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# Fuzzy based poultry production quality evaluation

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**Abstract**--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 framework involves fuzzy based 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 work of fiction of poultry production quality evaluation in data mining.

**Keywords**--Decision, Classification, Evaluation, Fuzzy method, Poultry production Quality, Diseases.

## 1 Introduction

Agriculture based businesses like poultry production mainly have obstacles of poultry disease. Fuzzy based classifications, predictions and grouping applied to poultry data can help in significant way to identify patterns of symptoms and other parameters to help with solutions to support veterinary stakeholders.

Data captured or collected to useful decision is a technical framework involves different stages of Data Extraction, Regularization, organization and applying different machine learning methods to filter significant decision as represented in figure no.1:

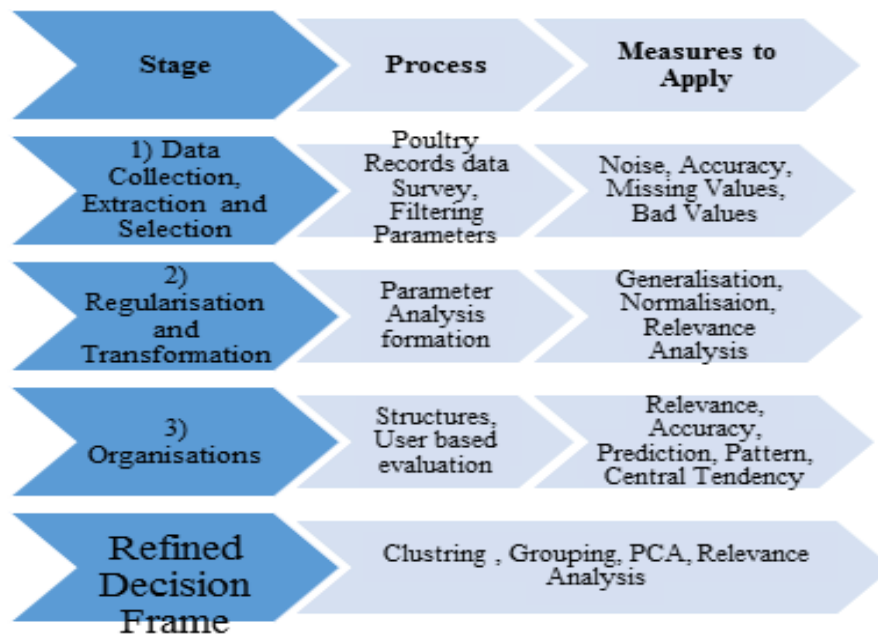


Figure No.1: Refined Decision Conceptual Approach

### 1.1 Data Collection, Extraction and Selection

Agri-based businesses are less computerized and having formless data. So right from primary stage of data collection, abstraction, trials and problems need to be agreed to reach to objective and learn related valued knowledge. As shown in figure no.1, very first stage of survey based data collection needs to be collected and corrected with noise, accuracy, missing values and bad value measure parameters mainly. By verifying with these measures, collected data is extracted to filtered level of input parameters.

### 1.2 Regularization and Transformation

Data deep-rooted for its worth with different measures at the first stage is further regularized and standardized to bring it to general form from specific. Standardization and regularization brings unclear data in order or simple form and so achieves selection technique to control the difficulty of data. The measures as Generalization, Normalization, and Relevance Analysis using correlation and variance are used to confirm the parameter standards and to verify parameters are independent and significantly co-related to consider in final decision making.

### 1.3 Organization and Structuring

Survey based data can be collected in required format but end user readable (respondent's response) need to be regularizes and transformed in required analysis format. Further to study association, grouping or dominant data components to gain real glimpse and real insights mining techniques as

clustering, grouping, principal component analysis, factor analysis or relevance analysis can be useful. This will represent data in more simple or normal forms.

#### **1.4 Decision Discovery**

This is the last phase of machine learning based decision making process discovery, in this phase different algorithms of methods are implemented to get patterns and associations, to group data to capture similarity and dominance, to predict future events based on learning mechanisms processed on data. Automated technique as combination of advanced statistical and optimized machine learning based computing techniques can result in significant evaluation techniques for Poultry Production quality analysis. This mix decision in the light of fuzzy based decision and applications of expertise skills and knowledge applicable to vague dynamic conditions and constraints. Fuzzy reasoning can resolve the imprecision and complexity of decision making to classify, prioritize the poultry production quality according to diverse vibrant input constraint values. As stage wise fuzzy decision making process results can be assigned to input membership parameters accordingly significant result of poultry production quality observed. The blend of these various input constraints with different membership interval may result in different certain value which can be examined as evaluation parameter of poultry production quality.

