ANIMAL HEALTHCARE AND FARM ANIMAL DISEASE PREDICTION USING MACHINE LEARNING

Augustin Nadar
Information Technology
Fr. C. Rodrigues Institute of Technology,
Vashi, India
samuelnadar28@gmail.com

Adishree Sane
Information Technology
Fr. C. Rodrigues Institute of Technology,
Vashi, India
adishreesane@gmail.com

Glenn Muga
Information Technology
Fr. C. Rodrigues Institute of Technology,
Vashi, India
gmuga7@gmail.com

Easther Masih
Information Technology
Fr. C. Rodrigues Institute of Technology,
Vashi, India
masiheasther@gmail.com

Smita Rukhande
Information Technology
Fr. C. Rodrigues Institute of Technology,
Vashi, India
smita.rukhande@fcrit.ac.in

2023 5th Biennial International Conference on Nascent Technologies in Engineering (ICNTE) | 978-1-6654-6504-5/23/$31.00 ©2023 IEEE | DOI: 10.1109/ICNTE56631.2023.10146635

***Abstract*—Veterinary care is an extremely important part of animal care. The focus of the Veterinary doctor or practitioner is to supervise the overall health and clinical care of the animals. A veterinary doctor is responsible for observing and promoting the well-being of the animal at all phases of the animal's life span. In the inaccessible remote locations of India, access to Veterinary services is difficult. Farmers or livestock owners have to travel long distances from their villages when they require treatment for their animals. This has adversely affected eutherian mammal farming in rural regions that square measure usually set in remote locations. A website to connect Veterinarians with Livestock owners can turn out to be a valuable solution. Farm Animals represent a valuable quality of nutritional products such as dairy products they also are a great resource of the economy for the owners. The production of dairy and other nutritional products is being challenged due to the toxic use of pests and malady infestation resulting in poor productivity. Death of the animals can also be expected in such cases, massive economic losses to livestock owners and the nation. Such issues must be addressed timely before the situation gets out of hand, this is only possible by making Veterinary services available to every part of the nation, be it via online mode or by providing Veterinary practitioners to rural areas. Livestock production in the farm sector acts as an important source of nutrition to India, it provides economic support to many farmers and contributes to the economy of India.**

Keywords - Machine Learning, Prediction, Dataset, Algorithms, Veterinary Care, SVM, Random Forest, Naive Bayesian, Django, Farm Animals.

I. INTRODUCTION

Farm animals are an important part of one's daily life. The health of farm animals is severely threatened by pests and disease infestation, which has a terrible impact on productivity, results in animal deaths, and causes severe economic losses to farmers and nations that are hazardous to the ecosystem's balance. To minimize damages to farmers' livelihoods and sources of income and nations' economies, one must safeguard farm animals. However, before infections have a chance to have crippling effects, a diseased animal will vocalize or give off visual cues to indicate a physiological imbalance. A farmer's comprehension of the specific communication cues given by the stock would enable prompt detection of any underlying illness within, even though a healthy animal conveys its physiological status by active display and movement of the bodily organs. Predicting rising diseases is among the foremost tough challenges faced by researchers and health managers. One tends to give out their approaches and tools to sight rising diseases in animals supported by clinical observations of stock by veterinarians. The Scope is to provide veterinary care to inaccessible areas, thanks to this pandemic state of affairs even regularly, Online Consultation will bring serious relief to the current field and make it easier to manage health. A website wherein Livestock owners can interact with Veterinarian doctors and get online consultations. Through a sickness portal, individuals are going to be ready to determine the type of sickness the livestock is suffering through. To keep the animals alive, healthy, and guarded against any infection, one tends to additionally provide equal importance to community-level ethnoveterinary practitioners, non-public para-veterinary staff, and different veterinary service suppliers. Whereas they will not be qualified veterinary doctors, they typically have a much better rapport with farmers, and services are much more accessible as compared to government functionaries. The projected system may be a website that predicts animal disease. The website aims to produce several services like a sickness prediction system alongside different veterinary services still as Animal Healthy Style Management. Except for sickness prediction, it has different options like an animal care portal which will facilitate users to grasp varied diseases and animal health care. The users can even realize the veterinary gift in their state.

