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PREDICTIVE ANALYTICS IN AGRICULTURE ENHANCING CROP YIELDING FORECASTING – MACHINE LEARNING

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ABSTRACT:
Since more than half of the country people are depending on agriculture for its subsistence yield Random forests are versatile, very fast but coarse machine learning algorithm that performs both classification and regression tasks. The study results will be helps the farmer to understand their goods in how much they output before growing on Agriculture field. User given Input: Area & Soil Type. Some Machine Learning algorithms have been trained over the dataset to predict crop yield like SVM (Support Vector Machine commit[]).To predict the crop yield, various ML algorithms like Support Vector Machine (SVM), Artificial Neural Network(ANN), Random Forest(RF) and Multivariate Linear Regression (MLR) and K-Nearest Neighbour(KNN). Random Forest had the best performance of 95% accuracy among them.

Keywords: Predictive Analytics, Agriculture, Crop Yield Forecasting, Machine Learning, Data Analysis, Agricultural Technology, Precision Farming, Big Data, Remote Sensing, Environmental Factors, Soil Quality, Weather Prediction.

1.INTRODUCTION:

There are various ML algorithms are used in predicting the crop yield like Support Vector Machine (SVM),[1-5] Artificial Neural Network (ANN), Random Forest (RF) and Multivariate Linear Regression (MLR) and K-Nearest Neighbour (KNN).[6-11] Although Random Forest gave an accuracy of 95% which is the best one. [12-14]Additionally, the system suggests when is best time to use appropriate fertilizer composition for a better yield.[16-18] There are many variables which effect in crop yields and it is difficult to predict the exact outcome due to different parameters for each cropping seasons like management practices, cultivars such as soil types, pest behaviour & disease cycles. Hence a key reason is climate change. Weather and climate are critical for agriculture since almost everyone depends on it.[19] Crop yields are subject to wide fluctuations and unpredictable weather events due to changes in climate patterns. India — The agricultural sector is expected to become USD 24 billion by the year 2025. India is the 6th largest food and grocery market in the world with retail accounting for 70 percent of sales. As per [35-40]the advance estimates for Kharif 2022-23, the total production of food grains in the country would be at record level of 149.92 million tonnes (KMT) during FY22. [20-22]The sector is driven by the rapid population growth in India. The primary objectives are (a) to assess the prediction performance of ANN, SVR, KNN and RF using four ML algorithms used in this study layer by itself and with ensemble technique for Eg, stacking or blending on CVD risk score based upon all clinical attributes; b) To evaluate how each set of feature affects machine learning approach. [41-46]But in this paper uses the following feature selection algorithms to find unique features set: Forward Feature Selection (FFS), [23]Correlation-based Feature Selection (CBFS), Variance InflationFactor(VIF)andRandomForest.

Importance(RfvarImp).(a) The most concerned research areas of ML technologies such as RF, SVM, etc.in agriculture also complementary by geographical distribution sources organizations,(b)The fastest production ML models with significant(production count N>100),(c).[24-28]Most explored crops & animals from our curated dataset(d).[Implementation]Most employed features & technological trends. One of the reasons for low level production is more pest attack coerce many crops where sometimes this effect maximum on country socio-economic ways.[29-33] Climate variation imposes great impacts in crop production with massive pest infestations.

2.LITERATURE SURVEY:

Predicting Agriculture Yields Based on Machine Learning Using Regression and Deep Learning

Mobile-based crop yield prediction system aimed at empowering farmers with data-driven decision-making tools.[34-37] This solution addresses the limitations of current yield prediction methods and offers a practical, user-friendly approach. Key Features of the Mobile Application: Crop Selection Tool: Assists farmers in choosing suitable crops Yield Predictor: Utilizes machine learning to forecast crop yields. Crop Recommender: Suggests optimal crops based on various factors Fertilizer Timing Advisor:[38-39] Recommends appropriate fertilizer application schedules. The researchers implemented and compared several ML algorithms: Random Forest Artificial Neural Networks (ANN)Support Vector Machines (SVM)Multiple Linear Regression (MLR)K-Nearest Neighbours (KNN)Random Forest Regression emerged as the top performer, achieving an impressive 95% accuracy on datasets.

