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DATA MINING IN POULTRY DISEASES DETECTION: A Literature Review

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ABSTRACT:

Poultry products food consumption is consistently increased due to its rich nutritional value. Poultry production is agriculture-based subsidiary business for farmers. Different factors like any kind of disease symptoms, toxic agents, viral infections and many more factors affect the quality of poultry production. The study reveals the systematic framework for analysis of quality of poultry production. This study aims an extensive literature for fuzzy based and data mining method for classification, prioritization of poultry quality decisions against measures to define and validate the novel method and results in data mining. The researcher aims to value the gap to work on model by analysing the literature of poultry disease detection and production quality evaluation using data mining.

Keywords: Data mining, Poultry Disease Detection, Poultry Production quality, Fuzzy Classification.

1. INTRODUCTION

India is currently ranked as the fifth largest poultry producer in the world. The growth of the poultry sector in India is also marked by an increase in the size of the poultry farm. Poultry is one of the most commonly ate proteins for a good reason. There are varieties of poultry birds. The farmer will get benefited based on weight of chick, variety and quality of feed given, vitamins, medicines and vaccines provided for good health of bird.

Most of the time due to small ignorance affects a lot for growth, disease control, and environmental control for good production of poultry birds. Such things should be controlled. Many of the times, instead of disease detection, prevention and treatment mechanism, shortly most of village poultry farmers tend to start dealing with disease control once the symptoms appear in their flock which effects on production.

1.1 POULTRY PRODUCTION PROCESS

Poultry farming is the form of animal husbandry which raises domesticated birds such as chickens, ducks, turkeys and geese to produce meat or eggs for food. Poultry – mostly chickens – are farmed in great numbers. More than 60 billion chickens are killed for consumption annually. Chickens raised for eggs are known as layers, while chickens raised for meat are called broilers.

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A farmer receives the birds from the hatchery at one day old. A grow out consists of 5 to 9 weeks according to how big the kill plant wants the chickens to be. These houses are equipped with mechanical systems to deliver feed and water to the birds. They have ventilation systems and heaters that function as needed.

1.2 POULTRY DISEASES DETECTION PROCESS

The proper diagnosis of poultry diseases depends on three important factors:

1. Identification of vital organs and body structure.
2. Knowledge of disease symptoms and lesions.
3. A systematic plan for examining the bird's body.

1.3 FUZZY LOGIC

Fuzzy Logic (FL) is a method of reasoning that resembles human reasoning. This approach is similar to how humans perform decision making. And it involves all intermediate possibilities between YES and NO. The Fuzzy logic works on the levels of possibilities of input to achieve a definite output.

One legacy artificial and machine learning technology is fuzzy logic. Traditional and classical logic typically categorize information into binary patterns such as: yes/no, true/false, or day/night. Fuzzy logic instead focuses on characterizing the space between these black-or-white scenarios.

2. Research Motivation

India is an agri-based country, but farmer's suicides are concerns of major issue and care to think about. Farmers' income and increasing obligations of loans are main reasons found behind these suicides. Agri-businesses like poultry are also one of the major contributory options for farmer's income. Global Consumption of non-vegetarian protein intake is increasing highly. At the same time, people are becoming very precarious about health and hygiene. Quality poultry production can not only boost poultry business economically but also serve to meet global needs of health and hygiene. As there are different factors or parameters which determines the qualitative poultry production, consideration of combination of different extent of occurrence of different parameters for each case may result in different quality standard. Mainly early and precise poultry disease detection is highly important to control the disease and economic loss as well as to provide good quality poultry product.

So, the current Study aims to design fuzzy based poultry disease detection framework suing data mining by exploring and identifying different key parameters or determinants of poultry production quality. The Researcher will consider different fuzzy approaches for improvement and to address limitations in existing framework.

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3. LITERATURE REVIEW

The researcher has studied detailed literature to study conceptual and experimental framework and to trace out gap to address the problems in the detection of poultry diseases.

To perform extensive literature survey, the researcher has followed the following manner of study.