### **2. Fuzzy Approach For Poultry Production Quality Evaluation**

The Fuzzy approach for Poultry Production Quality involves input parameter analysis, and filtering these parameters with fuzzy partition/ sub-range design to frame and set rules and variables for proposed fuzzy model.

#### **2.1 R Tools Used for Analysis**

Researcher has applied the experiment using R- programming tool.

- RStudio Version- 1.1.383
- R Framework Version- 3.5.1

#### **2.2 Rule Analysis**

At different stages of conceptual framework different measures are required to test the process stage wise. According five input variables and six rules are framed to form fuzzy system. Mix of premises in implications swings the value of resulting parameter in fuzzy rules. For different combinations of different parameter values connections AND, OR, NOT logical connectors are used. In the planned fuzzy based model, fuzzy input constraints and class partitions are made for values subranges and again connected using AND, OR connectors as shown in table no.1.

Table 1: Poultry Production Quality Result Parameter Rule Base

Symptoms	Chick Age	Chick Weight	Viral Infections	Toxic Agents	Output Variable Poultry Quality
MostCommon	Kids	Very Low	Infected	NOTA	VeryStrong
LessCommon	Young	Low		Non-Infected	LESS
			Average		Weak
	High				
Severe	Old	Normal		VeryHigh	VeryWeak

**Source:** Compiled by Researcher

Different five input constraints (Viral Infections, Symptoms, Chick Age, Chick Weight, Toxic Agents) and the combination result can be passed as parameters ranging to different values as Very High, High, Low, Very Low which determines resultant output class variable Poultry Quality as one of the partitions specified Bad, Poor, Average, Good, Very Good, Best.

### 2.3 Input Parameters

Poultry production quality using computerized machine learning technique is determined by using dissimilar factors and reliability and degree of role played by these factors in result will be altered every time. Diverse altitudes of values of input membership are bagged using partitions surrounded for five input variable are as:

First Input Parameter is ViralInfections(with subranges Infected=0, Non-infected=100)

#### 2.3.1 Symptoms

Table 2: Symptoms Input Variable Fuzzy Parameter Partitions

Symptoms Label	Class	Degree of Class	Meaning
Very Few	Most Common	0	Symptoms are very less and seems most common so will have less impact on quality of poultry
Few	Less Common	50	Symptoms are few but seems less common so will have average impact on quality of poultry
High	Severe	100	Symptoms are very high and seems not common but severe so will have serious impact on quality of poultry

*Source:* Compiled by Researcher

At initial level, data is pre-processed to compact with noisy data to fetch this data to further consistent form as depicted in table No.2. This pre-processing is performed to get PoultryProductionQuality improved but methods and techniques chosen for data pre-processing and data validity results in different degrees of

production quality, to capture granularity of such data preprocessed data quality with different sub-ranges of partitions for input parameters membership fitness.

### 2.3.2 Chickage

Table 3: Chick Age Input Variable Fuzzy Parameter Partitions

ChickAge Label	Class	Degree of Class	Meaning
Kids	Less Age Chicks	30	Less Chick age classified as Kids
Young	Young Age Chicks	60	Average Chick age classified as Young
Old	Old Age Chicks	80	High Chick age classified as Old

*Source:* Compiled by Researcher

ChickAge is one more important decision input constraint for fuzzy system where using Less, Young and Old age classifications in generalized form will contribute to poultry production quality. The resultant generalization and level of form is passed as input range of ChickAge member to different degree of classes as shown in Table no. 3.

Similarly ChickWeight with three subranges as Chick Weight (VeryLow, Low, Normal) is one more parameter mainly reflecting health of chicks and the extent of impact other factors will have can be evaluated.

### 2.3.3 Toxicagents

Table 4: ToxicAgents Input Variable Fuzzy Parameter Partitions

DataStructure Label	Class	Degree of Class	Meaning
NOTA	Non Toxic agents	0	ToxicAgents not observed in chick
Less	Less Toxic Agents	20	Less ToxicAgents observed in chick
Average	Average ToxicAgents	40	Average ToxicAgents observed in chick
High	High ToxicAgents	80	High ToxicAgents observed in chick relevant
VeryHigh	Very High ToxicAgents	100	Very High ToxicAgents observed in chick

*Source:* Compiled by Researcher

The Table No. 4 depicts the partition of ToxicAgents input variable to get ranges of availability of toxic agents in chicks which further determines quality. Toxic Agents always considered as major constraints in frameworks of poultry disease evaluation so it makes results more relevant and accurate. So for identification of such meaningful parameters relevance analysis is used, pattern detection will

identify patterns of symptoms and diseases so classification accuracy and central tendency or any user based measure evaluates data structures formed.

