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CATTLE DISEASE DETECTION USING MACHINE LEARNING TECHNIQUES

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ABSTRACT

A contagious and occasionally fatal viral disease, foot-and-mouth disease (FMD) affects cattle. Blisters that may break and cause lameness develop within the mouth and close to the hoof after a high fever that lasts for two to six days due to the virus. Since it is highly contagious and may be transferred by sick animals rather simply through coming into contact with contaminated farming equipment, cars, clothing, and feed, as well as by domestic and wild predators, FMD and Lumpy Skin Disease (LSD) has very serious implications for animal farming. In order to contain it, significant vaccination efforts, stringent surveillance, trade restrictions, quarantines, and the culling of both sick and healthy (uninfected) animals are required. FMD causes considerable production and productivity losses for cattle farmers, as well as trade restrictions and huge overall economic losses for the entire cattle industry. In order to solve this issue, we have deployed machine learning algorithms for predicting the development of lumpy skin disease and cow foot and mouth disease, which have shown to be effective at addressing such issues at an early stage.

Keywords: Machine Learning Algorithms, Foot And Mouth Disease, Lumpy Skin Disease, Cattle Disease.

I. INTRODUCTION

Animals with cloven hooves including cattle, pigs, sheep, and goats are susceptible to the deadly and highly contagious viral disease known as foot and mouth disease (FMD). By examining huge quantities of data on animal health, machine learning algorithms can be used to spot possible FMD epidemics. This includes animal movement trends, past immunization records, and symptoms. Machine learning algorithms can forecast the likelihood of FMD outbreaks and help with the installation of control measures to stop the disease's future spread by finding patterns and correlations in these data. Machine learning can be used to manage FMD epidemics early on, protect animal herds from harm, and reduce the financial toll that outbreaks have.

The viral infection lumpy skin disease (LSD) can affect cattle. Ticks and other insects that feed on blood, such some species of flies, mosquitoes, and ticks, spread it. It can also cause death, fever, and skin nodules, especially in animals that have never been exposed to the virus before. vaccinations and the eradication of unhealthy people. Two potential forms of control are animals. Traditionally, lumpy skin disease has only affected the southern and eastern regions of the continent; but, in the 1970s, it began to expand from the northwest to sub-Saharan west Africa.

