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A Review of Expert Systems in Animal Health Care

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***Abstract*— The information technology played an important role in information and knowledge dissemination in the last decade. The usage of IT to transfer information and knowledge in the animal health care domain using expert systems is one of the areas investigated by many institutions. The current era is witnessing a vast development in all fields of animal health care. Therefore there is a need for an unconventional method to transfer the knowledge of experts in this domain to the general public of livestock holders, especially that the number of experts in new technologies is lesser than their demand in a certain domain. The transfer of knowledge from veterinary consultants & scientists to livestock holders represents a bottleneck for the development of animal health care in any country. Expert systems are simply computer software programs that mimic the behaviour of human experts. They are one of the successful applications of the Artificial Intelligence field, a branch in Computer Science that investigates how to make the machine think like human or do tasks that humans do. Expert Systems are very helpful to ensure an effective and nationally coordinated approach in response to emergency incidents and in routine bio-security activities. Such systems enable better management of the information and resources used to manage animal's diseases and emergency responses to incursions.**

***Keywords*— Artificial Intelligence, Expert System, IITV, Ultrasound, Tomography, MRI, DSA , Endoscopy**

I. INTRODUCTION

Livestock wealth is very precious for a developing country like India. In India, animal husbandry is no longer a subsidiary to agriculture or a backyard vocation. Animal husbandry has metamorphosed into an industry and the latest reports suggest that the contribution of animal husbandry sector to the GDP of the nation is substantially higher despite the meager input. Animal husbandry offers a better scope for marginal farmers whose income from agriculture is dwindling fast due to vagaries of monsoon, fragmentation of landholdings, pest problems, poor pricing etc. Though the growth of livestock industry is very promising, in order to make India a global leader in animal husbandry, it is imperative to integrate it with developments in other fields. The developments in Information Technology over the past few decades are tremendous and offer great potential in improving animal health through various measures like effective disease forecasting, rapid and accurate disease diagnosis, modern therapeutic measures etc.

II. INFORMATION TECHNOLOGY IN ANIMAL HEALTH CARE

Medical diagnostic technology has made rapid strides with the advent of the computer. Many of the advances in human diagnostic technologies are translated into veterinary medicine in developed countries. Newer branches like Imaging, Radio diagnosis, Telemedicine, Telesonography and Teleradiology have emerged. Broadly, the instrumentation/devices which have been created with modern technology in the present digital age are listed below.

1) Image Intensifier TV system (IITV): Generally used in orthopedic surgery. IITV helps in X-ray imaging of the intra-operative site for orthopedic manipulations, and the same can be stored for future reference.

2) Ultrasound: In small animal ultrasound is routinely used as a diagnostic aid. Ultrasonography seems to have a promising future in veterinary medicine, particularly for the assessment of intra/peri-abdominal disease. Ultrasonography is non-invasive and non-surgical armamentarium of the veterinary clinician since the advent of the fiber optic endoscope.

3) Computerized Tomography (CT): CT has been an extremely significant development which has a unique cross-sectional imaging ability useful for the diagnosis of tumors, malformations, inflammation, degenerative and vascular diseases and trauma.

4) Magnetic Resonance Imaging (MRI): MRI is a highly sensitive and non-invasive technique providing accurate and detailed anatomic images with good contrast and spatial resolution. MRI is still in its infancy and its use is infrequent. To date, MRI has been used in developed countries in clinical cases as well as a research tool especially for diseases in small animals.

5) Digital Subtraction Angiography (DSA): DSA is a radiographic modality which allows dynamic imaging of the vascular system following intravascular injection of iodinated X-ray contrast media, through the use of image intensification, enhancement of the iodine signal and digital processing of the image data.

6) Laparoscopy: Only in the last 15 years, its use has been extensively in various animal species for research and clinical diagnostic and therapeutic purposes. The most advantageous characteristic of laparoscopy is that it allows direct examination of abdominal cavity with only minimal and superficial surgical intervention.

7) Endoscopy: It is a minimal invasive diagnostic modality which aids in documenting mucosal inflammation, hyperemia, active bleeding, irregular mucosal surface etc. and facilitates biopsy in tubular organs like GI tract, respiratory and the urogenital systems.