### 3. Output Variable Poultry quality

Table 5: Fuzzified Poultry Quality Classification Output Partitions

Poultry Quality Label	Class	Degree of Class	Meaning
Bad	Bad Quality	0	Very less Poultry Quality
Poor	Poor Quality	20	Less Poultry Quality
Average	Average Quality	40	Average Poultry Quality
Good	Good Quality	60	Good Poultry Quality
VeryGood	Very Good Quality	80	Strong Poultry Quality
Best	Best Quality	100	Very Strong Poultry Quality

Source: Compiled by Researcher

All five input parameters value will be applied to system to reach to final improved class of output variable PoultryProductionQuality. But PoultryProductionQuality varies depending on quality of each method and process application. In conclusion, mixture of membership partition of all five input parameters for poultry diseases evaluated leading in final decision will decide whether the resultant PoultryProductionQuality is Bad, Poor, Average, Good, VeryGood, or Best as represented in Table No.5.

As depicted in figure no.2, 6 rules for fuzzy system with five input and one output variable that 6 variables fuzzy system is constructed.

>print(system)

A fuzzy system consisting of 6 variables and 6 rules.

Variables:

ViralInfections(Infected, Noninfected)

ChickAge(Kids, Young, Old)

Symptoms (MostCommon, LessCommon, Severe)

ChickWeight(VeryLow, Low, Normal)

ToxicAgents(NOTA, Less, Average, High, VeryHigh)

PoultryQuality(Bad, Poor, Average, Good, VeryGood, Best)

#### Rules

Symptoms %is% LessCommon && ChickAge %is% Kids && ChickWeight %is% => PoultryQuality %is% VeryGood

Normal && ViralInfections %is% NonInfected || ToxicAgents %is% => PoultryQuality %is% VeryGood

Less => PoultryQuality %is% VeryGood

Symptoms %is% MostCommon && ChickAge %is% Kids && ChickWeight %is% => PoultryQuality %is% Best

```

Normal && ViralInfections %is% NonInfected || ToxicAgents %is% =>
PoultryQuality %is% Best
NOTA => PoultryQuality %is% Best
Symptoms %is% MostCommon || ChickWeight %is% Normal && ViralInfections
%is% => PoultryQuality %is% Good
NonInfected => PoultryQuality %is% Good
Symptoms %is% Severe && ChickAge %is% Old && ChickWeight %is% =>
PoultryQuality %is% Bad
Low || ToxicAgents %is% VeryHigh || ViralInfections %is% => PoultryQuality
%is% Bad
Infected => PoultryQuality %is% Bad
Symptoms %is% LessCommon || ChickAge %is% Young || ChickWeight %is% =>
PoultryQuality %is% Average
Low && ViralInfections %is% NonInfected => PoultryQuality %is% Average
Symptoms %is% Severe && ChickWeight %is% Low || ChickWeight %is% =>
PoultryQuality %is% Poor
VeryLow || ViralInfections %is% Infected || ToxicAgents %is% => PoultryQuality
%is% Poor
High => PoultryQuality %is% Poor
> plot (system) ## plots variables