II. LITERATURE REVIEW

Machine learning (ML) and natural language processing (NLP) are commonly employed in biological and medical research. This pattern is particularly in line with how the medical field is evolving, which is towards a highly interconnected society that embraces the World Wide Web and hosts discussions on important topics between regular people and health experts. Medical writings and discourses are primarily written in natural language, hence several text analysis frameworks and approaches have been created to extract knowledge from these texts and discourses.[1]. In order to gather medical data and share useful information on medical diagnosis, authorization, medicines, and treatment in order to assist clients with various ailments, the online networking structure interacts with clients, also known as clients, their closest relatives, and doctors. With the goal of returning to the anchor site according to placement, a ground-breaking online social medical suggestion system based on cryptography is envisioned.[2]. Psoriasis is a manifestation of the illness. auto immune disorders. The illness hardly ever has a treatment. Many people have experimented with various drugs and treatments. Allopathic, homoeopathic, ayurveda, and other sorts of therapy have been used on patients. Patients who received different therapies have shared their experiences online on numerous healthcare forums. Online users who are looking for information on various medical treatments and their efficacy must filter through a variety of opinions. This initiative pulls the helpful treatment recommendations from online health discussion boards.[3]. Language laying down is a technique used to condense the language and content of a large document into a brief summary. In a nutshell, it's a technique for obtaining important information from written material in order that it can be conveyed. In recent years, this technique has become incredibly important in a wide range of businesses, including search engines, business analysis, market assessments, and medical applications, among others.[4]. The Alstonia tree (Pale tree), a species of tree whose bark extraction is utilized for medicinal purposes, is difficult to locate. Since this allows us to gather the necessary information about different species to promote a given application, plant and tree identification is crucial. The pre-trained Inception V3 model and the Convolutional Neural Network (CNN) method are used to locate and categorize the trees in this instance. When compared to conventional methods, CNN models give higher accuracy rates.[5]. The vocal similarity of twins has recently been the subject of extensive research. The neural network facilitates speaker identification. In previous research on speaker identification, discriminative neural networks, utterance-level assessment speaker depictions, and the preciseness of the voice are typically calculated.[6]. Numerous diseases have an impact on the plant's complete development process, from the roots to the fruit. Infections must now be found visually, therefore farmers must constantly inspect each crop carefully to detect them. A deep learning technique called a convolutional neural network (CNN) takes a photo and assigns accessible biases and weights to various objects in the image. The CNN gains the ability to differentiate between items based on the findings [7]. Lumpy skin disease is an infectious viral disease of cattle, which often occurs in epizootic form. The disease is characterized by the eruption of nodules in the skin, which may cover the whole of the animal's body. Systemic effects include pyrexia, anorexia, dysgalactia and pneumonia; lesions are often found in the mouth and upper respiratory tract. The severity of the disease varies considerably between breeds and strains of cattle. Many cattle suffer severe emaciation and loss of production for several months. The skin lesions cause permanent damage to the hides. The mode of transmission of the disease has not been clearly established. Contact infections do not readily occur and the evidence from the epizootiology strongly suggests that insect vectors are involved. The disease has been confined to sub-Saharan Africa, until it recently appeared in epizootic form in Egypt and in Israel. Transmission occurs in a wide variety of biotypes, from semi-desert to temperate grasslands and irrigated land. It has the potential to extend its range further [8]. This chapter examines the foot-and-mouth disease (FMD) host range in both natural and artificial environments. In regard to advancements in our understanding of the pathophysiology of FMD, the paths and sites of an infection, incubation times, and symptomatic and pathological results are discussed and underlined [9]. 14 out of 194 Holstein cattle kept in Suez were found to have a bout of fever, increased spit, generalized deep skin modules, and swollen lymph nodes on June 2, 1988. Clinically sound cattle that had been transported from Somalia in the month of May 1988 were held with that herd at an authorized farm close to a quarantine facility. On October 31, 1988, a second outbreak in the Ismailia governorate was reported. A discharge of purulent material from wounds with subsequent bacterial involvement was present in 50% of 250 native (Balidy) cattle. In a group of samples from the initial epidemic, lumpy skin disease viruses (LSDV) and bovine herpesvirus-4 were both found. The only isolate from the additional outbreak was LSDV [10]. By displaying a particular antigen or nucleic acids, with or without preceding viral amplification in cell culture (virus isolation), the presence of the FMD virus is demonstrated. The laboratory diagnostic and type detection of the virus needs to be carried out in a lab with an acceptable level of bio-containment, as established by risk analysis in line with Chapter 1, due to the highly transmissible nature of FMD and its economic importance.1.4 Standards to handle biological risk in veterinary laboratories and animal facilities are biosafety and biosecurity. FMD viral antigens can be found using enzyme-linked immunosorbent assays (ELISA), which can also be used for serotyping. Additionally becoming more widely accessible, lateral flow detectors (LFD) can also be used to find FMD viral antigens.[11].

III. METHODOLOGY

The following steps are commonly included in the methodology for diagnosing cow foot and mouth disease (FMD) and lumpy skin disease (LSD) using machine learning algorithms:

Data collection: The first step is to collect data from various sources, such as clinical records, blood tests, and imaging results, for cattle with suspected FMD. The data should include information about the symptoms and test results for both infected and non-infected cattle. Collect a large dataset of images of cattle, with a balanced representation of healthy and LSD-positive animals.

