Identification of ILL Animals(Poultry) using Audio Processing and Thermal Imaging with Machine Learning

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Abstract: **The purpose of our project is to identify and separate sick animals(poultry) from healthy ones by incorporating the concept of sound audio filtering, thermal imaging and machine learning. By separating the sick animals spreading of the same disease can be prevented thus increasing the production and efficiency. This project requires minimum human intervention thus making the process less laborious and less time-consuming.**

Keywords : Thermal Imaging,Audio Filtering,Machine Learning.

1. INTRODUCTION:

Poultry farming has become one of agriculture's most essential parts. Poultry farming is an important and diverse component since egg and meat are part of a larger population's health and diet all over the world. Sick or unhealthy chicken has a significant impact on overall production. Most poultry diseases can affect egg production and quality, either directly by affecting the reproductive system or indirectly by lowering the bird's health. Respiratory infections that induce air sacculitis can cause ovarian and oviduct illnesses. Several infections also infect the oviduct and ovaries via ascending infection. Because low egg quality is usually caused by a combination of factors, Determining the cause or causes of poor egg quality can be difficult.

Most chicken diseases are highly infectious, meaning they can spread from one hen to another, eventually infecting the entire flock. Therefore to avoid massive production losses, sick hens must be separated and treated from the healthy flock in a short amount of time. This operation is traditionally carried out by human examination and separation, which is time consuming and inefficient. Furthermore, in the traditional procedure, there is a risk of illnesses being transmitted from people to hens during inspection, worsening the situation. Chickens might become afraid as a result of constant human interaction, lowering their production rate.

2.LITERATURE SURVEY:

With the continued expansion of the breeding industry, the breeding density of livestock has increased, and the epidemic of animal diseases such as swine fever and poultry diseases has increased. Not only does this phenomenon cause significant economic loss to the breeding industry, but it also has a major impact on human health. Rapid and accurate detection of poultry disease has become a major challenge in the industry, which is challenging even in current research. At this stage, detection of poultry disease in the breeding industry predominantly relies on manual detection. To predispose if poultry is ill, the poultry's falling colour, special movements, sounds, rectal temperature, and other characteristics are observed. This method requires a large number of workers and is not only time and labour-intensive, but also highly reliant on the knowledge of the breeder's experience. It is very idiosyncratic and cannot meet the needs of rapid detection and large breeding.

The goal of this project is to create a system that can automatically detect if poultry is sick. The idea is to use the poultry's thermal and audio data to determine whether it is healthy or not. The goal of this project is to reduce the amount of time and effort required by humans. The project's main benefit is that it reduces manual labour. The software is based on straightforward machine learning algorithms and is simple to implement. The number of paid workers will be reduced as a result of this process.

3.METHODOLOGY:

3.1 Audio Analysis:

It is seen that these sick or unhealthy hens cluck differently. Their body conditions are directly reflected through the noise they make. The difference might be in sound frequency, like a higher pitched clucking and peeping, or rate of clucking and others. This is a general aspect as seen in other animals and birds too where their sounds change because they are just unwell.

3.2 Data Acquisition Equipment - Sound sensors:

A normal microphone or a good sound sensor is required to hear the chickens. These sensors have a small sheet i.e., a diaphragm, connected to magnets. Just like how our human ears detect sound vibrations, the diaphragm vibrates when it gets the sound signal, which in turn vibrates the magnets, thus inducing current in the steel or copper wire coils. Which means sound signals will be converted to digital

signals. Sound sensors, such as microphones, usually contain built-in amplifiers that boost the power of the incoming signal. The sensor records sound level data for a certain time (measurements per predetermined c programme language time) or for a continuous time (stages achieved over a period of time) within the vicinity where it's far situated.

3.3 Data Processing - Audio analysis

Audio data is stored in time segments as it varies with time. The segment based feature extraction of sound data is efficient for samples with a particular sampling frequency. This feature extraction also aids in machine learning. Refining the sound data is essential for detecting the required frequencies. To increase signal-to-noise ratios, filtering is required to remove ambient noise from sound sources. This was performed using Spectral Subtraction method with Minimum Mean Square Error (MMSE) . After that, broiler vocal signals from different sound samples were processed with endpoint detection. This was performed based on cestrum distance.

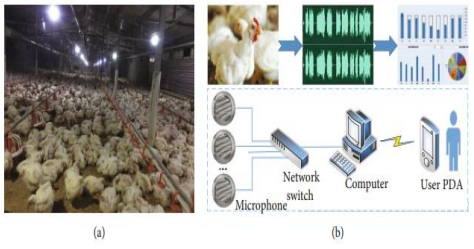

FIGURE 1: System structure. (a) Interior of the broiler building; (b) system model.

