Data Modelling for Database Design in Production and Health Monitoring Systems for Dairy Herds

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Abstract - *The health monitoring of dairy cattle plays a vital role for increasing the dairy products supply worldwide. Currently farmers are facing issues with cows as they are suffering from several ailing health issues, diseases, which, sometimes could lead to the death of the cattle and advanced breeding costs. Thus, it is necessary for farmers to adapt efficient technical methods for cattle health monitoring. Cattle Health Monitoring system is one of the systems implemented across the country for monitoring cattle's conditions and it has become an essential part of dairy herd management. To address the mentioned issues, the paper suggests a system to control and monitor the necessary information regarding the cattle's health using real time data. This system also provides an insight to the future, which is always necessary when one aims at a monitoring system to adapt the predictive based system using calculated probability values to predict the necessary conditions and getting the desired results. We have built an application which provides the above necessities using the calculated values and concluding about the conditions. The result sections demonstrate the application usage for prediction of health conditions of cows and taking preventive measures based on the result.*

Key Words: Clustering, metrits, milk fever, health monitoring and weightage.

1. INTRODUCTION

In some developing countries, where there is an abundance of rural areas, people still depend on the cattle as their source of income. Thus, the cattle's health condition is a crucial aspect since people depend on the dairy products for their livelihood. In addition to this, a large section of farmers in these areas cannot invest heavily in modern technologies and depend largely on their cattle for agriculture.

Due to the less availability of veterinarians in rural area, farmers are forced to travel for a veterinarian.

In line to this, research is going on, through which once is able to obtain valuable information regarding health parameters. Unfortunately, this is not been widely used.

Cattle health monitoring system should be able to monitor health through monitoring different parameters of cattle such as footsteps count, temperature, rumination and body humidity of the cattle. Different technologies can be used for implementation of such system.

Database System for health monitoring is an efficient approach which creates an environment for end users as well as managers of the database in collective storage of data, retrieval and manage large sets of heterogeneous data.

The main function is to constantly monitor health status of the cow with various health disorders like metrits, mastitis, milk fever and conditions that need to be controlled. The platform is designed with special emphasis on the user interface. Standard web-based, user-interface design is adopted to make it easier for the end user. The system also helps us in predicting, which can be vital in taking precautionary measures on the cattle.

1.1 Data Modelling for Database Design in Production and Health Monitoring Systems for dairy herds

Cattle's health is often assessed during farm visits, but such visits are cost time and money. A health monitoring system are great ways of maintaining databases and act as central database for monitoring health conditions in dairy herds. An advantage of such routinely available data is that they are uniformly gathered and registered throughout time. This system provides an effective way to assess the cattle's health based on routinely available data.
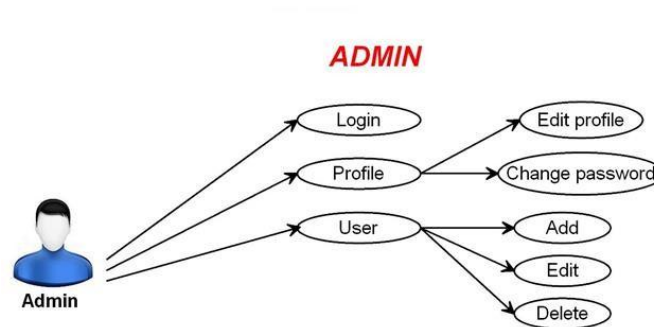
2. Design

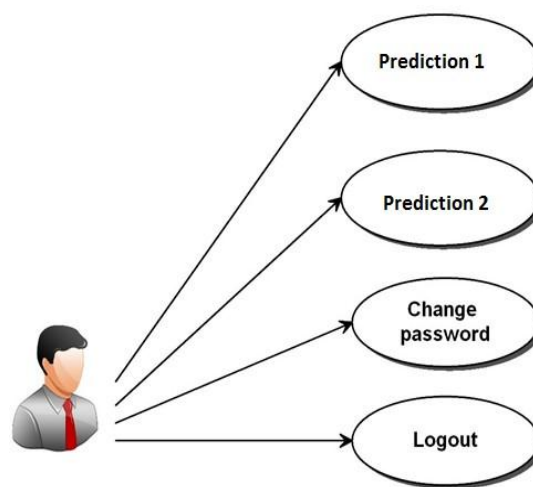
Fig – 1: User registration

Fig – 2: User registration

2.1 User Registration

In this module admin can add the user details like id and password.