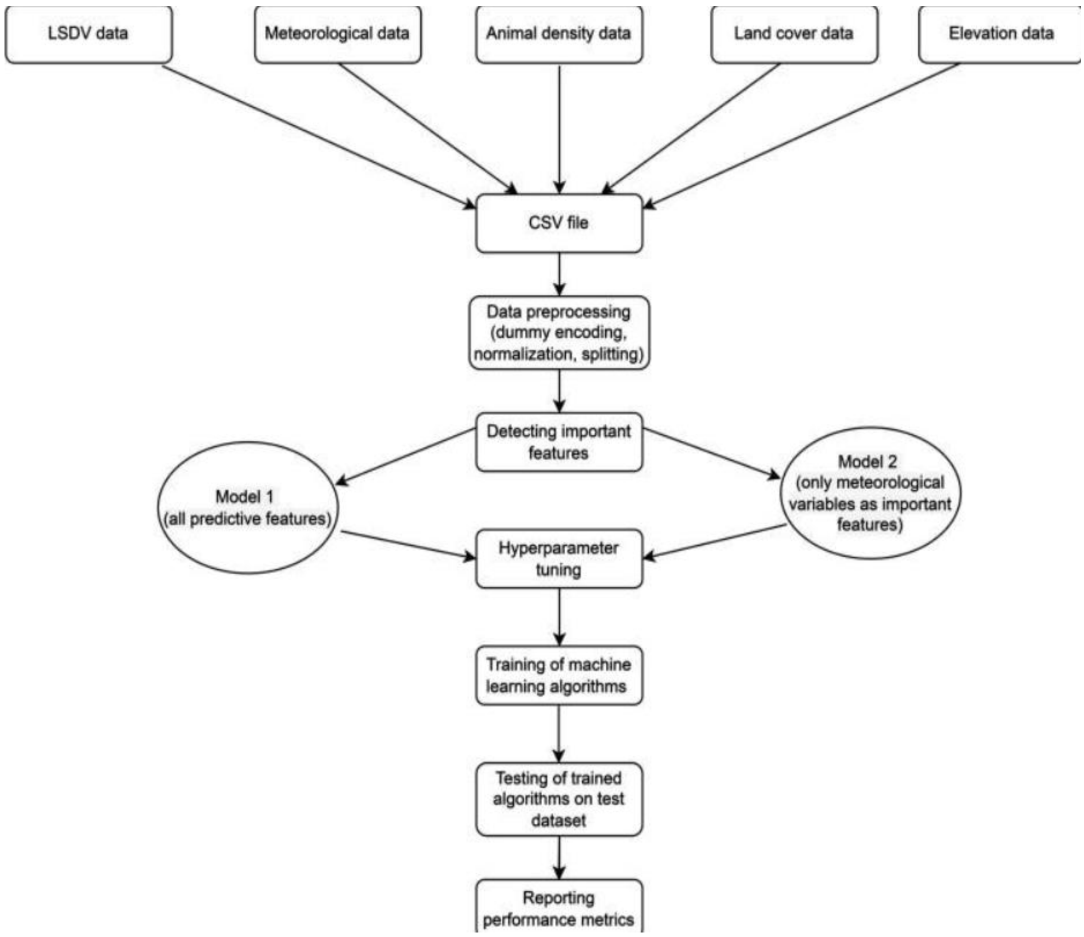
Data pre-processing: The collected data must be pre- processed to clean, normalize, and format it for analysis. This may involve removing any missing or irrelevant data, converting data into a suitable format, and transforming the data to ensure that it is in a consistent range.

Feature extraction: Extract meaningful features from the images that can be used to distinguish healthy and LSD- positive animals.

Model training: Once the data is pre-processed, the machine learning algorithm can be trained on the data. The algorithm will use the pre-processed data to identify patterns and relationships between the symptoms and test results and the presence of FMD.

Model evaluation: It is necessary to assess the trained model's diagnostic precision for FMD in cattle. To test the model's capacity to correctly categories infected and non-infected cattle, it may be necessary to use a validation dataset.

Model deployment: Once the model has been trained and evaluated, it can be deployed in a real-world setting to diagnose FMD in cattle. The model can be used to analyze data from newly suspected cases of FMD and provide a diagnosis. The specific machine learning algorithm used will depend on the type and quality of the data available, as well as the desired accuracy and efficiency of the model. The methodology can be adapted and modified as needed to improve the accuracy of FMD diagnosis using machine learning algorithms. Deploy the trained model in a real- world setting to detect LSD in cattle.



Hyperparameter tuning: With the help of the Randomized SearchCV method obtained from the scikit-learn library, the best set of variables for each machine learning methodology were selected. With a particular distribution, this approach can test a certain number of contenders from a collection of parameters.

Logistic Regression: One machine learning classification technique, logistic regression, predicts the categorical dependent variable using a collection of dependent variables and provides probabilistic values that range from 0 to 1.

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ANN: The multilayer perceptron (MLP) is an artificial neural network (ANN) that is easy to understand. It typically has three layers: an input layer, an output layer, and a layer that is concealed. The data that needs to be processed enters the system at the input layer. The classification process is handled by the output layer. Between the input and output layers, the MLP's true computational engine consists of any number of hidden layers.