II. LITERATURE SURVEY

There are a variety of animal diseases. One of the most prevalent infections in both humans and animals is Malta fever, often known as brucellosis. The majority of living things, including humans, horses, dogs, sheep, and cows, can contract the Brucella family of bacteria. Humans frequently come into contact with livestock and/or animal products, such as dairy, meat, etc., making this disease significant. [1] Livestock production and public health are significantly affected by the zoonotic disease brucellosis worldwide. Punjab is the state that produces the most cow and buffalo milk per capita in India, which is the world's largest producer of milk. Epidemiology of bovine brucellosis to demonstrate that the disease can be controlled in the state of Punjab, India. A cross-sectional human and livestock survey of dairy farms in remote locations of Ludhiana was conducted using a multi-level sampling approach, suggests that the most cost-effective

strategy is to vaccinate replacements in huge numbers at the start of the program. Further sensitivity analysis demonstrated that even at fifty percent of the estimated prevalence levels, all interventions would still be economically viable. [3] Another malady termed Lumpy skin disease (LSD) has catastrophic effects on the economy. LSD recently appeared in the Indian subcontinent, indicating that it has recently migrated to climatically different and formerly disease-free nations during the previous ten years (2019). [4] For getting an insight into another significant disease Calves were used as a means of managing cattle disease. Based on the calf's birth history, biometric measurements, environmental information about the house, and data on infections and immunity state for illness treatment, the calf's disease was assessed. When the immune system is functioning properly, these illnesses manifest, and diarrhea is a common clinical sign. Calf diarrhea has a fatal outcome. To enable the environmental management of livestock, livestock breeding farms needed to report the birth of calves and affix ears to the livestock. [5] To tackle such problems data mining plays a huge role. The extraction of hidden information, patterns, and relationships from a vast volume of data in one or more massive databases is known as data mining. Such information can be used to lower expenses and raise revenue. Prognostic models can be used to identify animals with brucellosis and to lessen the disease's effects through the use of data mining techniques. efficacy of neural network algorithm and decision tree-based prediction and diagnosis of brucellosis disease in livestock is accessed. The proper MATLAB software was employed to carry out this study. According to investigations, the decision tree produced forecasts with a higher degree of accuracy. [8] Another zoonotic illness present in India is anthrax. For reducing anthrax mortality as well as the risk of anthrax transmission in the public, early detection of anthrax is essential. With the help of machine learning techniques, a disease prediction model can be created to evaluate the risk of anthrax. A similar machine learning model was successful in detecting future outbreak susceptible areas. These areas contribute significantly to the disease outbreak. This machine learning model was developed using R statistical software using a variety of data mining regression and classification models, such as GLM, GAM, MARS, FDA, CT, SVM, NB, ADA, RF, GBM, and ANN. Cohen's Kappa, the ROC curve, and True Skill Statistics (TSS) were used to assess the accuracy of the model. Numerous ecological aspects, such as the effects of changing precipitation levels, were also taken into account by the model. Cohen's Kappa, the ROC curve, and True Skill Statistics (TSS) were used to assess the accuracy of the model. [6] As big data adoption rises in the biomedical and healthcare industries, accurate medical data analysis aids in early disease detection, patient treatment, and community services. However, the accuracy of the analysis diminishes when the medical data is of poor quality. For efficient chronic sickness outbreak prediction in areas with high disease incidence, machine learning techniques are simplified. Using actual hospital data collected in central China between 2013 and 2015, the improved prediction models were put to the test. A latent component model to fill in the blanks to get around the problem of incomplete data is employed. Research on a localized, persistent cerebral infarction condition is conducted. The expression of machine intelligence by machines is known as artificial intelligence (AI). Deep learning and machine learning are its two subfields. Machine learning (ML) applies algorithms to data to identify trends and produces a model to forecast the future. The methods K-nearest, support vector machines, decision trees, and linear regression are frequently employed. Convolutional neural networks, restricted Boltzmann machines, autoencoders, and sparse coding are some of the categories under which deep learning techniques fall. One of the most noteworthy methods is the Convolutional Neural Networks (CNN), which finds important features automatically and doesn't need human supervision. Utilizing CNN-based techniques has been very beneficial in image-level diagnostics. In the diagnosis of diseases and the administration of farms, artificial intelligence has several applications. [9] Different planning processes have been transformed into artificially intelligent systems to collect data from diverse sources as a result of the digital revolution in cattle production. Machine learning (ML), a branch of artificial intelligence, holds great promise for addressing a variety of challenges facing information-based system organizations. [10] Modern, highly advanced technical applications like machine learning have become a big industrial trend. Machine learning is pervasive and used extensively in a wide range of applications. To find patterns in medical data sources and to better anticipate diseases, machine learning is applied. In this article, we examine several machine learning techniques that have been applied to creating effective decision support systems for healthcare applications. The research gap for developing effective decision support systems for medical applications is filled in part by this work. [11] suggests that ensemble techniques can be used for software defect prediction. To answer the question, around 46 of the relevant papers have been researched to identify the latest trends and advances in ensemble learning techniques for software defect prediction. Through the study, the author has discovered that the most used most frequently used algorithms are Random Forest. [12] In actual life, classification is necessary. The Naive Bayes classifier is a mathematical classification method that uses a series of probabilistic computations to get the best classification for a given set of data inside a problem area. This paper describes a Naive Bayes classifier implementation. This classifier is adaptable to many classification domains and can be used as a universal toolkit. A sample data set is chosen to test this classifier to guarantee the accuracy of the probabilistic computations involved.

