

IV. RESULTS AND CONCLUSION

The intention of this work was to improve wind and solar energy consumption thanks to the design and use of the renewable energy of the AI Rob Mod A1 optimizer. More precisely, these variable energy, winds, sun and temperature requests include; With the help of justification data and above all automatic learning, optimization thanks to the use of the linear regression, energy generation is predicted and consumption is more effective. Before practicing the strategy, the process included data, data, data cleaning, a training model and a data parameter model, so that there is high efficiency and low costs when using substitution energy resources.

In order to solve the problem of improving the self-exposed melting for melting for melting, improving the self-sufficiency of the model and the dependence on the dependence on non-newlings on the basis of the combination of renewable energy control systems and forecast methods for the treatment of consumption, energy generation and the cateris-paribus. The system in practice has also shown the type of strategies for coping with the unfavorable climate and the changes in energy requirements.

Future efforts can concentrate on improving the current model output thanks to more powerful automatic learning algorithms, but also in depth of learning and data analyzes that make it possible to make decisions in more urgent situations.

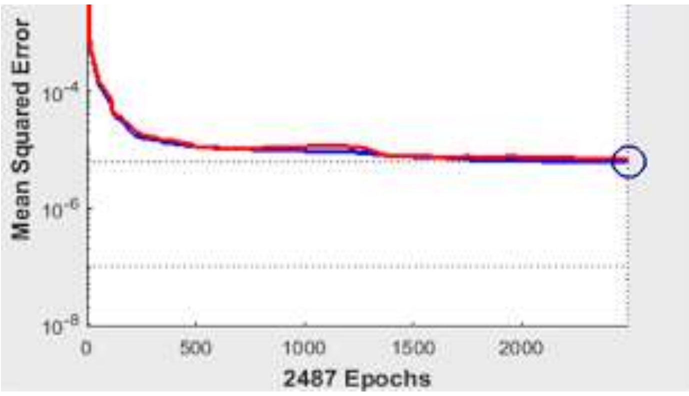

Figure 4: MSE vs. MAE Epoch Graph

V. FUTURE SCOPE

The AI-driven Renewable Energy Optimizer developed by the researcher presents promising opportunities for future investigations. Enhancing forecast accuracy could be achieved by incorporating additional offshore algorithms, such as decision trees, support vector machines, or deep learning techniques, which may reveal intricate relationships between energy supply and demand. This area is particularly in need of further development. Additionally, the proposed strategy emphasizes the importance of integrating real-time data from various sources, including sensors embedded in renewable energy systems, allowing the optimizer to adapt to fluctuations in weather and energy consumption patterns. Another critical aspect is the integration of the optimizer with the smart grid, which would significantly streamline energy information networks by enabling effective control over power usage based on current conditions. A notable trend in this field is the increasing implementation of advanced machine learning techniques, such as decision trees, support vector machines, or deep learning. These models have the potential to enhance forecast accuracy by uncovering more complex interactions between energy resources and their consumers. Moreover, an optimizer that consolidates multiple real-time data sources, including sensors from various locations, would be more adept at responding to changing weather conditions and dynamic energy demands.

REFERENCES

[1] Sharma, Prabhakar, et al. "Recent advances in machine learning research for nanofluid-based heat transfer in renewable energy systems." Energy & Fuels 36.13 (2022): 6626-6658.

[2] Gu, Geun Ho, et al. "Machine learning for renewable energy materials." Journal of Materials Chemistry A 7.29 (2019): 17096-17117.

[3] Rangel-Martinez, Daniel, K. D. P. Nigam, and Luis A. Ricardez-Sandoval. "Machine learning on sustainable energy: A review and outlook on renewable energy systems, catalysis, smart grid, and energy storage." Chemical Engineering Research and Design 174 (2021): 414-441.

[4] Al-Janabi, Samaher, Ayad F. Alkaim, and Zuhal Adel. "An innovative synthesis of deep learning techniques (DCapsNet & DCOM) for generating electrical renewable energy from wind energy." Soft Computing 24.14 (2020): 10943-10962.

[5] Alabi, Tobi Michael, et al. "A review on the integrated

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Available Online at https://www.cjesr.com

optimization techniques and machine learning approaches for modeling, prediction, and decision-making on integrated energy systems." Renewable Energy 194 (2022): 822-849.

[6] Schweidtmann, Artur M., et al. "Machine learning in chemical engineering: A perspective." Chemie Ingenieur Technik 93.12 (2021): 2029-2039.

[7] Yao, Zhenpeng, et al. "Machine learning for a sustainable energy future." Nature Reviews Materials 8.3 (2023): 202-215.

[8] Benti, Natei Ermias, Mesfin Diro Chaka, and Addisu Gezahegn Semie. "Forecasting renewable energy generation with machine learning and deep learning: Current advances and future prospects." Sustainability 15.9 (2023): 7087.

[9] Salcedo-Sanz, Sancho, et al. "Feature selection in machine learning prediction systems for renewable energy applications." Renewable and Sustainable Energy Reviews 90 (2018): 728-741.

[10] MLA Fan, Zhencheng, Zheng Yan, and Shiping Wen. "Deep learning and artificial intelligence in sustainability: a review of SDGs, renewable energy, and environmental health." Sustainability 15.18 (2023): 13493.

[11] Wang, Huaizhi, et al. "A review of deep learning for renewable energy forecasting." Energy Conversion and Management 198 (2019): 111799.

[12] Abualigah, Laith, et al. "Wind, solar, and photovoltaic renewable energy systems with and without energy storage optimization: A survey of advanced machine learning and deep learning techniques." Energies 15.2 (2022): 578.

[13] V. Simankov et al., "A Solar and Wind Energy Evaluation Methodology Using Artificial Intelligence Technologies," Energies 2024, 17, 416.

[14] Zhang, Bin, et al. "Deep reinforcement learning–based approach for optimizing energy conversion in integrated electrical and heating systems with renewable energy." Energy conversion and management 202 (2019): 112199.

[15] Lan, Tianze, et al. "An advanced machine learning-based energy management of renewable microgrids considering hybrid electric vehicles' charging demand." Energies 14.3 (2021): 569.

[16] Lai, Jung-Pin, et al. "A survey of machine learning models in renewable energy predictions." Applied Sciences 10.17 (2020): 5975.

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