ADVANTAGES:

Faster diagnosis: The time needed for diagnosis can be decreased by using machine learning algorithms to swiftly and accurately analyze vast amounts of data.

Improved accuracy: More accurate diagnoses can be made because ML systems can spot patterns in information that human inspectors might find difficult to discover.

Reduced manual labor: By eliminating the need for inspection by hand, the adoption of ML algorithms frees up resources and lowers the possibility of human error.

Better monitoring and control: In order to monitor and analyse the progress of the disease, identify outbreaks, and stop future spread, machine learning techniques can be deployed.

Cost-effective: The automation of the diagnostic process can reduce the cost of detecting and controlling foot and mouth disease in cattle populations.

DISADVANTAGES:

Dependence on data quality: The caliber and volume of data required to train the algorithms are critical to machine learning techniques. Inaccurate outcomes and incorrect diagnoses might result from bad data.

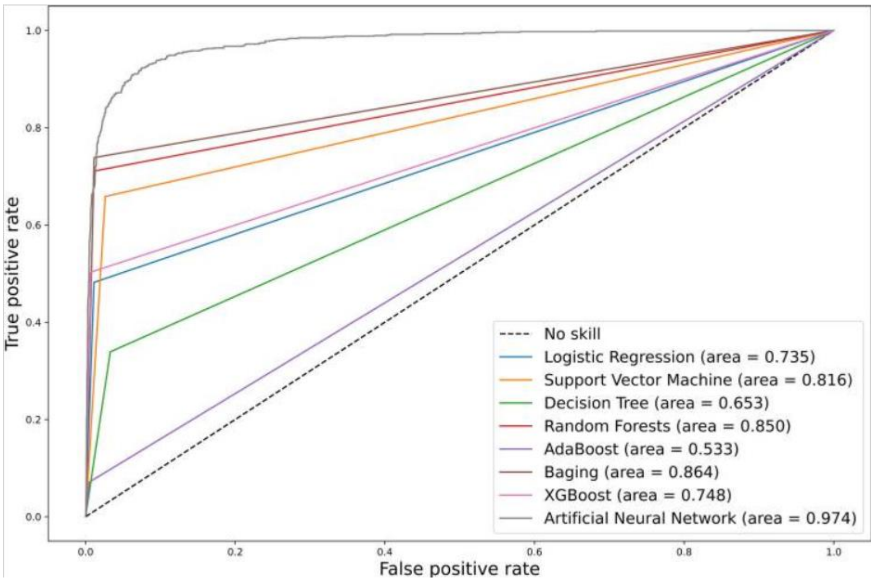
Technical limitations: ML algorithms may not be able to detect all types of foot and mouth disease, or may not be effective in all geographic locations and environments.

Cost of implementation: The initial investment in hardware, software, and personnel required to implement a ML-based detection system can be substantial.

Lack of transparency: Due to the intricacy of their methods for making decisions, some ML algorithms, especially deep learning models, might be regarded as "black boxes," making it challenging to comprehend how they arrived to a specific diagnosis.

Need for ongoing maintenance: ML models must be regularly updated and retrained to remain effective, which requires ongoing investment and effort.

IV. EXPERIMENTAL RESULTS



The results of the current study showed that the likelihood of the LSDV infection could be anticipated in the set being studied (unseen data) with excellent precision by employing machine learning techniques and using environmental and geospatial factors as predictive variables. For example, the ANN algorithm reported a 97% accuracy rating. The accuracy rating is not the classifiers' preferred performance metric, especially in cases when some classes are more prevalent than alternatives. As a result, performance measurements like recall, F1 score, accuracy, and Roc make more sense when evaluating the ability to predict the results of algorithms. The ANN method had the best performance in terms of the AUC metric, whether all predictive factors were included in the model or simply meteorological variables were used as predictors (97% in both models).

Using all predictor factors or just climatic predictor variables had little effect on the ANN's prediction ability, which had an AUC of 0.97. According to the research, feature selection can increase the classifier's capacity for generalization, scalability, and prediction accuracy. Because it lowers computing complexity, storage requirements, and cost, this approach is essential for information discovery. However, it should be remembered that any predicting feature may be worthless when used alone, but becomes useful when paired with additional features. As a result, selecting characteristics may not necessarily result in better results, and removing features might even be harmful in some circumstances.