III. PROPOSED SYSTEM

The proposed system is a website that predicts animal

diseases using ML. The website aims to provide many services like disease prediction systems using ML along with other veterinary services as well as Animal Healthy Lifestyle Management. Apart from ML-based disease prediction, it has other features like an animal care portal that will help users to know about various diseases and animal healthcare. The cost of maintaining a Django server is $40 and $10 for PostgreSQL.

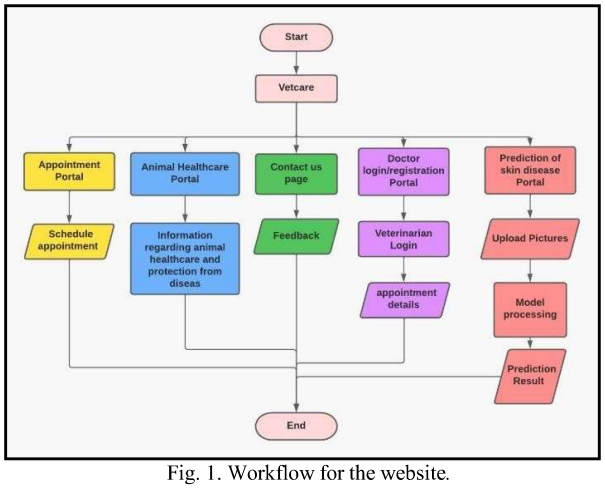

Fig. 1. Workflow for the website.

Fig. 1. shows the flow of the website, which contains 4 section Appointment portal, Animal Healthcare, Doctor Registration portal, and Disease prediction portal for scheduling an appointment with the Veterinarian, to gather knowledge about animal healthcare, Registration for new Vets, and Disease prediction. Fig. 2. shows all four modules existing on the website.

Disease prediction: In the disease prediction module the user needs to enter the symptoms of the disease based on which the model will predict the disease. Three models: the SVM model, Naive Bayesian, and Random Forest are used. The outcome will be the combined result of all these models.

Animal Healthcare: Animal healthcare provides all the necessary information for the well-being of farm animals. The symptoms of various diseases along with the preventive measures that need to be taken are listed in the animal healthcare portal. It also gives information regarding animal hygiene. Information is available in languages Hindi and English.

