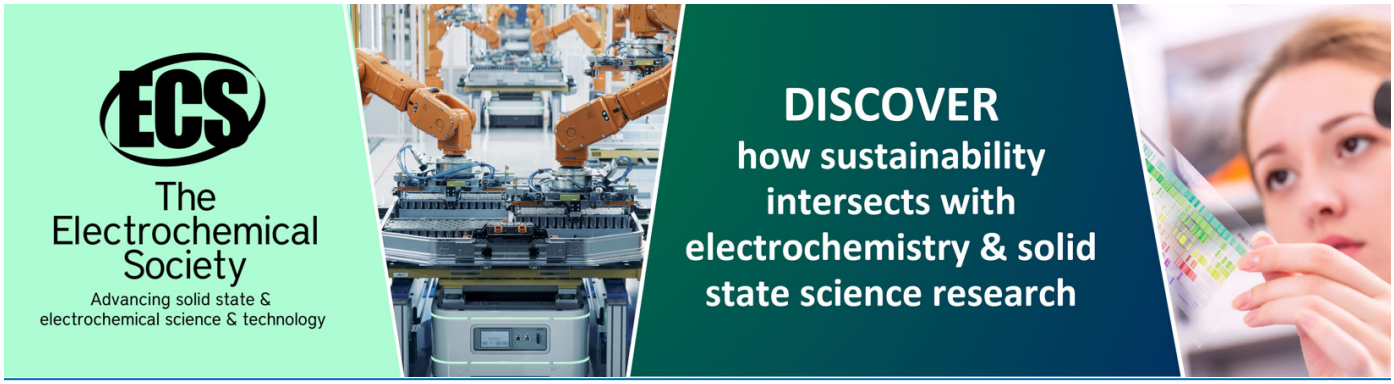
An Expert System for Diagnosis of Broiler Diseases using Certainty Factor



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An Expert System for Diagnosis of Broiler Diseases using Certainty Factor

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Abstract. Broilers are defined as chickens of meat-type strains raised specifically for meat production. Based on data production from the Ministry of the Republic of Indonesia raised 3.76% from 2015 – 2016. But in reality the price of chicken is expensive, because the amount of market demand is more than the amount of production. Harvest failure due to chicken disease is one of the causes. Detecting diseases at early stage can enable to overcome and treat them appropriately. Identifying the treatment accurately depends on the method that is used in diagnosing the diseases. A Diagnosis expert system can help a great deal in identifying those diseases and describing methods of treatment to be carried out taking into account the user capability in order to deal and interact with expert system easily and clearly. This system has 25 symptoms and 6 diseases using certainty factor method to solve the problem of uncertainty. The result of the research is that Broiler Expert System has been successfully identifying diseases that can solve the problem with accuracy 90%.

1. Introduction

Broilers are defined as chickens of meat-type strains raised specifically for meat production [1]. They are a hybrid of the egg-laying chicken, both being a subspecies of the red jungle fowl (Gallus gallus). Typical broilers have white feathers and yellowish skin. Most commercial broilers reach slaughter-weight at between five and seven weeks of age, although slower growing breeds reach slaughter-weight at approximately 14 weeks of age. Because the meat broilers are this young at slaughter, their behavior and physiology are that of an immature bird. Due to artificial selection for rapid growth and the husbandry used to sustain this, especially skeletal malformation and dysfunction, skin and eye lesions, and congestive heart conditions. The breeding stock (broiler-breeders) grow to motivate and beak trimming. Broilers are usually grown as mixed-sex flocks in large sheds under intensive conditions, but some breeds can be grown as free-range flocks. Chickens are one of the most common and widespread domestic animals [2].

Detecting diseases at early stage can enable to overcome and treat them appropriately. Identifying the treatment accurately depends on the method that is used in diagnosing the diseases. A Diagnosis expert system can help a great deal in identifying those diseases and describing methods of treatment to be carried out taking into account the user capability in order to deal and interact with expert system easily and clearly.