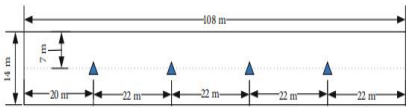

FIGURE 2: Top view of the four microphones' position in the broiler building. Blue triangles represent the network microphones.

Fig : Audio Extraction structure

3.4 Audio Classification Algorithm:

Hidden Markov model(HMM) has a strong capability of pattern classification due
to its rich mathematical structure and proven accuracy on critical applications. It was widely used in signal recognition and classification .HMMs are a type of probabilistic graphical model that allows us to predict a sequence of unknown (hidden) variables given a set of observed variables. The model's analytic capacity in the speech phenomena, as well as its accuracy in real audio recognition systems, are the key reasons for its usage in this method.

3.5 Thermal Analysis:

There are two methods for obtaining the temperature of a chicken: contact and non-contact (thermal imaging).Thermal imaging is used in this method to determine the temperature of the poultry crowd.A heat signature is the emission of infrared energy by all objects. The infrared energy of objects is detected and measured by an infrared camera.
The camera turns the infrared data into an electronic image that depicts the object's apparent surface temperature.

3.6 Data Acquisition Equipment - Infrared Camera:

An infrared camera contains an optical system that focuses infrared energy onto a special detector chip (sensor array) that contains thousands of detector pixels arranged in a grid.
Each pixel in the sensor array reacts to the infrared energy focused on it and produces an electronic signal.
The camera processor takes the signal from each pixel and applies a mathematical calculation to it to create a colour map of the apparent temperature of the object. Each temperature value is assigned a different colour. The resulting matrix of colours is sent to memory and to the camera's display as a temperature picture (thermal image) of that object.
Many infrared cameras also include a visible light camera that automatically captures a standard digital image with each pull of the trigger.
By blending these images it is easier to correlate problem areas in your infrared image with the actual equipment or area is being inspected.

3.7 Data Processing-Thermal Imaging:

Thermal imaging is simply the process of converting infrared (IR) radiation (heat) into visible images that depict the spatial distribution of temperature differences in a scene viewed by a thermal camera. Massive and unobtrusive screening of individuals in public places is a key challenge for ensuring safety in crowded shared spaces, as well as supporting early non-invasive disease detection and response to disease outbreaks. Thermal vision systems based on low-cost infrared (IR) array sensors may follow thermal signatures created by moving poultry, among other sensors and Internet of Things (IoT) technologies. With clever space management and maximum area coverage, wall- and ceiling-mounted systems are being explored for both small and big scale chicken farms.

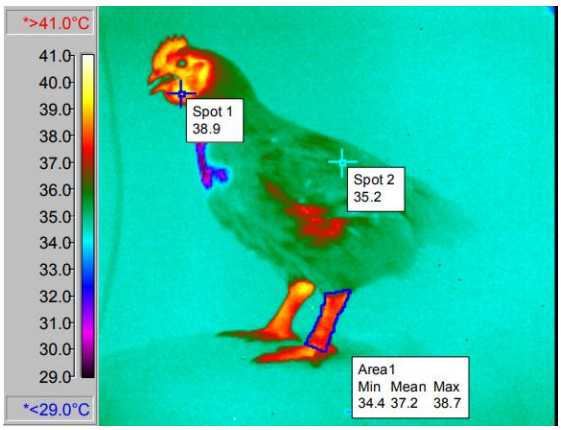

Fig:Thermal image of a broiler chicken exposed to 35ºC

3.8 Training and testing:

Thermal image data samples and audio samples of healthy chickens and unhealthy chickens are fed into the training model. The model is then tested with some more sample cases. Modules such as TensorFlow, Keras, OpenCV, etc. can be used.

4.CONCLUSION

The acoustic of vocal trait made by the chicken is examined within the frequency range if 125 Hz-2,000 Hz. As frequency of sound depends on how fast the source is vibrating and the wavelength fluctuates along with it, the sound is actually produced by the air pressure on the sound valve and the modified muscle tension a while syrinx it's the voice box. They produce a bleating patterns which appears persistent and goes louder at times is a common alarming factor considered while they cough or produce heavy breathing sound and raspy sounds which are signs of serious and requires immediate evaluation. Healthy animals tend to make minimal sound in equal time interval while breathing. In addition to this, the temperature variance in the animal is observed to bring out a more accurate conclusion. When the chicken hatches, the body temperature is about 103.5 degrees and comes with internal temperature control. The core temperature of a fully feathered chicken ranges from 105 to 107 degrees while the skin temperature of the chicken is about 3.5 degrees lower than its core temperature. If the temperature drops below 73 degrees due to the hovering of the ambient temperature, would indicate the heat stress is more. A heat stressed chicken makes panting sound to increase the evaporation of the warm body which is simultaneously detected using the sound and thermal sensor. Based on these factors, the health of the chicken is determined and is used to split the group of chickens into healthy ones and unhealthy ones.

5.REFERENCES:

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