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V. CONCLUSION

In conclusion, recent research have demonstrated encouraging outcomes for the application of neural network algorithms for the identification of cow foot and mouth disease (FMD). Algorithms based on machine learning have an opportunity to enhance the effectiveness, speed, and effectiveness of FMD identification as well as assist in tracking and limiting the disease's spread. The quality and quantity of data utilized to train models, as well as the particular methods and modalities used, are all critical considerations for machine learning-based FMD detection. For the cattle industry to implement reliable and scalable solutions, more investigation is required to properly assess the possible advantages and limitations of utilizing machine learning algorithms for FMD identification.

Machine learning algorithms have the potential to increase the precision, speed, and effectiveness of diagnosis of cattle foot and mouth disease. These algorithms may be used to track and stop the expansion of FMD, lessening the effects it has on herds of cattle and the economy. However, it is crucial to take into account the restrictions and difficulties related to making use of machine learning algorithms, which include the reliance on high-quality data, technical constraints, implementation costs, and the requirement for ongoing maintenance. To fully realize the possibilities of machine learning techniques for FMD identification and to solve these limitations, more study is required.

VI. REFERENCES

[1] Balipa, Mamatha, S. Yashvanth, and Sharan Prakash. "Extraction and Summarization of Disease Details Using Text Summarization Techniques." In Intelligent Communication Technologies and Virtual Mobile Networks: Proceedings of ICICV 2022, pp. 639-647. Singapore: Springer Nature Singapore, 2022.

[2] Balipa, Mamatha, S. Yashvanth, and Sharan Prakash. "Healthcare Solutions Extraction Based on ANNGOA and TDES." In 2022 Second International Conference on Artificial Intelligence and Smart Energy (ICAIS), pp. 45-52. IEEE, 2022.

[3] Balipa, Mamatha. "OPINION ANALYSIS OF TREATMENTS FROM ONLINE HEALTHCARE FORUMS FOR THE DISEASE PSORIASIS USING NLP AND ARTIFICIAL NEURAL NETWORK." Development 5, no. 07 (2018).

[4] Balipa,M., Balasubramani,R., Vaz, H., Jathanna,C.S., Text summarization for psoriasis of text extracted from online health forums using textrank algorithm, International Journal of Engineering and Technology(UAE), 2018,7(3.34 Special Issue 34), pp. 872–873.

[5] Balipa, Mamatha, and Ashton Castalino. "Alstonia Tree Detection using CNN and Inception V3 Algorithms." In 2022 International Conference on Computing, Communication, and Intelligent Systems

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(ICCCIS), pp. 318-321. IEEE, 2022.

[6] Balipa, Mamatha, and Afeefa Farhath. "Twins Voice Verification And Speaker Identification." In 2022 International Conference on Artificial Intelligence and Data Engineering (AIDE), pp. 322-325. IEEE, 2022.

[7] Balipa, Mamatha, Pallavi Shetty, Arhath Kumar, and B. R. Puneeth. "Arecanut Disease Detection Using CNN and SVM Algorithms." In 2022 International Conference on Artificial Intelligence and Data Engineering (AIDE), pp. 01-04. IEEE, 2022.

[8] DAVIES FG. (1991) b. Lumpy skin disease of cattle: A growing problem in Africa and the Near East. World Animal Review, 68, 37 – 42.

[9] Alexandersen S, Mowat N, (2005). Foot-and- mouth disease: host range and pathogenesis. Curr Top Microbiol Immunol. 288, 9-42.

[10] House JA, Wilson TM, El Nakashly S, Karim IA, Ismail I, El Danaf N, Moussa AM, Ayoub NN. (1990). The isolation of lumpy skin disease virus and bovine herpesvirus-4 from cattle in Egypt. Journal of Veterinary Diagnostic Investigation, 2(2):111-115; Office International des Epizooties (OIE), (2017).

[11] Foot and Mouth Disease (Infection with Foot and Mouth Disease Virus). In Manual of Diagnostic Tests and Vaccines for Terrestrial Animals. OIE, Paris, 1-32.