- Poultry Diseases
- Technology in Poultry Diseases detection
- Fuzzy Logic
- Fuzzy Logic in Poultry Diseases detection
- Data Mining approaches
- R tools for Fuzzy logic implementation
- R tools for Fuzzy based Poultry Diseases detection

- **Poultry Diseases**

Agriculture based business like poultry helps to enhance farmers life. Dr. Prof. A Sridharan[21], E. B. Sonaiya et. Al.[22] portrayed that the income of poor farmers can substantially be enhanced. But Different challenges of poultry business like production quality, quality emergence of production, and recent compact rapid disease spreading arrangements poultry [10, 25] are major challenges which demands to cater measures for drug discovery and disease control[27].

- **Technology in Poultry Diseases detection**

IT enabled systems and models can save time and manage poultries efficiently. Its expert advices supports to animal researchers, knowledge experts, veterinary doctors and poultry keepers [20, 38]

Authors developed deep convolutional model detect poultry diseases by classifying healthy and unhealthy faecal images. Fine tuning improved resultant accuracy and f1 score. This study was limited to classification. Authors recommended future work for real time object detection, segmentation and field testing [36]. Diagnosis Expert system can result in better predictions in future with different technological implementations. [12, 22, 29]. Few researchers also have designed and implemented poultry farming information management system that covers the cloud-based information management system for production aquaculture, corporate office, product traceability, and poultry disease detection.[59] Authors

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developed and explained technology for early warning algorithm[16] to detect sick broilers machine learning algorithms which uses K-means clustering and the ellipse model to segment the images which proved significant results[55].

Authors highlighted increase in Global animal protein consumption and discussed about the use of technologies for symptom detection can monitor the health status of broilers and laying hens in a continuous, non-invasive and automated way, and potentially assist in the early warning decision-making process. Article spotlighted recent literature on poultry disease detection and highlighted clinical symptom-monitoring technologies for sick poultry and finally concluded that current technologies are already showing their superiority to manual inspection, but the clinical symptom-based monitoring systems have not been fully utilized for on-farm early detection.

This review summarized recent literature on poultry disease detection and highlighted clinical symptom-monitoring technologies for sick poultry. The review concluded that current technologies are already showing their superiority to manual inspection, but the clinical symptom-based monitoring systems have not been fully utilized for on-farm early detection. Author suggested the prospectus development trends of intelligent automatic monitoring technology for poultry diseases based on clinical symptoms, as (1) establish the database of poultry characteristics, including different regions, chicken species, disease categories and clinical data. (2) Accelerate the optimization of disease detection algorithms to improve the accuracy and at the same time limit the size of the model to reduce the computational burden for algorithm deployment. (3) Integrate a variety of clinical characteristics to comprehensively evaluate the health status of poultry, and finally establish an expert system for the early warning of poultry diseases. (4) Develop and design complete sets of intelligent equipment for poultry disease detection and early warning.

- **Fuzzy Logic**

Authors developed fuzzy inference system for covid-19 patients data analysis for pattern identification and classification using R programming which mainly focuses fuzzy framework design of Fuzzification model by specifying fuzzy parameters-Rulebase-Inference criteria-System-Defuzzification-Output in form of pattern detection or classification.

- **Fuzzy Logic in Poultry Diseases detection**

Authors developed a fuzzy logic-based algorithm for image features to identify dissimilar pixels on the chicken surface showing symptoms of systemic disease. Test on two datasets of images displayed improved accuracy of prediction [58]. Authors proposed an expert system for allergy detection in human being using MATLAB with the new system which consists of Fuzzy generator, Fuzzy system of logic and standard based reasoning. On testing with 20 patients the model showed 95% accuracy. Researchers suggested extension of the model as Medical data mining; medical informatics for future study [26]. A new fuzzy analytical

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prediction model with the hierarchy process based resulted effective for decision making with parameter or constraints like egg production, cough, watery eyes, wings hanging down, a grey sprocket, legs paralyzed. And found model resulting effective outcome [29]. Authors designed and developed intelligent fuzzy logic based poultry system which imitates the roles of the poultry employees in distributing water and feed for poultry birds at indicated time intervals. This reduces workload and increases returns on investments in poultry production business [31].