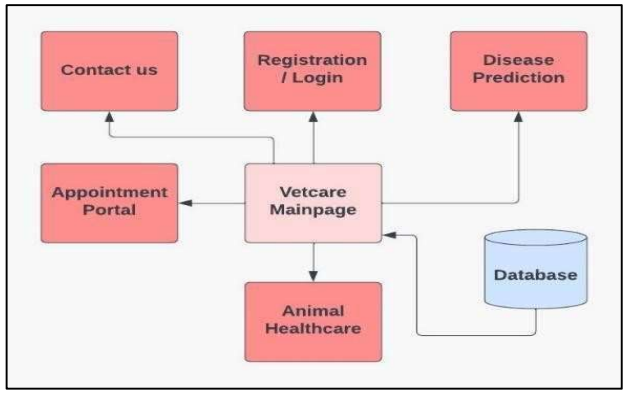

Fig. 2. Architecture diagram for website

Appointment portal: This allows the user to schedule appointments in Veterinary care or online with any veterinarian. The appointment can be scheduled by filling out a form provided in the appointment portal.

Contact veterinarian: The contact details of all the veterinarian doctors across the country are provided so that one can book an appointment on the appointment page. The users can contact the veterinarian using that information.

Disease Prediction: Prediction of disease using minimum 3 symptoms given by the user using ML models like SVM, Random Forest, and Naïve Bayes classifier

Login/Registration: Login or registration of doctors.

A. Methodology

With the help of correct evaluation of scientific facts, biomedical, network services, and healthcare groups, early sickness detection is possible. With the help of this, an affected person can be cared for quickly. However, the evaluation accuracy decreases whilst the scientific facts are incomplete. Moreover, some specific areas showcase particular traits of sure local diseases, which may also weaken the prediction of sickness outbreaks. The disease prediction can enable the users to enter the symptoms ascertained in their animals and the system can predict the disease based on the symptoms provided. The training dataset consists of twenty-four diseases and fifty-six symptoms. The symptoms are square measured which are essentially organized in numerous mixtures with corresponding disease names. Three models: SVC, Gaussian NB, and Random Forest square measure are enforced and also the result of the combined prediction of all the models.

After inserting the information of perceived symptoms, the three classifiers collocate the symptoms. Further, K-Fold cross-validation gauges the machine learning models. Support Vector Classifier, Naïve Bayes Classifier, and Random Forest Classifier are the three models used in cross-validation. It is important to get acquainted with k-fold cross-validation and also machine learning models before starting with the implementation.

K-Fold Cross-Validation: It splits the data into k-chunks, trains with (k-1) chunks of a data object, and tests it on (k-1) th chunks. Furthermore, it trains a model on the portion that was excluded in the previous iteration and tests it on that chunk. This step is repeated. This takes K iterations i.e.; training and testing are performed k times.

Support Vector Classifier: It takes labeled training information after training with labeled data [10], it tries to find the best hyperplane possible that classifies the inputs into different classes.

Naïve Bayes Classifier: It is based on the Bayes Theorem, an algorithm that is used as a classifier in

machine learning models for effective classification. [12] It is probabilistic.

Random Forest Classifier: Random Forest is a type of supervised machine learning algorithm based on ensemble learning methods. [11] The algorithm will make a powerful prediction as it is a type of learning where one will join different types of algorithms or the same type of algorithm multiple times. It is used for regression and classification techniques.

The main homepage is made of Markup languages, CSS, HTML, JS, and Bootstrap. Square measures are worked and enforced in individual CSS, JS, and a few fields square measure foreign as Bootstrap themes and combined in index.html.

Under the views.py in the Listings app, all the functionalities for doctor facet login and registration the square measure is outlined.

B. Implementation Details

The machine takes input from the user and then directs the input given by the user to the farm animal disease prediction module, the disease prediction is carried out based on the 3 Models used which are SVC Model, NB Model, and the Random Forest Model. These three algorithms give possible predictions. Later the combined result is given based on the Mode of the 3 results. Fig. 3. represents the architecture of the ML model. The dataset is trained and tested using machine learning, firstly preparation of a dataset is done and then split into two that is training data and testing data, train data is sent to build up the model, and testing of the trained dataset is done using various cross-validation techniques and algorithms like SVM, Random Forest, and Naive Bayes Classifier.