2.2 Upload the dataset

In this module admin will upload the dataset like:

- Cow dataset
- Disease dataset

Training Data sets

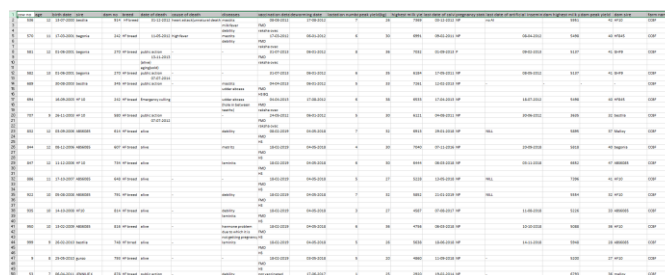Admin will upload all the datasets using the Excel API.

Fig – 3: Datasets

Prediction Process 1:

In this module we are calculating the weightage of the datasets and probability check condition.

Prediction Process 2:

We are comparing Prediction 1 and training data sets with the probability value observed by prediction 1.

2.3 Working

Admin stores account details of the user so the latter can access the database containing the details of dairy herds. Once the user aims to predict a disease condition for monitoring, he retrieves the data from the database and it gets compared with the already stored values.

Clustering, groups the type of bacteria's which clusters bacteria with every attribute associated with the cow and hence forms different classes containing the number of records in each clustered bacteria.

The weightage is given to the number of records regarding that particular bacteria. For each record, the sum of the weightage of all the cluster records with the total weightage of all the records gets calculated to get the average weightage as a probability value. This weightage is further stored in the database.

At the user page, the user inputs the attributes listed, calculates the weightage and compares it to the already calculated value and again compares and predicts the health condition based on probability values and displays the health condition. The final result displayed about the condition can be used to conclude on the health condition that can be prevented and avoided in the dairy herds in the farm.
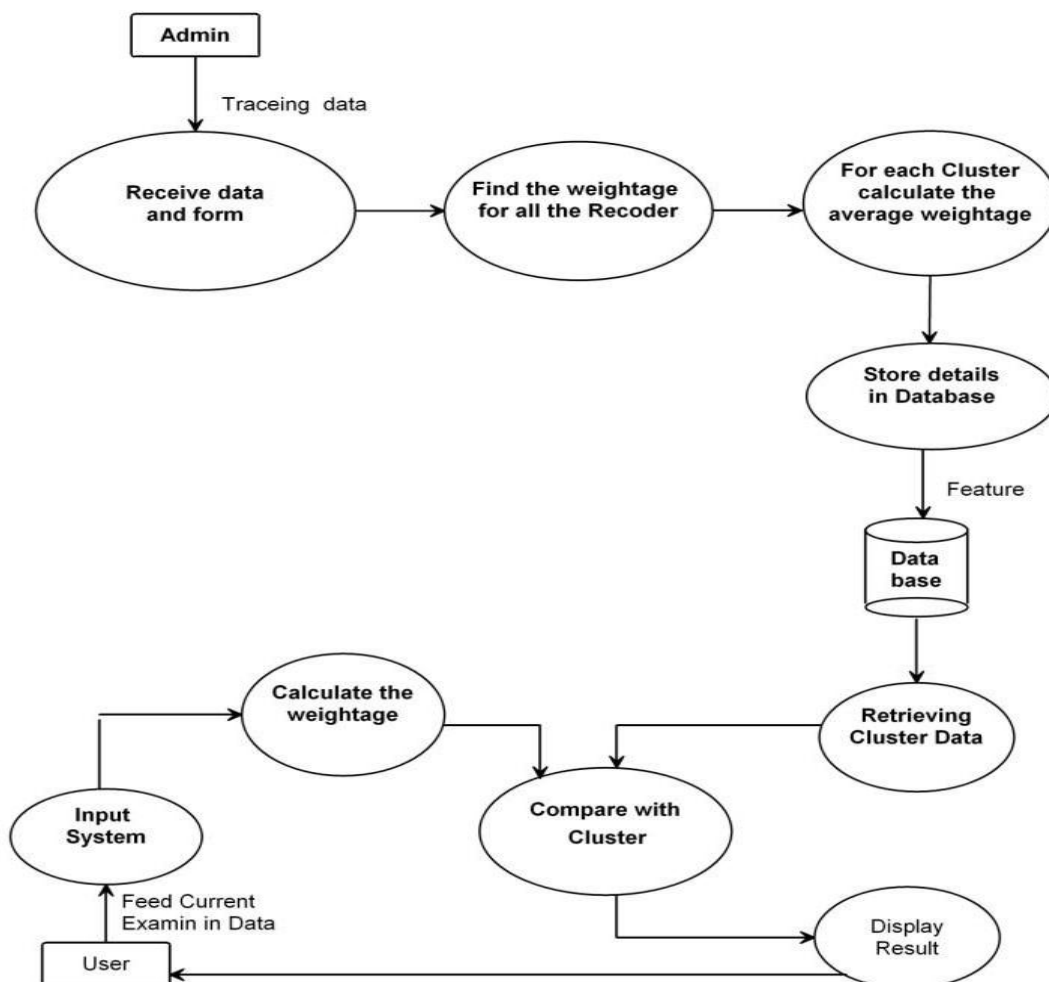

