Implementation of Artificial Intelligence Policy in the Field of Livestock and Dairy Farm

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ABSTRACT

Artificial intelligence is changing each and every field of the modern world and livestock is not any exception. It is greatly expected that this modern technology has the potential to bring a breakthrough in the field of livestock through combining biological information with technological advancement. Modern farms with the implementation of AI techniques are showing exceptional growth as they have improved efficiency in terms of livestock production and minimized the physical labor as well as the labor cost. Thus this sector has become more significant in world GDP. The present study is intended to highlight the principal benefits provided by AI techniques including robots, drones, and 3D printing. Through this research, readers can get a better idea about applications of AI, its benefits and disadvantages in the field of dairy farming and livestock. It will also encourage fellow researchers to conduct such research in the future.

Keywords: Artificial Intelligence, Smart Farming, Modern Livestock, AI Policy

INTRODUCTION

Artificial Intelligence thrives on animal farming and is developing at an astonishing rate. It has the potential to drastically alter the condition of farmers by keep their and animals health, and physical condition at good standard. This modern technology is very powerful and can deal with animal farming opportunities and thus indirectly enhance the strength of the whole dairy industry. AI has many operational programs, in livestock management, such as monitoring dairy operations, increasing milk production and production on the farm, diagnosing dairy disease in dairy cattle especially cows, obtaining the aroma of dairy farm and building smart farms that are empowered to analyze images. Finally, it offers new opportunities and open multiple prospects to enhance quality and growth in this industry through incorporating a profitable business strategy (Laloë, 2019).

Why AI is useful for famers?

AI has become one of the most important ways to improve the genetics of farm animals that have ever been designed. It is widely used to breed dairy cows, and is made of high quality bulls available to everyone. Let's take a look at why farmers use artificial intelligence and whether it is useful for them figure 1.

Farmer Safety: Dairy bulls have a reputation for being fierce. Dairy bulls are generally bred with high human interactions, resulting in a complete lack of concern when handling. This results in calmer calves, which are easier to catch in the herd. Bulls, on the other hand, are not only relieved when they have no fear, but they are also reluctant to vent their provocative testosterone. When farms relied on bulls for breeding, bulls were milked close to the cows in the milking parlor. This means that the milkers were very close to the animal twice a day, which could kick us in the head at any time. This risk is completely eliminated using the breeding process.

Cattle Safety: Bulls rarely vent their rage on a cow, but they are naturally large creatures. The male lifts the female and puts a lot of weight on her hind legs to breed natural cows. A good Holstein bull can weigh up to 2,000 pounds [2000 kg] easily, and if a cow is hot, it will usually breed many times over. That is more pressure, and the process has the potential to damage the domestic cow. The life of a cow can be in danger if it is dropped due to an injury to the leg or hip. The AI process, on the other hand, takes only a few minutes and has no potentially harmful effects on the cow (Chimakurthi, 2017a).
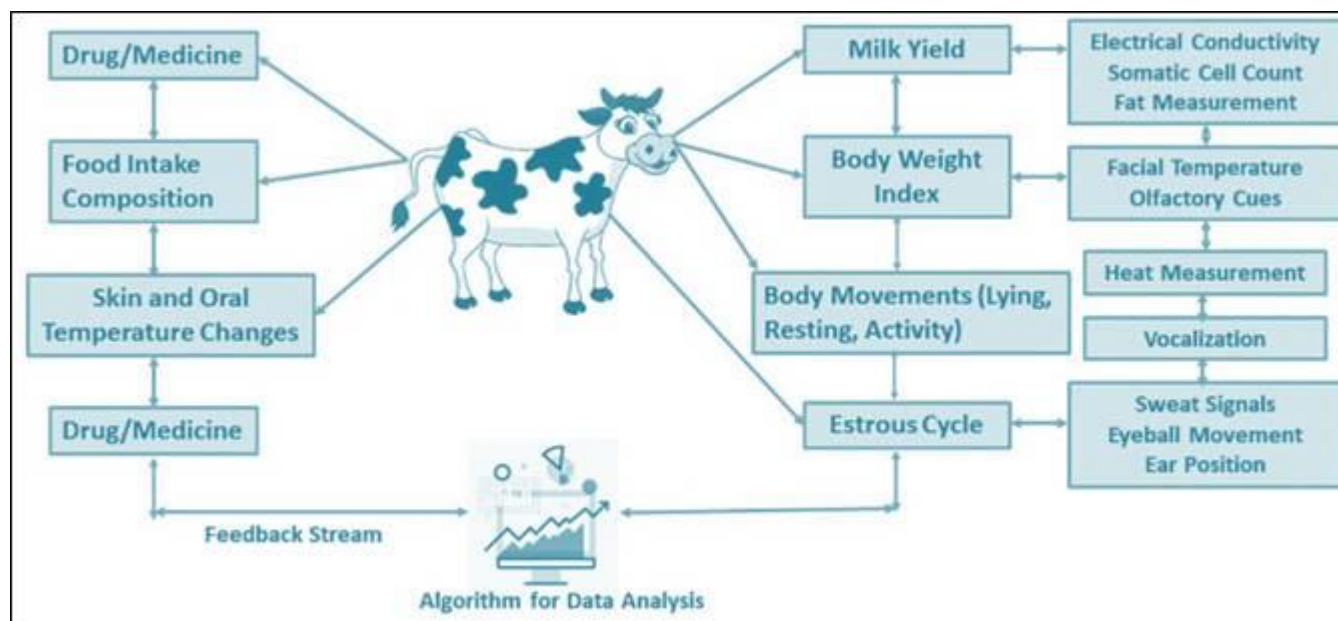
Figure 1: benefits of AI in livestock