As all the above techniques require human experts to analyse the results of IT application, there is a need for an unconventional method to transfer the knowledge of experts in this domain to the general public of livestock holders through the expert system. Expert system is one of the successful applications of the Artificial Intelligence field. Artificial intelligence may be defined by comparing computer and human functions. If the computer performs a task that seems intelligent when it is done by humans it can be said to be exhibiting artificial intelligence. In medicine, most artificial intelligence research has been devoted to creating computer systems that contain detailed information about a specific medical subject. By focusing relevant knowledge on the problems facing the physician, these programs are designed to act like consultants and thereby have the potential of expanding the practitioner's expertise.

Expert systems are computer programs that typically contain large amounts of knowledge for making decisions about specific problem domains such as an area of medicine. In medicine, several important experimental expert systems have been developed. For example: INTERNIST - Diagnosis in internal medicine, PIP - Renal disease, VM - Ventilator Management, PUFF - Pulmonary function and ATTENDING - Anesthetic Management. Similarly researchers have gone through following different researches based upon the various expert systems in animal health care domain.

III. REVIEW OF LITERATURE

Jeffrey C. Mariner1, Dirk U. Pfeiffer2(2011)

Through their research they suggested the Participatory Epidemiology Network for Animal and Public Health (PENAPH) seeks to facilitate research and information-sharing among professionals interested in participatory approaches to epidemiology and risk-based surveillance. As part of this process, the network supports innovation in institutional capacity by promoting minimum training guidelines, good practice and continued advancement of methods through action research.

Graeme Garner(2011)

This research indicates that trade and market access is a major focus of surveillance in Australia. The animal health surveillance system in Australia has evolved to meet a range ofregional, state/territory, national and industry needs including Notifiable disease reporting, Trade and market access, Regional and national animal disease management, Monitoring endemic diseases and Early detection of exotic and emerging diseases

Jampour,M (2011)

In his research, he concludes that animal health and domestic products health undoubtedly are the most basic health factors, although, there are complete and correct information in the disease of animal with neurological involvement, however, generally defined neurological diseases only on the basis of clinical symptoms is not so simple as so proximity neurological signs and in most instance veterinarians will doubt in diagnose. In this research researcher use the fuzzy logic model approach to determine and calculate lack or involvement of each the possible disease with neurological signs and sufficiently reduced natural Uncertainty regarding the diagnosis of disease.

Gustavo Sotomayor(2011)

He commented that the Animal Protection Division of the Agriculture and Livestock Service of Chile (SAG) has moved from using file-based information and local databases – in other words a nonstandard, non-interconnected system – to a centralized database with which users connect via a WAN (Wide Area Network). Until 2004 the recording, storage and analysis of data (information management) was mainly carried out using local, spreadsheet-type files compiled by those responsible for the different programmes. These were sent to the SAG operational offices and then bound as management reports or epidemiological analysis.

Hosein Alizadeh, Alireza Hasani-Bafarani, Hamid Parvin, Behrouz Minaei, Mohammad R. Kangavari(2008)

Through their research, researchers highlighted the possibility of developing of an expert system for replacing human expert investigated. Also, the knowledge extraction methods are scribed. Fuzzy logic is used for dealing with uncertainty. Finally, the Knowledge representation methods are discussed and fuzzy rule base is proposed for representing this knowledge.

Soegiarto(2011)

His research is based on Indonesian animal health service using computerized information systems to assist in managing animal and zoonotic disease for almost 20 years. Initially these were adaptations of programs developed internationally, but in the past ten years these have been replaced by three nationally developed systems: SIKHNAS for managing surveillance data, InfoLab used by regional veterinary laboratories, and the HPAI Information System for monitoring HPAI surveillance and control. These applications are all standalone, which can lead to data integration problems at a national level.

P.L. Nuthall, G.J. Bishop-Hurley(1999)

Their research is a section of a wider study involving expert systems for feed management which covers the development of a successful interface for expert systems and the farmers attitudes to the expert systems themselves. Alternative forms of the interface were created and presented to both professionals and farmers for evaluation and use. Their responses were used to conclude on a number of interface design questions. A clear preference for data input through as few screens as possible using pick lists and a mouse is evident, as is the benefit from providing on-call pictures to visually depict alternatives where the user has a choice.