This system has 25 symptoms and 6 diseases using certainty factor method to solve the problem of uncertainty. The Type of uncertainty that can occur in knowledge-based expert systems caused by problems with the data. For example: missing or unavailable data, present data but unreliable or ambiguous due to measurement errors, The representation of the data imprecise or inconsistent, the

data just be user's best guess, data based on defaults and the defaults may have exceptions. The result of the research is that Broiler Expert System has been successfully identifying diseases that can solve the problem.

2. Review of Literature

Review Literature related to theory about expert system, certainty factor and broiler as a basic knowledge

2.1. Expert System

Expert System is a reasoning system that performs comparable to or better than a human expert within a particular domain [3]. Expert systems are used by doctors to help with evidences that are hard to diagnose and to suggest preventive measures or measures of self-care where even human experts have difficulty [4].

Knowledge Base contains domain-specific and high-quality knowledge. Knowledge is required to exhibit intelligence. The success of any ES majorly depends upon the collection of highly accurate and precise knowledge. The data is collection of facts. The information is organized as data and facts about the task domain. Knowledge base is a collection of a particular field of knowledge at the level of experts in a particular format [5].

Inference Engine is use of efficient procedures and rules by the Inference Engine is essential in deducting a correct, flawless solution. In case of knowledge-based ES, the Inference Engine acquires and manipulates the knowledge from the knowledge base to arrive at a particular solution. Inference engine is used to make inferences by deciding which rules filled with objects or facts, filled sort of priority rules, and executed in accordance with the priority rules [6].

2.2. Certainty Factor

Certainty factor is another method of dealing with uncertainty. This method was originally developed for the MYCIN system. In MYCIN, the certainty factor (CF) was originally defined as the difference between belief and disbelief.

$$CF(H, E) = MB(H, E) - MD(H, E) \quad (1)$$

where

CF is the certainty factor in the hypothesis H due to evidence E

MB is the measure of increased belief in H due to E

MD is the measure of increased disbelief in H due to E

The certainty factor is a way of combining belief and disbelief into a single number. Combining the measures of belief and disbelief into a single number has some interesting uses. The certainty factor can be used to rank hypothesis in order of importance. For example, If a patient has certain symptoms which suggest several possible diseases, then the disease with the highest CF would be the one that is first investigated by ordering tests. The measures of belief and disbelief were defined in terms of probabilities by

$$MB(H,E) = \begin{cases} 1 & if\ P(H) = 1 \\ \frac{\max[P(H|E), P(H) - P(H)]}{\max[1,0] - P(H)} & otherwise \end{cases} \quad (2)$$

$$MB(H,E) = \begin{cases} 1 & if\ P(H) = 0 \\ \frac{\min[P(H|E), P(H) - P(H)]}{\min[1,0] - P(H)} & otherwise \end{cases} \quad (3)$$

The certainty factor, CF, indicates the net belief in a hypothesis based on some evidence. Positive CF means the evidence supports the hypothesis since MB > MD. CF = 1 means that the evidence definitely proves the hypothesis. CF = 0 means one of two possibilities, 1. CF = MB - MD = 0 could mean that both MB and MD are 0 that is, there is no evidence 2.The second possibility is that MB = MD and both are nonzero the belief is cancelled out by the disbelief. Negative CF means that the

evidence favors the negation of the hypothesis since MB < MD, there is more reason to disbelieve a hypothesis than to believe it.

2.3. Broiler Disease

Broilers are defined as chickens of meat-type strains raised specifically for meat production. A disease is a particular abnormal condition, a disorder of a structure or function, that affects part or all of an organism. The study of disease is called pathology which includes the study of cause. Disease is often construed as a medical condition associated with specific symptoms and signs.