- **Data Mining approaches**

Authors proposed and implemented Adaptive neuro-fuzzy-genetic process and innovative methodology for optimisation of left-over chicken fat to get exceedingly needed fuel superiority. And authors found that, ANFIS-GA estimates and improved settings were extra accurate, particular and economical. Authors developed FIS and Fuzzy-GA systems using 2 approaches: one is Mogul approach and another is the Pittsburgh approach. This model gave more realistic results with less errors. Authors further improved the fuzzy models by using genetic algorithms [9]. Authors focused to study the future prototype of the integration of latest technologies for input and processing as mobile phones, sensors, and controllers, further experimental investigation [8]. Authors proposed a machine vision-based method and tested in an experimental broiler house [47], the new method to distinguish bird dispersal in the pictures, the pen floor was practically well-defined and divided into consumption, nourishing, and rest/exercise zones. This study provides the base for the advancement of programmed system to monitor poultry flooring deliveries and behaviour in a profitable production arrangement. Authors discussed technologies and tends in poultry welfare management. Also portrayed challenges fine poultry welfare management. Clustering proved very valuable method for determining data spreading and patterns in the data. Guo et al. (2021) advanced a typical system to determine chicken distribution and matched a method mixing the GB (Green/Blue) color space and two-dimensional processing with K-and C-Means methods about the handling time and target mining. This review investigates restrictions of poultry farms in knowing the possible innovative applications and insightful patterns of technological advances. The predictable fuzzy-logic regulators arranged in studies such as those from Lahlouh et al., 2020, Mirzaee-Ghaleh et al., 2015 are deeply dependent on the operator's awareness and understanding of the structure and complex rules. In addition, straight controllers (Conventional/proportional integral derivative (PID), fuzzy logic, predictive controller optimized by using genetic algorithm optimization techniques [22] suffer from the inability to learn in real-time. To address this limitation, recent technologies blended with fuzzy logic using datamining can be deployed to design and develop advanced intelligent systems. R. A. W. Sea designed involuntary sterilised drinking water system to offer acceptable supply of sterilized drinking water for birds. In this research work, neural network (NNs) prototypes [33] are projected for the classification of broiler chickens as healthy and sick for prior uncovering of poultry diseases. The Neural Networks used in the classification are artificial neural network (ANN), adaptive neuro-fuzzy inference

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system (ANFIS), and support vector machine (SVM). In the literature, the data set which includes seven visual features were acquired through the IPTs and was used for training, testing, and validating the process of NN models. The results point out that, the computer vision-based application using NNs is successfully classified the broilers in terms of their health conditions. Authors proposed hybrid model using genetic fuzzy classifier for classification of textural images of poultries[35]. Poultry object color and background size and shape elongation identified as features. And the parameters of the fuzzy rule based system are optimized using genetic algorithm. Author found the experimental model is effective to classify healthy and unhealthy images with 92.4% accuracy.

- R tools for Fuzzy logic implementation

The researcher have experimented and designed fuzzy based algorithm for sentiment analysis for facebook and tweet posts using R programming tool. And also designed to implement fuzzy-genetic-Machine Learning based sentiment category prediction algorithm. The researcher suggested to design and implement the fuzzy based and evolutionary algorithms for other domains of ambiguity and imprecision [37]. Authors have surveyed different research articles for viral disease detection and have applied machine learning algorithms to COVID-19 data to classify, prioritise data and also designed evolutionary prediction model. The experiments designed and implemented using R tool for COVID-19 disease data analysis [39].

Outbreak Tools is industrialized by a communal of epidemiologists, bio-informaticians statisticians, and modellers to device methods and categories for storing, handling and visualizing the outbreak data. (which involves real and simulated outbreak datasets) This article also explains different approaches that can be considered for maximum audience and trying and maximize the obtainability of front-line methods for epidemics analysis to the stakeholders at great level[42]

- R tools for Fuzzy based Poultry Diseases detection

Authors explained that R is an ideal choice of language for such a toolbox as it is freely available and used by a wide variety of researchers from a variety of research fields: creating a tool in R will provide a generic infrastructure for a wide range of users and will hopefully lead to an increase in the uptake of fuzzy logic systems (of all flavours). Authors have the functionality in terms of type-1 and interval type-2 fuzzy logic systems and provided examples of the visualization capabilities of the toolkit for type-2 fuzzy systems in general [43].