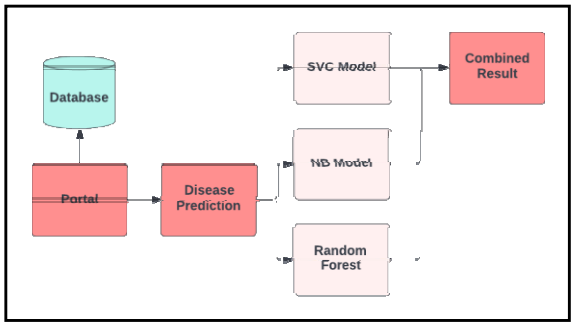

Fig. 3. Architectural block diagram for ML model

The predictions of the 3 models are collected, the Mode of the 3 predictions is made and the final prediction is given by the model. This Combined model gives an accuracy of 95%.

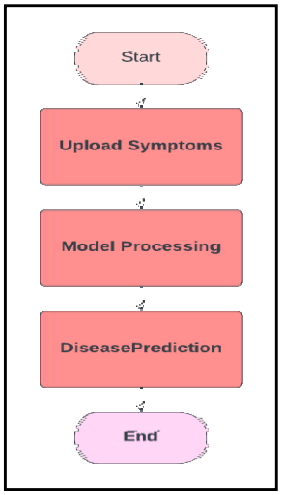

Fig. 4. Flowchart for ML model.

Fig. 4. shows the flow of the disease prediction module, where the user uploads the symptoms using the dropdown, then the model processes the data, and the disease is predicted as an Output.

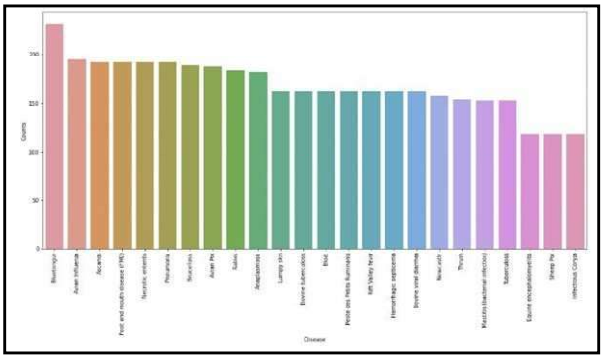

Fig. 5. Graph of the dataset

The following code checks the balancing of the dataset:

```
Disease_count = data["Disease"].value_count()
Temp_df =pd.DataFrame({
        "Disease": Disease_count.index,
        "Counts": Disease_count.values})
```