A Comprehensive Review of Crop Yield Prediction Using Machine Learning Approaches:By harnessing the power of remote sensing and machine learning, we're not just predicting yields – we're paving the way for a more sustainable and food-secure future. Imagine a world where:[40-42]

- Farmers can make precise decisions about resource allocation
- Supply chains can be optimized based on accurate yield forecasts
- Policymakers can develop targeted strategies to enhance food security

This isn't science fiction – it's the dawning reality of precision agriculture. One of the most intriguing aspects of the study was the impact of sowing dates on yield predictions. The results were eye-opening:**SD1 (Early Sowing)**: Predicted yield of 260.54 g/m2.**SD2 (Mid-Season Sowing)**: Predicted yield of 201.64 g/m2.**SD3 (Late Sowing)**: Predicted yield of 47.29 g/m2.[43-44]These findings underscore the critical importance of timing in agriculture. The stark difference in yield between early and late sowing dates

Combating Food Insecurity with Crop Yield Prediction through Remote Sensing and Machine Learning.

1.Researchers are harnessing the power of **remote sensing data** and **machine learning (ML) algorithms** to transform how we predict and manage crop yields. This groundbreaking approach promises to revolutionize [45]farming practices, ensuring optimal resource utilization and minimizing environmental impact. **Random Forest**: A robust ensemble learning method

2.**Xtreme Gradient Boosting (XGB)**: Known for its speed and performance

3.**Least Absolute Shrinkage & Selection Operator (LASSO)**: A regression analysis method that performs both variable selection and regularization.[46-48] These models are crunching numbers faster than a combine harvester, turning raw data into golden predictions. **LASSO** emerged as the top performer, achieving a coefficient of determination (R2) of 0.93 and a mean absolute error (MAE) of 21.72 in April.

Enhancing Crop Yield Predictions through Machine Learning with Integrated Weather and Pesticide Data.

Agriculture forms the backbone of India's economy, with millions depending on it for survival. However, the nation faces a critical challenge: balancing food security with a rapidly expanding population.[49] This study aims to leverage cutting-edge technology to assist farmers in boosting crop production through accurate yield predictions. Our research employs a robust combination of machine learning and deep learning algorithms to forecast crop yields. We utilize key variables such as rainfall patterns, crop types, meteorological conditions, cultivated area, and historical production data. These factors have been identified as critical determinants in the long-term sustainability of agriculture. The study compares the performance of various algorithms:

[50]Machine Learning: Decision Tree, Random Forest, and XG Boost Regression The Random Forest model, in particular, demonstrates exceptional accuracy with an impressive coefficient of determination (R^2) of 99.99%.

3.PROPOSED SYSTEM:

In a crop yield prediction project, the main aim is to figure out how much crop a specific area will produce based on different factors. This kind of project has an influence on several key steps:

Data Collection: Weather Data: Covers temperature, rainfall, humidity, and other climate conditions.

Soil Data: Details about soil type, pH levels, moisture content, and nutrient levels**.**

Crop Data: Past records on crop yields, planting dates, and growth stages. Satellite/Remote Sensing Data: Pictures and info that show vegetation health, land use, and more.

Agricultural Practices: Facts about the use of fertilizers, pesticides, watering methods, etc**. Data Preprocessing:** Cleaning the data to get rid of any mistakes or inconsistencies.

Picking the Right Model: Choosing good models to guess how much crops will grow, like: **Linear Regression:** To understand how yield relates to a group of independent variables. **–**

Decision Trees/Random Forest: To catch non-linear links and how variables work together.

- Neural Networks: To predict based on complex patterns and deep learning.

Support Vector Machines (SVM): To classify and make regressions.

ADVANTAGES:

Predicting crop yields has many perks that can help farmers, ag businesses, and folks who make policies. Here's a rundown of the main benefits: **Better Use of Resources:** Farmers can decide how much water, fertilizer, and pesticides they need cutting down on waste and costs. This means they use resources more which is key to keeping farming sustainable. **Handling Risks:** Foreseeing crop yields helps farmers get ready for possible shortages or extra crops letting them take steps to protect against risks like market changes or bad weather. **Better Profits:** Farmers can plan their finances better when they know what their yields will be. They can sell at the best times to get higher prices.