Fig -4: System Flow

3. Implementation

The collected datasets form a base for the paper, at both individual cattle and farm level. The dataset is analysed to choose required attributes for predicting and monitoring specific health condition for cattle. These attributes chosen are checked for dependencies with other attributes to help analyse and decide to the kind of attributes required to predict a certain health condition in cattle. Decision of specific health condition on the basis of chosen attributes.

4. Algorithm

Naive Bayes is a kind of classifier which uses the Bayes Theorem. It predicts membership probabilities for each class such as the probability that given record or data point belongs to a particular class. The class with the highest probability is considered as the most likely class.

Naive Bayes is a simple technique for constructing classifiers: models that assign class labels to problem instances, represented as vectors of feature values, where the class labels are drawn from some finite set. There is not a single algorithm for training such classifiers, but a family of algorithms based on a common principle: all naive Bayes classifiers assume that the value of a particular feature is independent of the value of any other feature, given the class variable.

For example, a fruit may be considered to be an apple if it is red, round, and about 10cms in diameter. A Naive Bayes classifier considers each of these features to contribute independently to the probability that this fruit is an apple, regardless of any possible correlations between the color, roundness, and diameter features.

For some types of probability models, Naive Bayes classifiers can be trained very efficiently in a supervised learning setting. In many practical applications, parameter estimation for naive Bayes models uses the method of maximum likelihood; in other words, one can work with the naive Bayes model without accepting Bayesian probability or using any Bayesian methods.

Despite their naive design and apparently oversimplified assumptions, naive Bayes classifiers have worked quite well in many complex real-world situations. In 2004, an analysis of the Bayesian classification problem showed that there are sound theoretical reasons for the apparently implausible efficacy of Naive Bayes classifiers.

Still, a comprehensive comparison with other classification algorithms in 2006 showed that Bayes classification is outperformed by other approaches, such as boosted trees or random forests.

An advantage of naive Bayes is that it only requires a small number of training data to estimate the parameters necessary for classification, very simple, easy to implement and fast, if the Naive Bayes conditional independence assumption holds, then it will converge quicker than discriminative models like logistic regression, even if the Naive Bayes assumption doesn't hold, it works great in practice, need less training data, highly scalable, can be used for both binary and multiclass classification problems, can make probabilistic predictions, handles continuous and discrete data, not sensitive to irrelevant features.

Algorithm ():

Naive Bayes (Cluster_ Data, Training _ Data)

{

For (each cluster file in cluster data directory)

For each cluster.

Map<each cluster, sum of cluster probability> Probability Map; For each dataset based on input.

probability=probability*(total_weight (0- 4)/ sum) getting attribute probability for each cluster.

 set final _ probability= (cluster_ record/"+sum+") order wise getting the probability values. Classified_ data=Key of Max probability value.

}

5. Conclusions

Creation of admin and user page on the application using XML and Java servlets. This enables the admin and the user, control the application for registering of new clients and using existing accounts for monitoring of cattle's health.

Database, containing datasets, regarding herd details are stored in SQL. The real time datasets are collected and stored in the database which is then connected to the UI to the inputs selected by the user which then calculates the linear probability values using algorithm and clustering.

The calculated probability gives an insight of the kind of disease condition in herds based on the set. Results are monitored and concluded to find the health condition of cattle or herd.

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