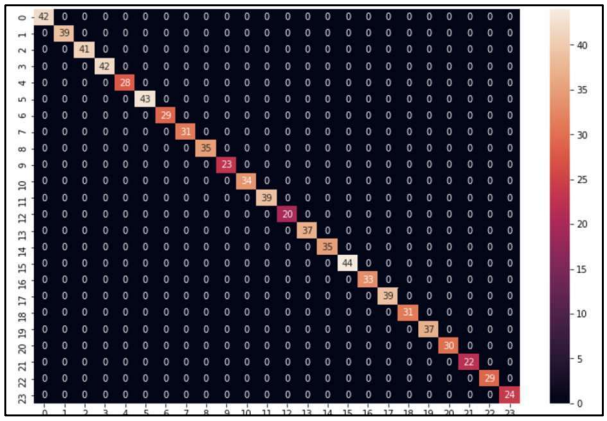

Fig. 6. Correlation matrix of an SVM Classifier Model on TestDataset

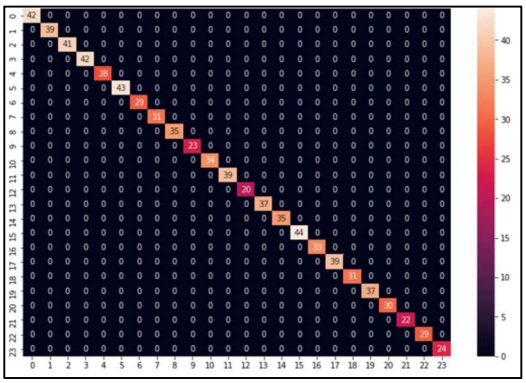

Fig 7. Correlation matrix of a Naïve Bayes Classifier Model on Test Dataset

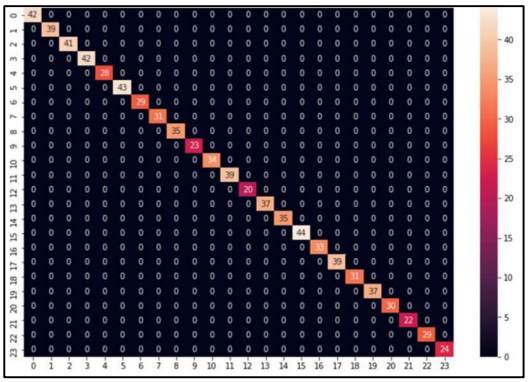

Fig. 8. Correlation matrix of a Random Forest Model on TestDataset

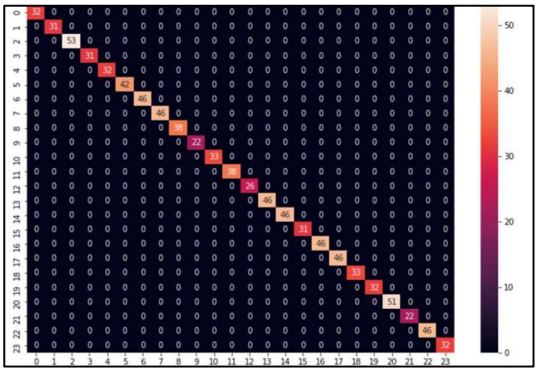

Fig. 9. Correlation Matrix of the Combined Model on Test Dataset

IV. EXPERIMENTAL RESULTS

In Fig. 10. one will see the Disease Prediction page in which the user needs to fill in the details of symptoms and submit the form. In the event of 'submit', the Machine Learning model will work on the symptoms and predict the disease.

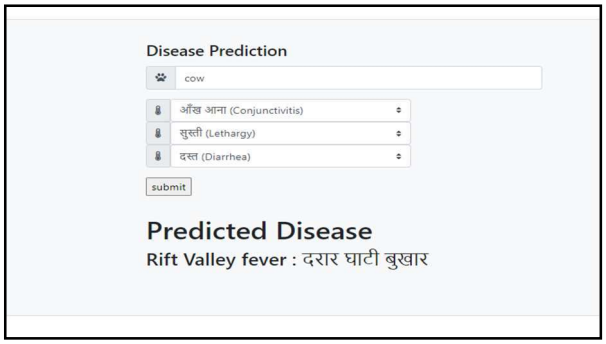

Fig. 10. Disease prediction page

Fig. 11. is the Homepage of the website; it lists all the services provided to the users as well as veterinarians. It comprises the main features of the Website.

Fig. 11. Homepage of the website

Fig. 12. shows The Animal Healthcare portal, it provides users with the necessary information about animal healthcare, the lifestyle of animals and critical diseases, and the possible remedies.

Fig. 12. Animal Healthcare

Fig. 13. one can see the output of the disease prediction module based on the symptoms given by the user, note this is the output of the Jupyter notebook.

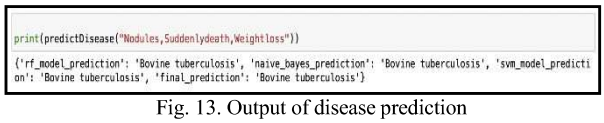

Fig. 13. Output of disease prediction

V. CONCLUSION

The website helps the farmers with veterinarian services without the need of visiting the actual veterinary care in rural areas. The users can contact veterinarians, get feedback on various diseases, know about animal healthcare and hygiene, and can also schedule appointments in veterinary care. For this, the user just needs to access the website through a proper internet connection and therefore the system provides cost-effective services which can be accessed easily at any time and any place. If such a system is used in Gram Panchayats of villages it can reach each farmer and help them to provide proper treatment to their farm animals. A good amount of information is also added to the website divided into Disease portals and Health Lifestyle Management portals for the Livestock on the website. Thus, successfully implemented animal healthcare facilities and disease prediction systems as a website. Through the Disease prediction portal farm animal owners can predict disease more precisely which would help in the treatment of the animal. Using ML an effective Disease prediction system can be made that will help livestock owners with the prediction of different diseases found in animals. Prediction of diseases will help provide proper treatment on time. Accurate predictions by such a model will provide aid to maintaining a healthy animal lifestyle which in turn will boost the production of livestock products that will satisfy the increasing demands.