SYSTEM ARCHITECTURE:

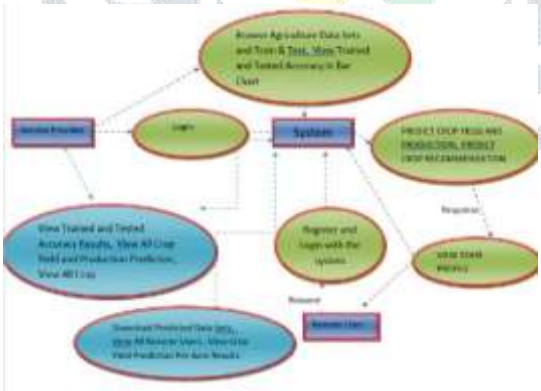

Fig1:system architecture

DATASET

	A	B	C	D	E	F	G
1	sname	District_N	Crop_Year	cseason	Crop	Area	production
2	Andaman	NICOBARS	2000	Kharif	Arecanut	1254	2000
3	Andaman	NICOBARS	2000	Kharif	Other Khar	456755	57845453
4	Andaman	NICOBARS	2000	Kharif	Rice	102	321
5	Andaman	NICOBARS	2000	Whole Yea	Banana	176	641
6	Andaman	NICOBARS	2000	Whole Yea	Cashewnu	720	165
7	Andaman	NICOBARS	2000	Whole Yea	Coconut	18168	6510
8	Andaman	NICOBARS	2000	Whole Yea	Dry ginger	36	100
9	Andaman	NICOBARS	2000	Whole Yea	Sugarcane	1	2
10	Andaman	NICOBARS	2000	Whole Yea	Sweet pot	5	15
11	Andaman	NICOBARS	2000	Whole Yea	Tapioca	40	169
12	Andaman	NICOBARS	2001	Kharif	Arecanut	1254	2061
13	Andaman	NICOBARS	2001	Kharif	Other Khar	2	1

Fig2:Dataset of crop yield prediction

UML DIAGRAMS:

CLASS DIAGRAM

A class diagram is a type of static structure diagram in the Unified Modeling Language (UML) that describes the structure of a system by showing its classes, attributes, operations (or methods), and the relationships among the objects. Class diagrams are essential in object-oriented design as they provide a blueprint for the system, helping developers visualize and understand the architecture.

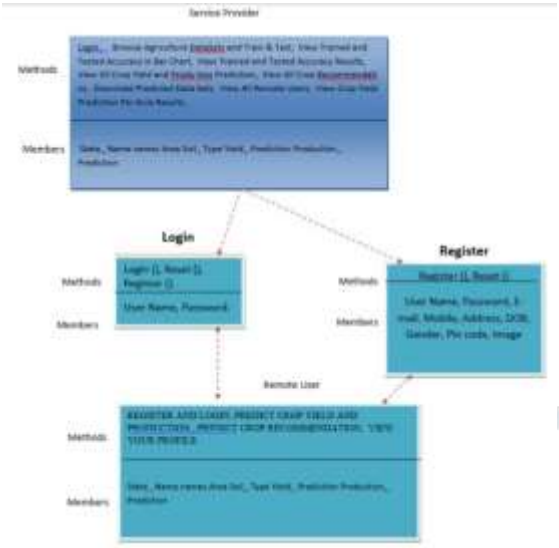

Fig3 class diagram

SEQUENCE DIAGRAM:

A sequence diagram is one of the types of interaction diagrams in the Unified Modeling Language (UML) that shows how objects interact in a particular sequence of actions over time. It's used to illustrate the flow of messages, events, and the order of interactions between objects to accomplish a specific functionality within a system.

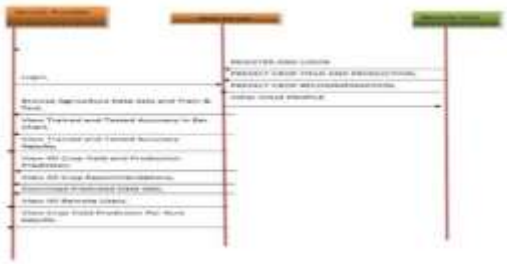

Fig4:Sequence diagram

FLOWCHART DIAGRAM:

A flowchart is a visual tool that helps you map out a process step by step using symbols and arrows. It's like a diagram that shows what happens first, what happens next, and so on, making it easy to understand how a process works.