Van Dang Ky(2011)

Through his research, he indicated that Viet Nam's disease information and surveillance system has been in place since the 1960s. However, before the year 2000 the system showed limitations, such as slow outbreak detection and delayed information transmission. Many outbreaks, therefore, could not be detected early on and the

implementation of control measures was delayed, causing diseases to spread. At pesent, many diseases are under intensive surveillance and monitoring. Rapid response to outbreaks is performed well at different levels of the veterinary system.

Dickens M Chibeu(2011)

The researcher has explained the role of the Animal Resources Information System (ARIS) in decision-making, planning and monitoring cannot be overstated. Specifically, ARIS is useful in early warning and rapid response, allocating resources, assessing the level of livestock contribution to livelihoods and GDP, and formulating policy. About a decade ago, there was no comprehensive information system at IBAR or in most Member States (MS) capable of contributing efficiently to these surveillance and decision-making activities. The focus then was on disease reports for international organizations, with no systematic data collection, analysis and information dissemination. Data from different sections of Animal Resources was fragmented, with a majority of MS using paper-based data management rather than databases.

Kellaway, RC(1988)

His research is a design of CAMDAIRY, a computer model containing a package of programs designed to help advisers, farmers, students and research workers who are involved in the feeding of dairy cows. Details of the model are given by Hulme .The core program incorporates functions to predict nutrient requirements, feed intake, substitution effects when feeding concentrates, tissue mobilisation and partition of nutrient utilisation between milk production and growth. Nutrient partitioning is described by a series of asymptotic curves relating energy intake to milk production, such that energy requirements per litre increase progressively with level of milk production.

Mokganedi Mokopasetso(2011)

He concludes that within the Southern African Development Community (SADC) member states, livestock farming is considered one of the main pillars for developing rural livelihoods. In particular, there is a critical need to strengthen national epidemic surveillance systems to enable timely collection, reporting and analysis of animal disease data. The overall project objective was to strengthen regional preparedness against the spread of trans-boundary animal diseases, and its main undertaking was to strengthen animal disease surveillance through improving disease data collection and processing for decision-making. This is the context in which Digital Pen Technology (DPT) was introduced to the region as an innovative way to collect and send animal disease surveillance data from remote areas in the field to Central Epidemiology Units for analysis and decision-making.

Lawrence R. Jones(1990)

Technologies outlined in this research represent the foundation of the next generation of computer applications for dairy herd management. If adopted, these technologies will allow the development of systems that are more intuitive to use, are easier to learn to use, and provide more complete access to management information. Integrated decision support systems have the potential to supply dairy herd managers and their consultants with a complete computerized system to address many farm problems. As these systems are augmented with more intelligent user interfaces, they should eliminate many of the problems facing dairy herd managers in selecting and using software. The result of adopting such technologies will be better informed management

Mat Yamage and Mahabub Ahmed(2011)

Developed for Avian Influenza Technical Unit, Food and Agriculture Organization of the United Nation Department of Livestock Services, Dhaka, Bangladesh, his research described the SMS gateway system which is a tool for transmitting a large amount of information from the grassroots level via a mobile phone to a central Internet server and consolidating this information automatically for handling by a single database manager. The flow of information is bi-directional and timely instructions can be given in response to a particular situation. The system is suitable for the surveillance of HPAI H5N1 in Bangladesh where the majority of poultry farms are in rural areas and not readily accessible to the national veterinary services owing to a shortage of human and material resources.

C. H. Burton, H. Menzi, P.J. Thorne, and P. Gerber, Cemagref(2008)

Their research commented that dissemination and knowledge transfer remain a challenge in many fields of research. This is especially the case for the application of livestock waste management in developing countries where there an overwhelming volume of material is already available to the farm advisor and the real need is often the transfer of such knowledge to the local level. The object of this project is to package up suitable techniques as an expert and design system that can be applied directly to farm situations across South East Asia. The software will comprise both calculation models (e.g. nutrient excretion of animals, nutrient balance, design and costs of manure treatment facilities), and decision tree elements (e.g. structured analysis of the present situation at a given farm). Outputs will include summary reports providing specific recommendations, specifi cations, case study examples and supporting multimedia background information.