Improved Management: There are farms that do a better job of breeding bulls, but that requires almost as much effort as an AI program without additional benefits. Because bulls were always present when milking the farm, no one knew when a cow was raised or which bull was raised. They could not keep waiting until the calf was born to give birth, and they did not know when they would dry up. Now that they have specific breeding dates and they can choose the recipe for each game. They know better about cows' pregnancy and lactation if they know when they are giving birth.

Genetic Benefit: Genetics is the most important reason why people choose AI. There is no doubt that the largest bulls in this breed end up in the genetic business. Are there any good bulls on the market? I'm sure they are, but in all cases, there are higher options in AI. Even though they are small farms, AI allows them to use a large variety of grains (rather than putting all their eggs in one basket) and use bulls with outstanding genetic promise. They can choose bulls based on a variety of factors that predict the animals' appearance, and how soon they will give birth, how often they will get sick, how much milk they will produce, and the fat and protein of their milk. . They do this to breed and produce balanced and productive cattle, and they may analyze their accomplishments on their farms and change strategies based on the strengths and weaknesses of the ever-changing herd.

Better data analysis: For better management and control of their farms, all farmers rely heavily on data and similarly gather and analyze as much data as possible. Regression analysis is the one mode through which data analysis can be done by following equation

$$Y = aX + b$$

Where regression line is represented by following equation

$$Y = f(X, \beta) + \varepsilon$$

Farms gather different kinds of data through various different kinds of sensors. Health data of cattle is collected, for example, by moving sensors attached to cattle and sensors of milking robots. Many farm workers are truly unable to process raw data on their own and depend on the functions found in the Farm Management Information Systems (FMISs) that help them to manage, analyze and process the complex data. Previously, FMIS used to be just a simple farm management or controlling system, but today, it has been able to process detailed and complex sensor information and provide comprehensive functionality to support decisions. But, the complete range of data from a variety of sensors may only be used when FMIS begins to integrate algorithms of machine to automate processes of decision making in animal farms (Garcia, 2019).