Authors developed combined multi-window spectral subtraction[25] and high-pass filtering to reduce the influence of noise the deep poultry vocalization network (DPVN), for the early detection of ND based on poultry vocalization. The performance of the detection method was evaluated using the intersection-over-union (IOU) between the detected vocalizations and ground truth vocalizations. Recall and Precision resulted in 95.11% and 96.54% respectively.

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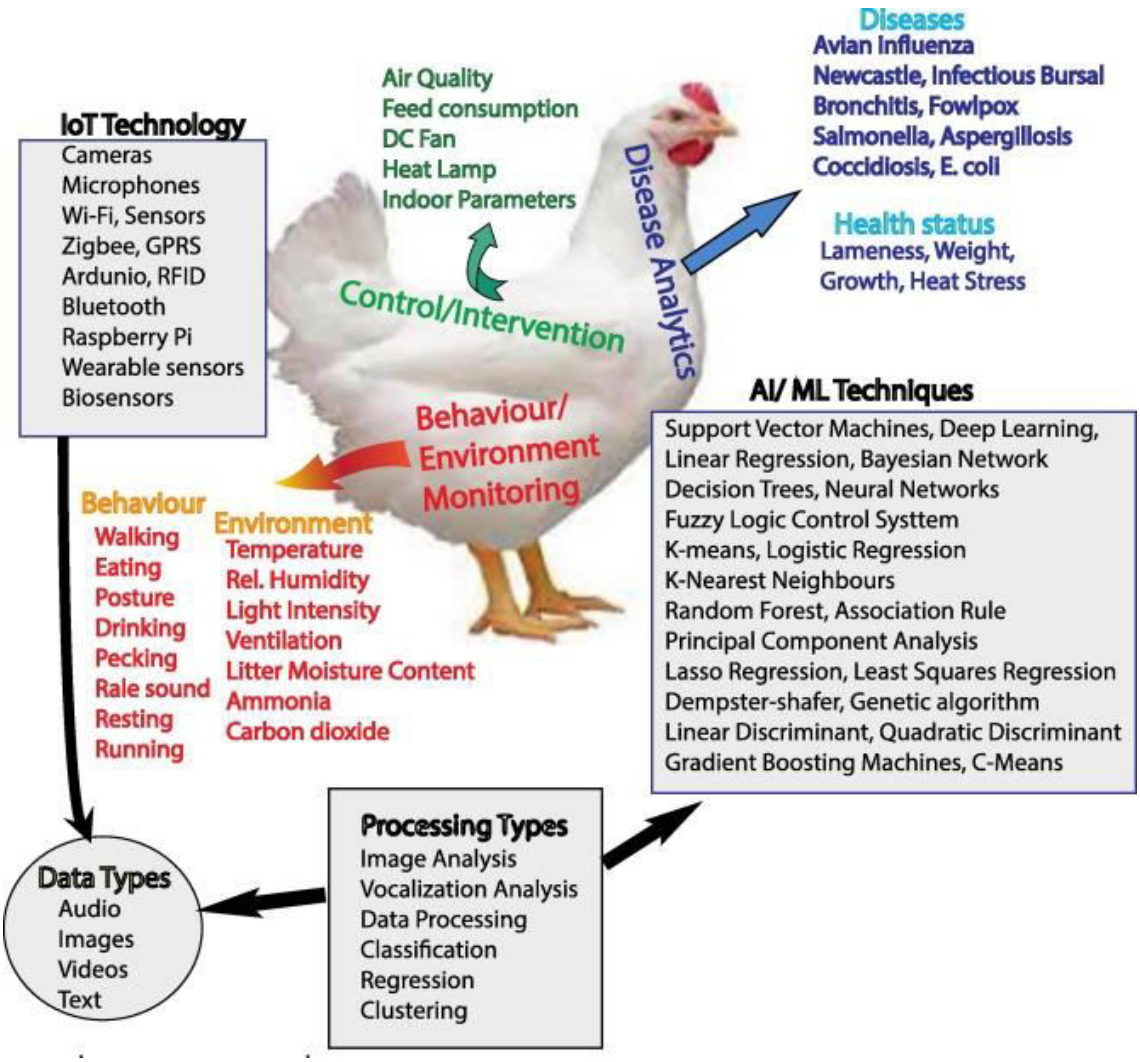
So authors suggested that will be significant for improving animal welfare and the automated monitoring of poultry production.