*2.3.1. Newcastle Disease / ND / pneumoencephalitis.*an acute, contagious viral disease of birds. It is one of the most important diseases which cause great economic loss in poultry industry [7]. The highly contagious and lethal form of Newcastle disease is known as viscerotropic (attacks the internal organs) velogenic Newcastle disease, VVND, exotic Newcastle disease, or Asiatic Newcastle disease. VVND is not present in the United States poultry industry at this time. Species affected: Newcastle disease affects all birds of all ages. Humans another mammals are also susceptible to Newcastle. In such species, it causes a mild conjunctivitis. Clinical signs: There are three forms of Newcastle disease mildly pathogenic (lentogenic), moderately pathogenic (mesogenic) and highly pathogenic (velogenic). Newcastle disease is characterized by a sudden onset of clinical signs which include hoarse chirps (in chicks), watery discharge from nostrils, labored breathing (gasping), facial swelling, paralysis, trembling, and twisting of the neck (sign of central nervous system involvement).

2.3.2. Pollorum / *bacillary white diarrhea/ BWD* are septicaemic diseases, primarily of chicken and turkeys caused by Gram negative bacteria, Salmonella Gallinarum and S. Pullorum, respectively [8]. Clinical signs: Death of infected chicks or poults begins at 5-7 days of age and peaks in another 4-5 days. Clinical signs including huddling, droopiness, diarrhea, weakness, pasted vent, gasping, and chalk-white feces, sometimes stained with green bile. Affected birds are unthrifty and stunted because they do not eat. Survivors become asymptomatic carriers with localized infection in the ovary.

2.3.3. Chronic Respiratory Disease. This disease has been reported in chickens and turkeys. CRD is specific disease caused by one of the group of organisms known is pleuro pneumonia like organism (PPLO), but more closely defined is Mycoplasma; the particular organism directly associated with CRD is Alycoplasma gallisepticum with or without any secondary complications. According to I he recommendation of FAQ committee meeting held in May l969, the term "Avian Respiratory Mycoplasmosis" (ARM) be used in uncomplicated outbreaks involving only pathogenic avian PPLC (Mycoplasma) and the term CRD be used when PPLO infection is superimposed with other condition in I eel ion is superimposed with other condition. The mortality entirely to CRD is negligible, but it is important because it predisposes the birds to infection for other disease producing organisms.

2.3.4. Fowl Cholera (FC/ avian pasteurellosis, cholera, avian hemorrhagic septicaemia) . Pasteurella multocida subspecies is the most common cause of fowl cholera alhough subspecies septica and gallicida may also cause fowl cholera- like disease to some extent [9]. Clinical signs: Fowl cholera usually strikes birds older than 6 weeks of age. In acute outbreaks, dead birds may be the first sign. Fever, reduced feed consumption, mucoid discharge from the mouth, ruffled feathers, diarrhea, and laboured breathing may be seen. As the disease progresses birds lose weight, become lame from joint infections, and develop rattling noises from exudate in air passages. As fowl cholera becomes chronic, chickens develop abscessed wattles and swollen joints and foot pads. Caseous exudate may form in the sinuses around the eyes.

2.3.5. Infectious Bronchitis / IB / bronchitis/ cold. One of the major economically important poultry disease distributed worldwide. It caused by infectious bronchitis virus (IBV) and affects both galliform and nonggalliform birds [10]. A similar disease occurs in bobwhite quail (quail bronchitis), but it is caused by a different virus. Clinical signs: The severity of infectious bronchitis infection is influenced by the age and immune status of the flock, by environmental conditions, and by the presence of other diseases. Feed and water consumption declines. Affected chickens will be chirping, with a watery discharge from the eyes and nostrils, and laboured breathing with some gasping in young chickens. Breathing noises are more noticeable at night while the birds rest. Egg production drops dramatically. Production will recover in 5 or 6 weeks, but at a lower rate. The infectious bronchitis virus infects

many tissues of the body, including the reproductive tract. Eggshells become rough and the egg white becomes watery.