Estrus detection: Accurate heat detection is significant factor in the exceptional growth of animal farms. Advances in AI and its use have empowered farmers to overcome or minimize the losses made by improper acquisition of Estrus (figure 2). A collar attached to it beef neck gathers all kinds of cow-related data throughout the day. These intelligent components present in the milk automation system completely process the data gathered to provide information about temperature pressure, changes in feed efficiency and cow estrus. The emergence of the estrus cycle causes the release of some particular hormones that greatly affect the behavioral responses and movement of cattle. For illustration, any cow in the dry heat is may stand for longer periods of time allowing bulls to ride it. The

smart component actually makes a comparison of the newly generated data (about movement) to the database and can make a good prediction about the maturation of the cow before time. Since the time of ovulation begins after the first 24 to 32 hours of "dry heat," the caretaker has ample time make the cow ready for incubation (Smith, 2018).
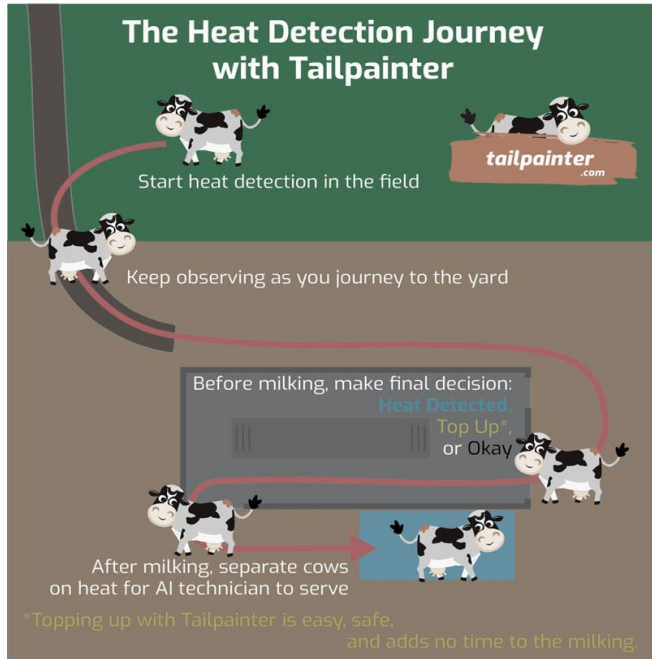

Figure 2: process of heat detection by AI

REVIEW OF RELATED LITERATURE

After all, AI is designed to provide the most comprehensive services on the farm, a good partner that assist farmers to protect cattle health, increase milk quantity and enhance farm production, it is also noted by researchers that "Ultimately, it will provide new hope and open hopes for development in the dairy industry," say the scientists, "in a profitable business model" (Chimakurthi, 2017b).

Knowledge of the performance of each cow and herd level (milk production, disease detection, diet) is clearly better integrated with many other sources like climate to give complete guidance for further development of management processes and data based decisions. Some researchers reported that how AI can adjust the temperature of a cow's herd in a barn, or enhance heat loss in the times of high heat stress (Kaab et al., 2019). These scientists are proposing a system of milk robots based on individual cattle tests in combination of weather data that may be connected with ease to any smartphone or digital app. "Model results can be set automatically at certain volume and milk quality levels [and] the system can automatically control the gates to direct individual cows to a cooling system with water sprayers or standard milking units," the scientists explain. The team believes AI systems can be used with sound investment in small and medium-sized dairy farmers (Rouhiainen, 2018).

Researchers have successfully formulated a modern system that through AI identifies and tracks the behavior of all cattle in a pen. The information is greatly used to make better performance indicators for cattle and farm (based on production, welfare etc.). A recently developed program showed that cattle, due to some reason, were consuming soft drinks that could affect their milk quantity and physical health. As a result of the plans, the farmer made a comprehensive investigation and discovered that there was electricity running through the supply of water (Williams, 2018).

This technology can also benefit breeding as the software is capable to apply data for better milk production, dietary foods and more to give suggestions for breeding decisions. Moreover, in order to give detailed consumer data about dairy products and to ensure its safety and quality, many scientists have recently introduced the Intelligent Edge-IoT (Internet of Things) platform to monitor and control livestock and plant breeding conditions. AI may also be used, in the opinion of researchers, to assist the livestock sector to make the necessary changes "in the current market with efficient, environmentally friendly, transparent and secure products" (Chimakurthi, 2018).