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RESEARCH GAP

The aids of this study are to collaborate with the gap of scientific works that offer fuzzy based poultry disease detection framework using data mining. This study systematizes the main topics related to the use of poultry diseases, its detection, technology in poultry disease detection and fuzzy based poultry disease detection and presents future investigations, considering the relationship with the topic using data mining. During our literature review, the researcher found research work based on poultry disease detection model using data mining. Disease detection depends on various factors to overcome these poultry farmer's

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problems, all these analyses aimed to present a design poultry disease detection model using data mining.

Dr. Prof. A Sridharan, E. B. Sonaiya et. Al. portrayed that the income of poor farmers can substantially be enhanced. Astill J explained that to achieve required rate of production technologies needs specifically for detection, diagnosis, and prediction of infectious diseases. Allen Daniel Sunny et. Al. identified that With increase in data set, diseases are added, the scope of diagnosis increases with better predictions in the future. Zheng suggested that the cloud-based information management system will lead the development direction of the poultry farming management system. Whereas Rasheed O discussed that to overcome this shortcoming, recent technologies blended with fuzzy logic using datamining can be deployed to design intelligent systems to optimize a policy for complex tasks. According to Erdem, AI models' most important advantage is that they can address a system's nonlinearity and complexity effectively and overcome the drawbacks of using numerical models. Pengguang He, Zhonghao Chen suggested the prospectus development trends of intelligent automatic monitoring technology for poultry diseases based on clinical symptoms, as (1) establish the database of poultry characteristics(like regions, chicken species, disease categories, clinical data). (2) Improvement in Optimization of disease detection processes to improve the accuracy and at the same time limit the size of the model to reduce the technical burden for algorithm deployment. (3) integrate different clinical characteristics to determine the health status of poultry products.

So identifying poultry characteristics for disease detection is most important concern of research based on which further AI models and new technologies can improve poultry disease detection with more accuracy and optimization.

4. STATEMENT OF THE PROBLEM

During this initial phase of literature review, the researcher found that lot of researchers had done work on technology application in poultry farming but very few of them worked on poultry disease detection. After reviewing lot of literature it is found that most of the fuzzy implementations are related to resource and poultry house management or feed and water management for new change but Recent pandemic situation become a need to take help of new technology specifically to detect diseases so very less work have been done inside design and implementation of fuzzy based algorithm for poultry disease detection is the need of time.

The limitations and gaps have been identified for future Research, to find solution so that the early and timely detection of poultry disease will help to solve problems. Moreover, the work was largely concerned with features and innovative applications. The research focuses to identify major influential parameters of poultry diseases, design fuzzy based algorithm for

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poultry disease detection and to detect patterns of combinations or blends of these parameters. To address these concerns, the researcher has designed a simple static prototype that demonstrates how fuzzy based algorithm can help to detect poultry disease in more efficient, and more trustworthy way. This technology is therefore still undergoing an evolutionary process since it is in initial experimental stages. It is assumed that an advanced analysis can be composed in near future as the poultry farmers are adapting and advancing technologically.