2.3.6. Infectious Bursal Disease IBD/ Gumboro / infectious bursitis / infectious avian nephrosis is an acute, highly contagious viral disease of young chickens that primarily affects lymphoid tissues [11-14]. It is caused by a member of the genus Avibirnavirus in the family Birnaviridae [15]. Clinical signs: In affected chickens greater than 3 weeks of age, there is usually a rapid onset of the disease with a sudden drop in feed and water consumption, watery droppings leading to soiling of feathers around the vent, and vent pecking. Feathers appear ruffled. Chicks are listless and sit in a hunched position. Chickens infected when less than 3 weeks of age do not develop clinical disease, but become severely and permanently immune suppressed.

3. Working Methodology

3.1. Identification of problem

Broiler is a very popular chicken by the breeders, because the harvest time is short and the quality of the meat is good. However, broiler chickens are very susceptible to disease. So will be made a desktop software that handles broiler disease. The concept that is associated with this expert system will produce a system that can identify the disease of broiler chickens. The breeder inputs the symptoms that exist in broiler chickens so that it can help diagnose the disease to find the outcome of the disease and its solution.

3.2. Knowledge Base

Knowledge base is one of expert system development. This knowledge base is knowledge came from expert who provide information about diseases and symptoms that occur in broiler based on believe value.

Diseases: Bronchitis Infection (P1), Symptoms: loss of appetite (G001), Sneeze (G002), Snore (G003), Cold and Flu (G018), Sluggish (G005), gathered around the heater (G025)

Diseases: Gumboro (P2), Symptoms: fever(G006), Tend to peck the cloacal / theorem of area (G022), white stringy thing in poop like pasta (G008), Anorexsia (G001), Tremble (G010), Weak (G005)

Diseases: Pollorum (P3), Symptoms: shortness of breath (G007), slumber (G023), whitish-lime diarrhea (G009), A Swollen Knee (G015), Shiver (G011), Dirty or Sticky Bottoms (G021)

Diseases: Kolera (P4), Symptoms: breath less (G007), wet snoring (G004), loss of appetite (G001), loss of appetite (G001), Green Diarhhea and unplesant smell(G014), Swollen Head Syndrome(G016), mucus in eyes and nose (G018), Fever (G006), A Swollen Knee(G015), Drowsiness with standing feathers (G019)

Diseases: Newcastle Disease (P5), Symptoms: shortness of breath (G007), Green Dirt (G012), Sluggish (G005), loss of appetite (G001), Torticolis (G013), Snore (G003), Sneeze and cough (G020)

Diseases: Choronic Respiratory Disease (P6), Symptoms: wet snoring (G004), shortness of breath (G007), loss of appetite (G001), Dull Fur (G017), mucus in eyes and nose (G018)

Solution: P1: Is given Therapy as a preventive is given for 3 days with a dose of 0.1 gram per kg body weight while Trimezyn administered for 3-5 days in a row with a dose of 0.1-0.2 grams per kg body weight, P2: chickens aged 3-4 weeks were given broad-spectrum antibiotics 3/4 doses, P3: A small bottle of 2 ml per-oral ND vaccine is mixed with 200 ml of clean water, then stored in a plastic bucket. Combine 2 kg of the career feed into the vaccine solution slightly and stir until blended, P4: antibiotic (Tridosin bradycardia), P5: Vaccine: Medivac Gumboro A Medivac Gumboro B, P6: Given medicine Neo Sulfa with a dose of 3 tablespoons mixed 3.8 liters

3.3. Inference Engine

An inference engine will interprets and evaluates the facts from knowledge base in application. The benefit of inference engine is to take a decision by analyzing data by doing comparative facts and giving conclusion [16] based on the rules which are stored in knowledge base on Table 2.

4. Experiment and Result

The experiment show the application will run based on methodology. The data came from knowledge base and proceed by inference engine. Then continued calculated with certainty factor method for knowing the belief value.

5. Conclusion

The conclusion that can be achieved from making the identification of broiler disease are:

1. This application is designed with certainty factor method to overcome the uncertainty of the symptoms.
2. Application of broiler chicken disease identification, can facilitate farmers in diagnosing disease in broiler, and user input of existing symptoms in chicken, the application will show the results of disease outbreaks that occur in broiler and the solution of the disease.
3. The results of accuracy this system is 90%.

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