Scholars stated that AI is quite capable to compile huge amounts of farm data and that at the moment, this lack of combination or link means a longer, poorer life expectancy. Performance and health issues are still ongoing. However, researchers warned that ownership of farm-produced data is a matter of concern. It is also reported on a study that included data analysis with a software program called 'MotivBase. the practicality of the 'and' diet plan ') and considered it, more than 11% of those who participated in these dialogues and conversations felt aware of benefits of AI within the diet plan. "Greater awareness is likely to grow rapidly in the near future," researchers reported (Williams & Scott, 2019).

However, researchers noted that in terms of AI applications in dairy farming, majority of people can look at the applications that are now being used and suggested directly, as these applications are targeted to improve the health of cattle and ensuring safety of food. "The need for very high levels of tracking of dairy products and all food products is growing, and without AI, we will not be able to meet the tracking levels of the diet plan that consumers want,". "Furthermore, we must remember that none of these AI systems in dairy farming are fully functional without human decision-making at some level" (Murase, 2000).

CHANGING THE WHOLE DAIRY INDUSTRY

Data collection and automation through sensors and lasers has greatly helped all farm owners and staff to manage the difficulty of managing workers ready to perform hard manual labor to take care animals. One impressive attribute of automation is that the animals are getting used to this new technology and liking robots better.

Drones: There are multiple opportunities for modern drones in the livestock and dairy sector, but they are limited to require conventional technology. They can be applied to spy on herds or fences or to help herd cattle from fields to pens (figure 3). The installation of other such technologies offers great chances of growth. Visual sensors have been shown to be useful in deeply surveying the soil and analyzing grazing growth. Moreover, milk uses drones to map, explore and get the images of pastures to determine growth. Different algorithms make the drones able to directly identify cattle and to avoid mixing them with similar predators or other animals. When linked with a photo, the chances of finding and tracking cattle are greatly increased, especially in thick fields or dense foliage. Similarly, temperature detection will permit farmers to detect any unusual abnormal in cattle, like lame, sick or breeding. Drones can be very helpful in all these aspects, especially to extend life expectancy and improvement in autonomous flight capabilities.

Figure 3: monitoring of animals by drone

Robots: Robot milking (figure 4) machines are the most renowned application of robots in the livestock, to increase efficiency and replace costly machineries. Modern Voluntary Milking System not only reduces labor expenses, and permits cattle to take the decision to be milked or not. Milkbots or milk robots clean the udder, automatically recognize cow's teats and milk. Other technologies, like a rotating platform, that permits farmers to enhance the effectiveness of milking of herd while offering a relaxed and secure environment for both herdsmen and cattle. The miRobot offers a new system of milking that is actually formulated for large tasks. Many organizations offer multiple tables, automatic milking services for milking cows at one time, filling full parlor in just one driver. These new technologies have allowed farmers to reduce labor expenses and receive more milking every day. The new systems acts like a pasture gate that permits cattle to graze only after milking. Cattle enter the specialized box, and the cattle monitoring system decides whether the cattle can be released for grazing or not. Before the introduction of robots, cows were commonly milked two times in a day. Now, cows are able to be milked thrice a day or even

more, which truly increases productivity and profitability. Moreover, as the cows are standing for greater duration for milking, there is a great chance for medical check-ups through modern sensors - which can determine the pace, quantity and milk quality but also the quantity the cow has consumed, its heat cycle and so on (Chimakurthi, 2018).
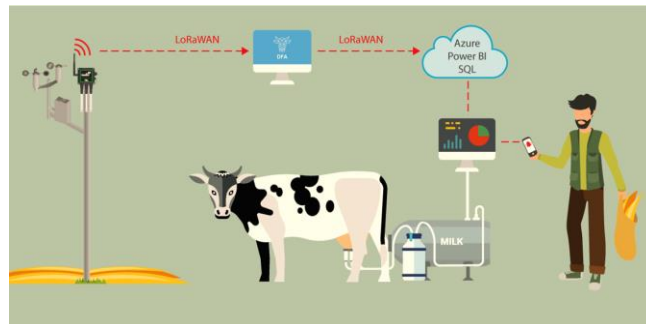