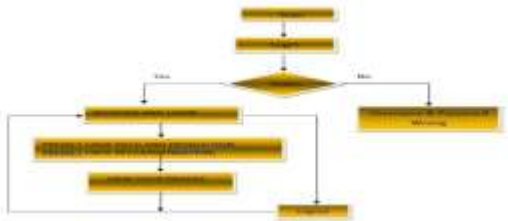

Fig5:flow chart diagram

4.RESULTS:

Login to the website

In the below given website the use have to login with their credentials,if they are not having account they have to sign in to website. In this the user can check their crop growth and yield prediction,soil quality,weather pattrens etc.

Fig 6:Website login

View All Yield Prediction and Production Prediction Details

This table shows crop and production, prediction details for different states in india as shown below table. In this table banana has highest yield production.

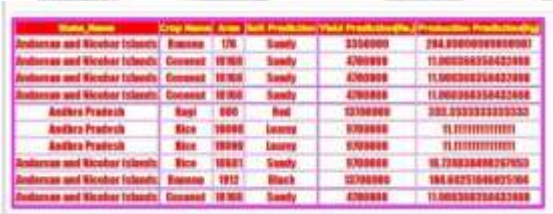

Fig7:Crop Prediction table

View All Crop Recommendations Details

Here we are showing the recommendation crops based on yield production on the analysis

Fig8:Recommendation of crop

Analysis of Crop Yield using Bargraph

The bargraph represents the accuracy of different classifiers

Title: Yield using Bargraph

X-axis: Classifiers(Naïve Bayes, SVM, Decision Tree, K-Neighbours, Random Forest)

Y-Axis: Accuracy(%) ranging from 0 to 100.

Data: Naïve Bayes: Around 20,SVM:around 90,Decision Tree: around 60,K-neigbours:around 70,Random forest:around 90

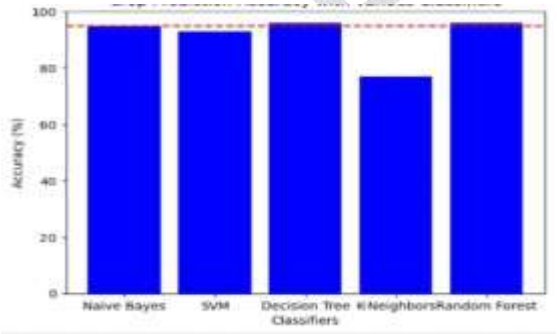

Fig9:Bargraph of Crop Yield prediction

5.CONCLUSION:

This paper highlighted the limitations of current systems and their practical usage on yield prediction. It then introduces a practical yield prediction system designed for farmers, featuring seamless connectivity through a dedicated mobile application The mobile application includes multiple features that users can leverage for the selection of a crop. The integrated recommendation system enables users to explore potential crops and their yields, empowering them to make more informed decisions. for yield to accuracy, various machine learning algorithms such as Random Forest, ANN, SVM, MLR, and KNN were implemented and tested on the given datasets from the Andaman& Nicobar and Andhra Pradesh states. Different algorithms are evaluated and compared based on their accuracy to determine the most effective method.. The results obtained indicate that Random Forest Regression is the best among the set of standard algorithms used on the given datasets with an accuracy of 95%. The proposed model also explored The future work will be focused on updating the datasets from time to time to produce accurate predictions, and the processes can be automated. Another feature to be implemented is recommending the appropriate type of fertilizer based on the specific crop and location.to implement this through study of available fertilizers and their relationship with soil and climate needs to be done. An analysis of available statistical data needs to be done.

REFERENCES:

1. M. Rashid, B. S. Bari, Y. Yusup, M. A. Kamaruddin and N. Khan, "A ComprehensiveReview of Crop Yield Prediction Using Machine Learning Approaches With Special Emphasis on Palm Oil Yield Prediction," in IEEE Access, vol. 9, pp. 63406-63439, 2021.
2. A. Mitra et al., "Cotton Yield Prediction: A Machine Learning Approach With Field and Synthetic Data," in IEEE Access, vol. 12, pp. 101273-101288, 2024.
3. P. Sharma, P. Dadheech, N. Aneja and S. Aneja, "Predicting Agriculture Yields Based on Machine Learning Using Regression and Deep Learning," in IEEE Access, vol. 11, pp. 111255-111264, 2023.
4. Vejendla, L. N., Bysani, B., Mundru, A., Setty, M., & Kunta, V. J. (2023). Score-based support vector machine for spam mail detection. Proceedings of the IEEE International Conference on Electronics, Computing and Communication Technologies (ICOEI), 915–920. https://doi.org/10.1109/ICOEI56765.2023.10125718
5. Anusha, P., Ravikiran, A., Lakshman Narayana, V., & Maddumala, V. R. (2020). Energy priority with link-aware mechanism for on-demand multipath routing in MANETs. Journal of Electrical Engineering and Automation, 29(3), 8979–8991.
6. Narayana, V. L., & Bharathi, C. R. (2017). Identity-based cryptography for mobile ad hoc networks. International Journal of Engineering and Technology Innovation, 95(5), 1173–1181
7. Narayana, V. L., & Midhunchakkaravarthy, D. (2020). A time interval-based blockchain model for detection of malicious nodes in MANET using network block monitoring node. Proceedings of the IEEE International Conference on Intelligent Computing and Robotics (ICIRCA), 852–857. https://doi.org/10.1109/ICIRCA48905.2020.9183256
8. Bharathi Vejendla, C. R., Narayana, L., & Ramesh, L. V. (2020). Secure data communication using Internet of Things. Journal of Advanced Research in Dynamic and Control Systems, 9(4), 3516–3520.
9. Narayana, V. L., Sujatha, V., Sri, K. S., Pavani, V., Prasanna, T. V. N., & Ranganarayana, K. (2023). Computer tomography image-based interconnected antecedence clustering model using deep convolutional neural network for prediction of COVID-19. Traitement du Signal, 40(4), 1689–1696. https://doi.org/10.18280/ts.400437
10. Patibandla, R. S. M. L., Rao, B. T., & Narayana, V. L. (2022). Prediction of COVID-19 using machine learning techniques. In Handbook of Machine Learning for Computational Biology and Bioinformatics (pp. 219–231). https://doi.org/10.1016/B978-0-12-824145-5.00007-1