```

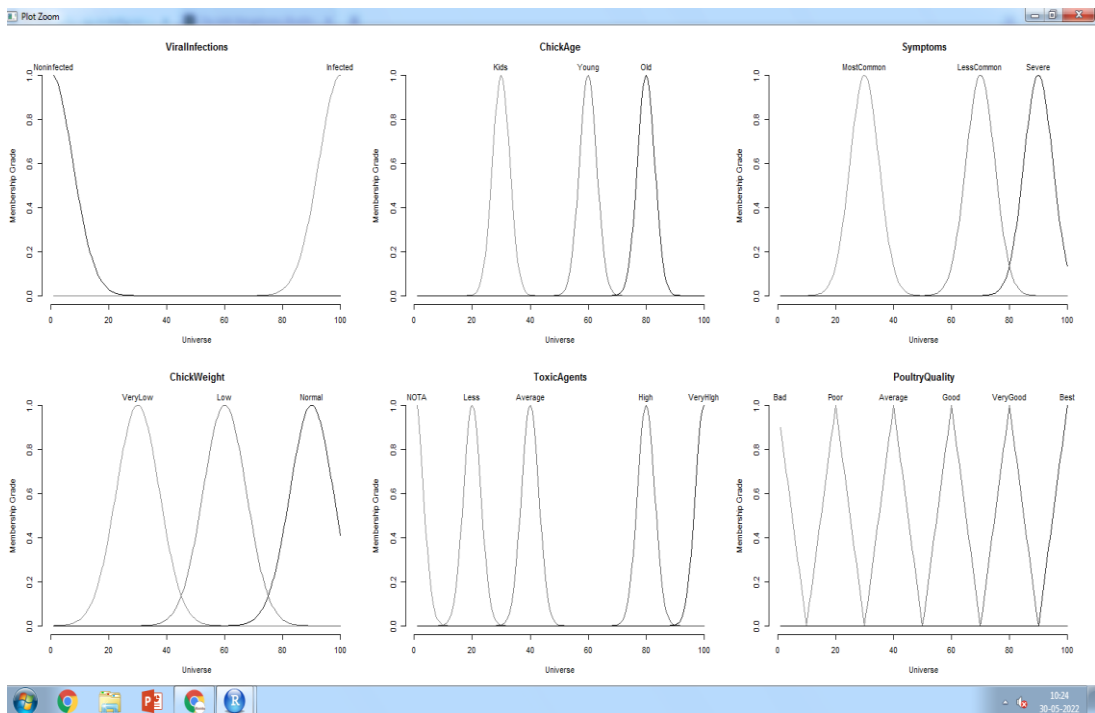


Figure No. 2: Fuzzy Model

This model shows plot of five input parameter sub-ranges or partitions and one output PoultryQuality

```

> fi.1 <- fuzzy_inference(model, list( Symptoms = 75, ChickAge = 0, ChickWeight
= 70, ViralInfections=100, ToxicAgents=80))

```

```
> gset_defuzzify(fi.1, "centroid")
[1] 24.39479
> plot (gset_defuzzify(fi, "centroid"))
```

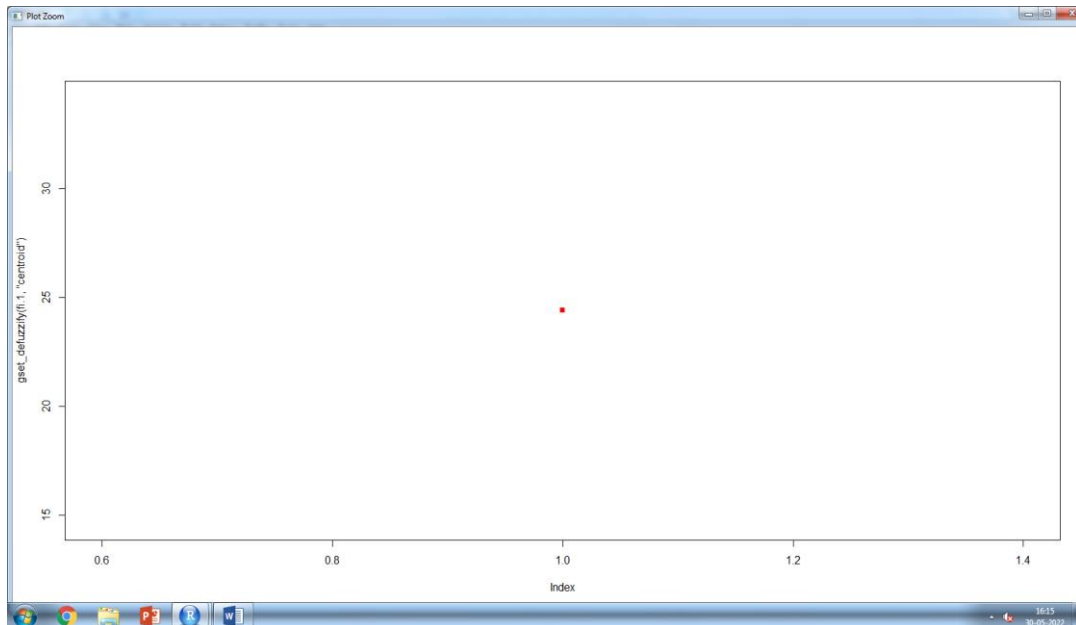


Figure No.3: Certain Class Centroid after defuzzification

As result of inference input values of parameters as Symptoms = 75, ChickAge = 0, ChickWeight = 70, ViralInfections=100 and ToxicAgents=80 and using centroid method of defuzzification, it gives result as PoultryQuality=24.39479 so class range is 24 which represents to poor PoultryQuality Class.

#### 4 Conclusion

The create and experiment research strategy work considers fuzzy based approach for poultry production quality decision generated using methodical framework; each phase is evaluated with different testing measures. Measures result and evaluation aspect can be significantly developed to focus different dimensions of evaluation at each phase for valid classification outcomes and predictions. In future research, the researcher has planned to determine tactic of active selection of input parameters based on relevance analysis according to data spread. Researcher has planned to apply Fuzzy K-means and Fuzzy C-means comparative analysis of performance for input attributes. Further the researcher would like to apply classification combined with some hybrid with genetic algorithm and advanced training algorithms approaches to address limitations for optimization and prediction.

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