Figure 4: milking by AI machines

3D Printing: Multiple applications for 3D printing are benefiting the dairy and livestock sector. The main use of this technology is for mechanical components, which can be of special benefit for rural farmers, saves valuable money as well as time, based on the required component. Cheese is easiest food to replicate with 3D printing, owing to its flexible nature from solid state to liquid state. Studies purposed that printed cheese is much less sticky while softer and more soluble than raw cheese. However, the idea of printed foods may not attract the attention of all consumers, so the issue is to make nutritious foods, of low cost, better taste and improved nutrition. Companies use 3D printing in combination of genetic sequences to generate a yeast-like fermentation product similar to milk. This special product is marketed as a non-dairy product or for people who do not tolerate milk. 3D cameras can also help in facial recognition of animals to avoid fraud (figure 5).

Figure 5: facial recognition of animals by 3D camera

Augmented reality: Augmented reality (AR) is explained as the combination of digital information and a user's real-time environment. Research has reported that this

can be applied to formulate food with better appearance or to correctly measure appropriate feeding size. AR can allow a farmer to quickly see farm-related statistics through mirrors. Information about each cow is covered with mirrors instead of the farmer's point of view. He can view all the data on the premises and even check the milk quality. Will it be reused in the animal kingdom for testing and observation? Probably in combination with reliable sensory data, a veterinarian can provide appropriate disease control recommendations and reduce the need to visit specific farm calls, thus reducing costs (Zhang et al., 2017).

Virtual reality: Virtual reality (VR) may be explained as the digital atmosphere that may be communicated in a manner that seems realistic by electronic gadgets and devices. Applications of this technology in the livestock change with farm visits to animal training, which have boosting effects on safety as well as on efficiency. Many new companies have partnered with the development of practical health and safety training technologies that allow workers to roam the production and distribution areas, thus minimizing ride durations. Companies' staff learns to recognize potential hazards and meets dangerous conditions in a virtual reality environment, improving the learning experience without the threat of exposure. This technology also offers the benefit of cost reduction by changing the quantity of health and safety training positions. Furthermore, it is applied to train animal readers the technique of breeding cattle. Even a new model of a cow has been generated that combines a non-realistic object with robots. Another feature of VR, allows readers to view what is inside the cow - making them able to test infertility, pregnancy, or to decide to give birth without putting themselves at risk.

Blockchain: Consumers are highly curious about where their eating material comes from and what the process of its production is. Blockchain offers its services to connect different parts of supply chain from manufacturer to clients and permit for food security and safety. From an agricultural and food angle, providing this kind of data to clients will be a good advantage and will not be a challenge or issue as in other agricultural areas, like beef, which often alters ownership.

Internet of Things: Combined all these mentioned technologies create good chances in the livestock sector to increase efficiency, profit and production (figure 6). The communication of this technology was possible by the implementation of the Internet of Things (IoT). Many companies use IoT to maintain complete farm records, including crops production, inventory, animal numbers, operations, grazing and environmental safety. Many companies also use IoT to provide all kinds of products, from standard herd controlling to dairy testing, payment processes and cold chain management. Other companies also actively participate in IoT programs and works with dairy producers (Ivanov & Webster, 2017).
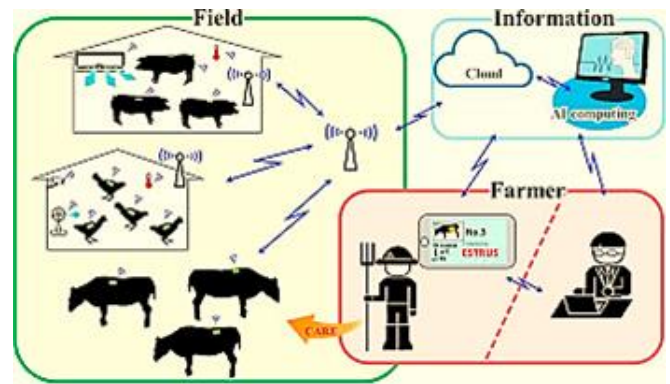