11. Pavani, V., Sri, K. S., Krishna, P. S., & Narayana, V. L. (2021). Multi-level authentication scheme for improving privacy and security of data in decentralized cloud server. Proceedings of the IEEE International Conference on Systems and Electronics Engineering (ICOSEC), 391–394. https://doi.org/10.1109/ICOSEC51865.2021.9591698
12. Arepalli, P. G., Jairam Naik, K., & Rout, J. K. (2024). Aquaculture water quality classification with sparse attention transformers: Leveraging water and environmental parameters. In ACM International Conference Proceeding Series (pp. 318-325). https://doi.org/10.1145/3651781.3651829
13. Kumar, S. A., Babu, E. S., Nagaraju, C., & Gopi, A. P. (2015). An empirical critique of on-demand routing protocols against rushing attack in MANET. International Journal of Electrical and Computer Engineering, 5(5), 1102-1110. https://doi.org/10.11591/ijece.v5i5.pp1102-1110
14. Arepalli, G., Erukula, S. B., Gopi, A. P., & Nagaraju, C. (2016). Secure multicast routing protocol in MANETs using efficient ECGDH algorithm. International Journal of Electrical and Computer Engineering, 6(4), 1857-1865. https://doi.org/10.11591/ijece.v6i4.9941
15. Arepalli, P. G., Akula, M., Kalli, R. S., Kolli, A., Popuri, V. P., & Chalichama, S. (2022). Water quality prediction for salmon fish using Gated Recurrent Unit (GRU) model. In 2022 2nd International Conference on Computer Science, Engineering and Applications, ICCSEA 2022. https://doi.org/10.1109/ICCSEA54677.2022.9936539
16. Narayana, V. L., & Gopi, A. P. (2017). Visual cryptography for gray scale images with enhanced security mechanisms. Traitement du Signal, 34, 197-208. DOI: 10.3166/ts.34.197-208
17. Arepalli, P. G., Narayana, V. L., Venkatesh, R., & Kumar, N. A. (2019). Certified node frequency in social network using parallel diffusion methods. Ingenierie des Systemes d'Information, 24(1), 113-117. https://doi.org/10.18280/isi.240117
18. Peda Gopi, A., & Lakshman Narayana, V. (2017). Protected strength approach for image steganography. Traitement du Signal, 34(3-4), 175-181. https://doi.org/10.3166/TS.34.175-181
19. Narayana, V. L., Gopi, A. P., Anveshini, D., & Lakshmi, G. V. V. (2020). Enhanced path finding process and reduction of packet droppings in mobile ad-hoc networks. International Journal of Wireless and Mobile Computing, 18(4), 391-397. https://doi.org/10.1504/IJWMC.2020.108539
20. Vejendla, L. N., Naresh, A., & Arepalli, P. G. (2021). Traffic analysis using IoT for improving secured communication. In Innovations in the Industrial Internet of Things (IIoT) and Smart Factory (pp. 106-116). https://doi.org/10.4018/978-1-7998-3375-8.ch008
21. Kanumalli, S. S., Lavanya, K., Rajeswari, A., Samyuktha, P., & Tejaswi, M. (2023, February). A scalable network intrusion detection system using bi-lstm and cnn. In 2023 Third International Conference on Artificial Intelligence and Smart Energy (ICAIS) (pp. 1-6). IEEE.
22. Kanumalli, S. S., Mantena, S. J., Kandula, S., Doppalapudi, K., & Atluri, T. (2022, May). Automated Irrigation Management System using IoT. In 2022 6th International Conference on Intelligent Computing and Control Systems (ICICCS) (pp. 476-482). IEEE.
23. Kanumalli, S. S., Swathi, S., Sukanya, K., Yamini, V., & Nagalakshmi, N. (2022). Classification of dna sequence using machine learning. In Soft Computing for Security Applications:
24. Chaitanya, Kosaraju, et al. "Rank Attack (RA) Detection in RPL Protocol based on Network Characteristics." 2023 8th International Conference on Communication and Electronics Systems (ICCES). IEEE, 2023.
25. Kosaraju, Chaitanya, et al. "Mirchi crop yield prediction based on soil and environmental characteristics using modified RNN." 2023 IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS). IEEE, 2023
26. Chaitanya, Kosaraju, et al. "Ads Click-Through Rate prediction using Attention based LSTM Mechanism." 2024 IEEE International Students' Conference on Electrical, Electronics and Computer Science (SCEECS). IEEE, 2024.
27. Sujatha, V., Prasanthi, Y., Pravallika, C.H., ... Ayesha Banu, S.K., Sahithi, M.,K(23)
28. " A Computer Vision Method for Detecting the Lanes and Finding the Direction of Traveling the VehicleLecture Notes in Networks and Systems", 2023, 612, pp. 373–382
29. Sri, L. Akhila, K. Manvitha, G. Amulya, I. Sai Sanjuna, and V. Pavani. "FBI crime analysis and prediction using machine learning." Journal of Engineering Sciences 11, no. 4 (2020): 441-448.