So, the researcher aims to apply data mining model and to detect the poultry disease by proposing study titled,

"POULTRY DISEASES IDENTIFICATION MODEL USING DATA MINING"

5. OBJECTIVES OF THE STUDY

To meet the requirement, we will prepare questionnaire and collects data from the poultry farmers. Obtained data will be analysed and parameters will be cleared. By focusing on those parameters we will design a model which will clarify all the details regarding poultry birds, their productivity factors, disease controlling parameters etc. Here machine learning approach can be used to generate rules to produce efficient results. Identifying factors influencing poultry quality and detecting poultry diseases using data mining technique with proposed model and testing the proposed model with Sangli district poultry farms data is aimed in proposed research.

6. RESEARCH METHODOLOGY

The researcher has planned to follow Design and Creation research Strategy. The strategy focuses on design of poultry diseases detection model using data mining.

The research work follows 'Design and creation' strategy in support of survey method. The research study is based on assumptions that all respondents would be cooperative and Provide reliable responses through the questionnaires distributed and within the given time. It was assumed that a novice user wants to set up a poultry farm and should get benefited from it. It is based on the belief that the farmers selected were motivated by profits from the poultry projects. Researcher has planned to apply data mining techniques for prediction and suggest appropriate action to be taken to avoid disease infection.

Performance Evaluation:

For performance evaluation, we will implement it using test data.

Proposed Framework-

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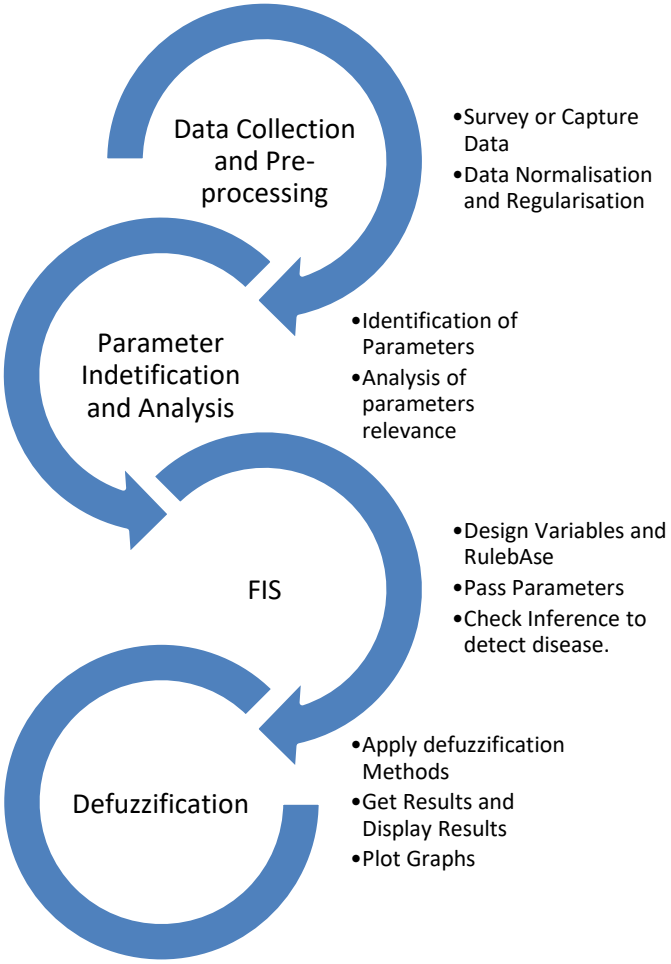

Figure 5: Framework of Poultry Disease detection Model

7. IMPLEMENTATION

The Researcher has identified important parameters through literature survey and field investigation for consideration of relevance analysis and further those will be used to define and design Fuzzy Variables, Rulebase and Fuzzy Model for poultry disease detection. This model will be experimented and implemented using R tool.

8. CONCLUSION

The Researcher performed Conceptual analysis for fuzzy logic concept and performed The Review of Literature helped to summarize and analyze existing approaches and technologies for poultry disease detection. In depth study of literature helped to avoid duplication of research problem and to come up with Novel concept and problem specification, Review of literature tracks research gap and methodological gap which needs continuous improvement

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and adoption in existing framework. Proposed framework gives simplification and improvement in processing logic and will also help farmers to design strategic policies to lead in profit making poultry deals.

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