Figure 6: IOT sensors for smart livestock management

Advantages of AI implementation in Dairy Farming:

- The great advantage of AI is that it allows the best sires to fully utilize their power. The natural service is likely to reduce the number of mating per bull to less than 100 per year.
- In 1968, AI allowed one milk cylinder to supply enough sperm for about 60,000 servings.
- The use of AI prevents particles from being exposed to sexually transmitted infections, reducing the risk of infection.
- AI reduces the time it takes to get tangible evidence from young bulls.
- Other benefits include the early detection of infertile bulls, the use of older or disabled bulls, and the avoidance of risks associated with handling bulls.

Disadvantages of AI implementation in Dairy Farming:

There are a few disadvantages of AI that can be minimized with careful management.

- Performance skills require more staff, infrastructure, and management technology than natural work.
- AI application requires specialized training, skill, and practice.
- The genetic base can be reduced by using fewer particles, as is the case with AI.
- Every effort should be made by the AI business and dairy farmers to get as many fish as possible (Nadimi et al., 2009).

THE IMPORTANCE OF AI IN DAIRY FARMING

Animal agriculture shares the burden of 14.5% in the total greenhouse gas emission of world, 20% of which are due to milk production. With the 22% increase in predicted global milk production, it is important that the dairy sector adequately addresses the key challenges that will ensure the future sustainability of the global dairy industry. However, an increase in the number of dairy herds naturally will lead to increased employment for farmers, which may reduce working hours or reduce animal health, as farmers have to take care of the growing number of livestock. Therefore, dairy farmers need to improve production (e.g., reduced production costs per liter of

milk) without sacrificing milk production capacity, milk quality, or animal health and wellness. To achieve this, all aspects of the dairy cycle must be continuously monitored, monitored and adjusted to minimize the risk of adverse farm events that may affect production and profitability.

Use of software and hardware technology that supports dairy farmers through self-determination on the farm can help farmers to accommodate the increase in herd size without additional labor requirements. Machine learning algorithms and cognate methods can provide the precision of guessing needed to enable this technology through the ability to self-study and improve over time as new data becomes available. Therefore, there has been a widespread spread of machine learning algorithms used in all dairy books. As farm data collection technology evolves and becomes more and more common in conjunction with the release of the 5G network, the potential for this powerful machine learning technology will also grow. Machine learning algorithms provide flexibility with respect to multicollinearity data, input distribution and missing data points while having the ability to measure non-linear interactions between features (i.e., independent variables) of retrospective and phase problems. Machine learning algorithms include both supervised strategies (e.g., random forests), requiring training data to find patterns, and non-supervised methods (e.g., k-means clustering), which do not require training data to obtain patterns. The ability of a machine learning model to provide accurate predictions and / or farm decision-making details is directly related to the quality of input data used for model training. In addition, it should be carefully considered to ensure that a rigorous verification process (supervised reading) is performed, as over-installation of the model may result in over-consideration of predictive skills. To get the full potential of these algorithms, it is important that the best practices are identified and applied throughout the dairy research field (Chimakurthi, 2018).

CONCLUSION

The growing dairy need of increasing world population is fueling the need to adopt modern technologies of AI animal farming. More recently, pandemic has restricted veterinarians and farm owners to visit the farms physically and keep every livestock's activity under the strict monitoring and control. AI technologies are able to do all this and generate data which are easily accessed remotely in lower cost and better performance, which resulted in an increase demand by the consumers. Though AI algorithms have developed with a quick pace and sheer lack of standardization is the major limitation to collect and share the data throughout the world. Nevertheless, as more farmers get linked to modern technology, this will begin playing more significant and decisive role to help farmers to find better solutions for all grave issues. While there many limitations as well as various open-ended questions, one thing is quite certain that In present decade true power of artificial intelligence in the sector of livestock will benefit the millions of farers.

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