A.J. Mendes da Silva1, E. Brasil(2011)

Their research indicates that the Second Inter-American Meeting on foot-and-mouth disease and Zoonoses Control (RICAZ), under Resolution I, took the first steps towards establishing a Continental Epidemiological Information and Surveillance System (SCIV). The proposal was put forward by the Pan-American foot-and-mouth disease Centre (PANAFTOSA), which had at that time already established procedures by which member countries were urged to submit periodically, epidemiologic information on the occurrence of foot-and-mouth disease (FMD) and vesicular stomatitis, as well as other diagnosed types and subtypes of virus.

Sanjay S. Chellapilla(2003)

This research describes the design and implementation of DairyMAP, a Web-based benchmarking analysis and Expert System for Dairy Herd Producers, as part of the Dairy Management Analysis Program undertaken by the Edgar L. Rhodes Center for Animal and Dairy Science. The system consists of two major components – a preliminary statistical benchmarking analysis (based on Dairy Herd

Information reports provided by the Dairy Records Management Systems, Inc., in Raleigh, NC) and, a detailed expert evaluation of the four major areas of dairy herd management, viz., Somatic Cell Count and Mastitis, Reproduction, Genetics, and Milk Production. The preliminary analysis provides information to the producer about the areas of concern within each component of dairy management, and suggests further evaluation and diagnosis by the Expert System, concluding with comments and recommendations for improving the producer's herd.

T. Rousing, M. Bonde & J. T. Sorensen(2001)

Their research suggests a welfare assessment protocol for loose housing systems for dairy caws based on four sources of information being the system, management, animal behavior and animal health. The animal behavior indicators refer to social behavior, man-animal relationship and resting/rising behavior. Health indicators focus on causes of pain and discomfort to the animal: Extreme body condition, skin injuries and disorders, udder and teat lesions, lameness, hoof disorders and systemic diseases with general affection of the animal. The listed indicators were included in a protocol, which will be tested in ten commercial dairy herds. The herds will be visited regularly during a one-year period. System and management will be described and the behavioral and health indicators will be measured on a sample of the animals. The evaluation of the indicators will include statistical analyses, expert opinion and interviews with the articipating farmers.

A. Dagnino, J. I. Allen, M. N. Moore, K. Broeg, L. Canesi and A. Viarengo(2007)

Through their research they developed an expert system which is based on a set of rules derived from available data on responses to natural and contaminant-induced stress of marine mussels. Integration of parameters includes: level of biological organization; biological significance; mutual inter-relationship; and qualitative trends in a stress gradient. The system was tested on a set of biomarker data obtained from the field and subsequently validated with data from previous studies. The results demonstrate that the expert system can effectively quantify the biological effects of different levels of pollution. The system represents a simple tool for risk assessment of the harmful impact of contaminants by providing a clear indication of the degree of stress syndrome induced by pollutants in mussels.

J. Enting, R.B.M. Huirne, A.A. Dijkhuizen, M.J.M. Tielen(1999)

For constructing a knowledge-based system in the field of animal health management a documentation methodology has been developed and is reported in their research. The methodology was based on, among other things, the CommonKADS technique. It includes three subsequent phases: documenting concepts and facts in hierarchies, documenting separate inferences which integrate knowledge documented in hierarchies, and documenting the strategy or sequence of the inferences to be made. The method supports the full pathway of the documentation process and addresses both declarative and procedural knowledge. Also, the method provides a quick insight into knowledge of a knowledge source (e.g. experts) and comprehensible transcripts for the expert. The latter facilitates the process of knowledge verification.

Michele Ruta, Floriano Scioscia, Eugenio Di Sciascio(2009)

Their research is based on an innovative Decision Support System for healthcare applications which is based on a semantic enhancement of RFID standard protocols. Semantically annotated descriptions of both medications and animals, or person case history are stored in RFID tags and used to help doctors in providing the correct therapy. The proposed system allows discovering possible incompatibilities in a therapy suggesting alternative treatments.

From above reviews, it clear that most of them are based on Animal Disease Surveillance to improve disease analysis, early warning and predicting disease emergence and spread. As a preventive measure, disease surveillance is aimed at reducing animal health-related risks and major consequences of disease outbreaks on food production and livelihoods. Early warning systems are dependent on the quality of animal disease information collected at all levels via effective surveillance; therefore, data gathering and sharing is essential to understand the dynamics of animal diseases. Through the proposed expert system researchers will utilize the experts knowledge for the best management practices for developing rules in variety of animal health care issues with special reference to lactating animals.