REFERENCES

[1] Holt HR, Bedi JS, Kaur P, Mangtani P, Sharma NS, Gill JPS, Singh Y, Kumar R, Kaur M, McGiven J, Guitian J, “Epidemiology of brucellosis in cattle and dairy farmers of rural Ludhiana, Punjab”. In Plos Journal PLoS Negl Trop Dis, 2021 Mar 18.

[2] Singh BB, KostoulasP, Gill JPS, Dhand NK, “Cost-benefit analysis of intervention policies for prevention and control of brucellosis, in India " Published in Plos Journal paper, PLoS Negl Trop Dis. 2018 May 10.

[3] Kumar N, Chander Y, Kumar R, Khandelwal N, Riyesh T, Chaudhary K, Shanmugasundaram K, Kumar S, Kumar A, Gupta MK, Pal Y, Barua S, Tripathi BN. “Isolation and characterization of lumpy skin disease virus from cattle in India”.Published in Plos journal, PLoS One. 2021 Jan 11.

[4] Y. -J. Kang, D. -O. Choi and L. Yin, "Prediction of Livestock Diseases Using Ontology”, Published at 2018 International Conference on Sensor Networks and Signal Processing (SNSP), 2018, pp. 29-34.

[5] M. Gholami and R. Javidan, "An intelligent model for prediction of brucellosis”, in 4th International Conference on Knowledge-Based Engineering and Innovation (KBEI), IEEE, 2017, pp. 0570-0576.

[6] M. Chen, Y. Hao, K. Hwang, L. Wang and L. Wang, "Disease Prediction by Machine Learning Over Big Data from Healthcare Communities," Published on IEEE in IEEE Access, vol. 5, pp. 8869-8879, 2017,

[7] Kour, Savleen, Rajesh Agrawal, Neelesh Sharma, Abha Tikoo, Nishi Pande, and Ayushi Sawhney. "Artificial Intelligence and its Application in Animal Disease Diagnosis." Journal of Animal Research 12, no. 1 (2022): 1-10.

[8] Bylaiah, Sushma, Seema Shedole, Kuralayanapalya Puttahonnappa Suresh, Leena Gowda, Bindya Shivananda, Chandan Shivamallu, and Sharanagouda S. Patil. "Disease Prediction Model to Assess the Impact of Changes in Precipitation Level on the Risk of Anthrax Infectiousness among the Livestock Hosts in Karnataka, India." International Journal of Special Education 37, no. 3 (2022).

[9] Roy, Rita, Manish Mohan Baral, Surya Kant Pal, Santosh Kumar, Subhodeep Mukherjee, and Bhaswati Jana. "Discussing the present, past, and future of Machine learning techniques in livestock farming: A systematic literature review." In 2022 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COM-IT-CON), vol. 1, pp. 179-183. IEEE, 2022.

[10] K. Shailaja, B. Seetharamulu, and M. A. Jabbar, "Machine Learning in Healthcare: A Review," 2018 Second International Conference on Electronics, Communication, and Aerospace Technology (ICECA), 2018, pp. 910-914.

[11] F. Matloob et al., "Software Defect Prediction Using Ensemble Learning: A Systematic Literature Review," in IEEE Access, vol. 9, pp. 98754-98771, 2021, doi: 10.1109/ACCESS.2021.3095559.

[12] F. -J. Yang, "An Implementation of Naive Bayes Classifier," 2018 International Conference on Computational Science and Computational Intelligence (CSCI), 2018, pp. 301-306, doi: 10.1109/CSCI46756.2018.00065.