30. P. V, L. S. K, P. Vyshnavi A, M. Ch and S. B. G, "Students Community Portal using Machine Learning," 2023 Second International Conference on Electronics and Renewable Systems (ICEARS), Tuticorin, India, 2023, pp. 1109-1113,doi: 10.1109/ICEARS56392.2023.10085516.
31. Sirisha, Aswadati, et al. "Intrusion detection models using supervised and unsupervised algorithms-a comparative estimation." International Journal of Safety and Security Engineering 11.1 (2021): 51-58.
32. Krishna, KVSS Rama, et al. "Vehicle Number Plate Detection using Deep Learning." 2024 International Conference on Integrated Circuits and Communication Systems (ICICACS). IEEE, 2024.
33. Krishna, Komanduri Venkata Sesha Sai Rama, et al. "Classification of Glaucoma Optical Coherence Tomography (OCT) Images Based on Blood Vessel Identification Using CNN and Firefly Optimization." Traitement du Signal 38.1 (2021).
34. Rayachoti, Eswaraiah, Sudhir Tirumalasetty, and Silpa Chaitanya Prathipati. "Watermarking system for telemedicine based on FABEMD." Multimedia Tools and Applications 81.30 (2022): 44383-44404.
35. Chaitanya, P. Silpa, KV Narasimha Reddy, and G. Madhavi. "Effective Search of Color-Spatial Image Using Semantic Indexing." International Journal of Computer Science, Engineering and Applications (IJCSEA) Vol 2 (2012): 9-19
36. Alapati, N., Prasad, B. V. V. S., Sharma, A., Kumari, G. R. P., Veeneetha, S. V., Srivalli, N., ... & Sahitya, D. (2022, November). Prediction of Flight-fare using machine learning. In 2022 International Conference on Fourth Industrial Revolution Based Technology and Practices (ICFIRTP) (pp. 134-138). IEEE.
37. Alapati, N., Prasad, B. V. V. S., Sharma, A., Kumari, G. R. P., Bhargavi, P. J., Alekhya, A., ... & Nandini, K. (2022, November). Cardiovascular Disease Prediction using machine learning. In 2022 International Conference on Fourth Industrial Revolution Based Technology and Practices (ICFIRTP) (pp. 60-66). IEEE.
38. Srikanth Kilaru ” A Novel Approach to Human Iris Recognition And Verification Framework Using Machine Learning Algorithm” 2023 6th International Conference on Contemporary Computing and Informatics (IC3I),
39. DOI: 10.1109/IC3I59117.2023.10397886, ISBN Information:Electronic ISBN:979-8-3503-0448-0 Print on Demand(PoD) ISBN:979-8-3503-0449-7
40. Srikanth Kilaru “Analytical models for collaborative autonomous mobile robot solutions in fulfillment centers” in Applied Mathematical Modelling, Volume 91, March 2021, Pages 438-457, https://doi.org/10.1016/j.apm.2020.09.059
41. Gopi, A. P., & Naik, K. J. (2022). An IoT model for fish breeding analysis with water quality data of pond using modified multilayer perceptron model. 2022 International Conference on Data Analytics for Business and Industry (ICDABI), 448-453. https://doi.org/10.1109/ICDABI56818.2022.10041617
42. Arepalli, P. G., & Naik, K. J. (2024). A deep learning-enabled IoT framework for early hypoxia detection in aqua water using lightweight spatially shared attention-LSTM network. Journal of Supercomputing, 80(2), 2718-2747. https://doi.org/10.1007/s11227-023-05580-x
43. Arepalli, P. G., & Naik, K. J. (2023). An IoT-based water contamination analysis for aquaculture using lightweight multi-headed GRU model. Environmental Monitoring and Assessment, 195(12), Article 1516. https://doi.org/10.1007/s10661-023-12126-
44. Gopi, A. P., Gowthami, M., Srujana, T., Gnana Padmini, S., & Durga Malleswari, M. (2023). Classification of denial-of-service attacks in IoT networks using AlexNet. In Smart Innovation, Systems and Technologies (Vol. 316, pp. 349-357). https://doi.org/10.1007/978-981-19-5403-0_30
45. Bikku, T., Gopi, A. P., & Prasanna, R. L. (2019). Swarming the high-dimensional datasets using ensemble classification algorithm. In Advances in Intelligent Systems and Computing (Vol. 815, pp. 583-591). https://doi.org/10.1007/978-981-13-1580-0_56
46. Sharmila, S.K., Lakshmi, M.S., Chowdary, G.S., Mounika, P., & Srujana, C. (2023). Speech emotion recognition using Mel Frequency Cepstral Coefficients. In Proceedings of the 5th International Conference on Smart Systems and Inventive Technology (ICSSIT 2023, pp. 1599–1604). https://doi.org/10.1109/ICSSIT55814.2023.10060950
47. Mohiddin, S.K., Sharmila, S., & Sharma, V. (2024). Integration of mobile edge computing in wireless technology. In Wireless Communication Technologies: Roles, Responsibilities, and Impact of IoT, 6G, and Blockchain Practices (pp. 1–18). https://doi.org/10.1201/9781003389231-1

48. Mohiddin, S.K., Yalavarthi, S.B., & Sharmila, S. (2017). A complete ontological survey of cloud forensic in the area of cloud computing. In Advances in Intelligent Systems and Computing (Vol. 547, pp. 38–47). https://doi.org/10.1007/978-981-10-3325-4_5
49. M. Ashfaq, I. Khan, A. Alzahrani, M. U. Tariq, H. Khan and A. Ghani, "Accurate Wheat Yield Prediction Using Machine Learning and Climate-NDVI Data Fusion," in IEEE Access, vol. 12, pp. 40947-40961, 2024.
50. S. P. Raja, B. Sawicka, Z. Stamenkovic and G. Mariammal, "Crop Prediction Based on Characteristics of the Agricultural Environment Using Various Feature Selection Techniques and Classifiers," in IEEE Access, vol. 10, pp. 23625-23641, 2022.