REFERENCES

[1] Jeffrey C. Mariner1, Dirk U. Pfeiffer2, Surveillance for the present and the future Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[2] Graeme Garner, Surveillance For Animal Diseases And Animal Health Information Management In Australia, Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[3] Kate Elizabeth Sawford, A Thesis Submitted To The Faculty Of Graduate Studies In Partial Fulfilment Of The Requirements For The Degree Of Doctor Of Philosophy

[4] Jampour,M, A Fuzzy Expert System to Diagnose Diseases with Neurological Signs in Domestic Animal,Information Technology: New Generations (ITNG), 2011 Eighth International Conference on Digital Object Identifier: 10.1109/ITNG.2011.220 Publication Year: 2011 , Page(s): C1 IEEE Conference Publications

[5] Gustavo Sotomayor, Progress and challenges in official information systems for disease surveillance in Chile , Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[6] Hosein Alizadeh, Alireza Hasani-Bafarani,Dairy Cattle Judging: An Innovative Application for Fuzzy Expert System www.iaeng.org/publication/WCECS2008/WCECS2008_pp247-250.pdf

[7] Soegiarto, Animal health information systems in Indonesia, Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[8] P.L. Nuthall , G.J. Bishop-Hurley, Expertsystems for animal feeding managementPartI: Presentation aspects, *Computers* and electronics in agriculture ISSN 0168-1699 CODEN CEAGE6. Source / Source. 1996, vol. *14*, no*1*

[9] Van Dang Ky, Animal health information system in Viet Nam , Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[10] Dickens M Chibeu AU-IBAR , Animal Resources Information System (ARIS) of the AU-IBAR, Challenges Of Animal Health

Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011.

[11] Kellaway, RC, CamDairy : a computer program for performance prediction, ration analysis and ration formulation to maximise profit from dairy cows. http: //www.asap.asn.au /livestocklibrary /1988 /Kellaway88.PDF

[12] Mokganedi Mokopasetso, Digital pen technology for animal disease surveillance in Southern Africa, Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[13] LAWRENCE R. JONES, The Current State of Human-Computer Interface Technologies for Use in Dairy Herd Management',"Emerging Agricultural Technology: Issues for the 1990s" by the Office of Technology Assessment, Congress of the United States, Washington, DC.

[14] Mat Yamage and Mahabub Ahmed, Active surveillance of H5N HPAI using sms gateway in Bangladesh1 Challenges Of Animal Healt Information Systems And Surveillance For Animal Diseases And Zoonose By Food And Agriculture Organization Of The United Nations Rome, 2011

[15] C. H. Burton, H. Menzi, P.J. Thorne, A computer-based Expert system to support the selection and implementation of systems for sustainable livestock waste management in South-East Asia, by Food and Agriculture Organization of the United Nations (FAO), Rome, Italy, www.ramiran.net/doc08/RAMIRAN_2008/Burton.pdf

[16] A. J. Mendes da Silva1*, E. Brasil1, SIVCONT epidemiological information and surveillance system , Challenges Of Animal Health Information Systems And Surveillance For Animal Diseases And Zoonoses By Food And Agriculture Organization Of The United Nations Rome, 2011

[17] Sanjay S. Chellapilla, Dairymap: A Web-Based Expert System For Dairy Herd Management , www.Ai.Uga.Edu/Iai/ Theses /Chellapilla_Sanjay.Pdf

[18] T. Rousing, M. Bonde & J. T. Sorensen; Indicators for the assessment of animal welfare in a dairy cattle herd with a cubicle housing system www.velferdsprotokoller.org, 2001

[19] A. Dagnino, J. I. Allen, M. N. Moore, Development of an expert system for the integration of biomarker responses in mussels into an animal health index 2007, Vol. 12, No. 2 ,

[20] J. Enting, R.B.M. Huirne, A knowledge documentation methodology for knowledge-based system development: an example in animal health management ,Computers and Electronics in Agriculture,Volume 22, Issues 2–3, April 1999, Pages 117–129

[21] Michele Ruta, Floriano Scioscia, Eugenio Di Sciascio, A knowledge-based framework enabling decision support in RFID solutions for healthcare International Journal of Recent Trends in Engineering, vol. 1, no. 4, pp. 68–71,2009