

ТЕХНОЛОГІЯ ВИРОБНИЦТВА І ПЕРЕРОБКИ ПРОДУКЦІЇ ТВАРИННИЦТВА.

УДК 636.2.034 619:614:253:17.023.35004:636.003.13

ARTIFICIAL INTELLIGENCE FOR ANIMAL WELFARE

Antonik I., associate professor of the department of technology of production and processing of livestock products of Odesa state agrarian university, responsible secretary, candidate of agricultural science, doctor Phd., primaveraryna@gmail.com

Nedosykov V., professor of the department of epizootology, microbiology and virology of the of National University of Life and Environmental Sciences of Ukraine, doctor of veterinary medicine, nedosekov06@gmail.com

Pushkar T., associate professor of the department of technology of production and processing of animal husbandry products of Odesa state agrarian university, candidate of agricultural sciences, doctor Phd. t_pushkar@ukr.net

Susol R., professor of the department of technology of production and processing of animal husbandry products of Odesa state agrarian university doctor agricultural sciences. r.susol@ukr.net,

Naidich O., associate professor of the department of production technology and animal husbandry products processing of Odesa state agrarian university, Candidate of veterinary Science, doctor Phd., olia_aidich@ukr.net

Sharandak P., professor of the department of therapy and clinical diagnostics of the National University of Life and Environmental Sciences of Ukraine, doctor of veterinary science, psv_ua@ukr.net.

This article presents the application domains of Artificial Intelligence in animal farming. Artificial Intelligence allows easy monitoring of farm activities, detecting abnormal behavior of the animals, detection disease, predicting economic performance, maintaining and improving the health and welfare of animals. It overcomes the several drawbacks of traditional farming. Still there is a scope of further adoption of advance technology in animal farming for improving the welfare and productivity. An analysis of the prospects for the use of artificial intelligence technologies in animal husbandry and its very important role in animal welfare.

Keywords: *artificial intelligence; Animal Health and Welfare, Animal Husbandry*

In the intensive animal farming, the Artificial Intelligence (AI) technology takes importance role on assisting a smart farming in the field of animal health and welfare improvement, so as to achieve good economic benefit.

Agriculture in Ukraine is currently facing serious challenges: high price pressure, fierce international competition, global economic constraints and increasing demands for food quality and environmental protection [1.2.4]. The livestock industry is one of the foundations of the country's agriculture, which forms about 30% of its gross output [2.3.4.6]. Livestock is a supplier of raw materials for the meat and dairy industry and fertilizers for crop production; it is able to provide the population with high-quality, high-calorie, dietary and fortified food products [3.5.7]. However, there is a difficult state in the development of the industry caused by a number of negative phenomena, some of which are of a long-term and systemic nature without overcoming which the current state can lead to a complete loss of certain segments of animal husbandry and will further worsen the food security of the state.

In recent years, Artificial Intelligence technology have expanded the possibilities of monitoring animal farm environment for studying the behavioral patterns, health and diseases of animals, environmental situations, etc. for the improvement in the welfare of animals.

The purpose of the study is to consider the essence and directions of application of artificial intelligence technologies in animal husbandry to improve animal welfare.

Research Methods: The analysis of the content of publications on the development of research on artificial intelligence technologies in animal husbandry and its role for animal welfare was carried out. The literature review was carried out on the basis of a systematic approach. Where in the bibliographic Web of Science article content database for the last 5 years. When screening the literature the text was analyzed for clarification, whether the articles are relevant to the research questions. As a result, they selected most relevant and important publications in peer-reviewed journals on research topics. Publications in various areas of research were combined into appropriate groups.

This made it possible to specify the essence and identify the main areas of application of technologies artificial intelligence in animal husbandry and its role for animal welfare and use this data in further practical activities and research.

Results. Currently livestock organizations of Ukraine are transitioning to AI technology. A key trend in the global economy over the past decade has been the widespread adoption of AI technology. Modernizing their economies foreign developed countries are rapidly developing innovative technologies using artificial intelligence, automation and digital platforms [1.2.3.4.5.8].

Agriculture is one of the oldest spheres of human activity, but today it can't remain away from total digitalization. In most developed countries, the agricultural sector is moving away from the conservative approach, "peasant with a plow" and "milkmaid with a bucket", towards an automated harvester and a robotic milker [1.2,3.5.7].

As the global human population is increasing tremendously, the demand of food also increases. In context of scarcity of resources and climatic change, it is very difficult to fulfill the increasing demand of food without the intervention of new advancing technologies and forecasting strategies. Therefore, AI technology takes important role as a predictive multidisciplinary approach integrated to improve the production performance of animals.

The optimal and sustainable animal farming can only be achieved by focusing on the quality of animal care and state of welfare for the animals. By using traditional measures all the

aspects of animal welfare such as health, safety, behavioral, emotional expression and manpower cost cannot be covered. Whereas AI technology have the potential to cope various aspects of animal welfare, health and production efficiency in animal farming. The market of adoption of AI technology is still in developing phase. Hence, early adoption of AI technology in farming will be a good opportunity for the stakeholders. This article presents the AI technology that are being used in the field of animal science. The advantage of using such technology are also discussed in the following section.

Individual Animal Identification Identification of individual animal is an essential task for large scale farm to enable farm managers to monitor the diet of individual animal and control the environmental conditions for optimal productivity. It is also an important step for tracing animal products through supply chain.

Health Monitoring and Detection Daily observation of animals is important for the farm owners to monitor their animals from any injuries or detect the sign and symptoms for sick animals. But for large farm, it is difficult to monitor individual animals. In such case, detection of unhealthy animals can be done by using deep learning and machine learning techniques [1.2.3.4].

Monitoring behaviour animals. The behaviour of animals are usually monitored using camera, microphone and accelerometer. This device are installed on the top or corner of the farm to record the activity of the animals. The data captured from the devices are translated to a meaningful information system using software such as Matlab, Python, etc. and through intelligent algorithms. This monitoring technique reduce the work load of the farm workers and maintains the health and welfare of the animals [1.2.3.4].

Activity Detection animals. The activity are characterised as lying, standing and walking. Manual detection of activity of individual animals is likely impossible. Therefore, in order to detect the environmental conditions and activity of the animals some machine vision based algorithm and sensor based systems were integrated with the Bluetooth, Wi- Fi networks and radio frequency methods. To acquire the activity data of animals, inertial devices embedded with the uniaxial accelerometer or 3D accelerometer are attached to the neck, ear, jaws and legs of the animals [1.2.3.4].

Machine learning and deep learning algorithms are used for classification of the activity. Activity detection based on machine vision and classifications of pigs become popular as it monitors the activity at low cost, non-invasive and non-stressful way.

Aggressive behaviours animals. One of the most important welfare issue in group housed animals is the aggressive behaviour as it results to injury of animals, infection and even causes death. This leads to reduction in the production performance.

Therefore, automatic aggressive behaviour recognition system are mandatory [1.2.3.4].

Feeding behaviours animals. The health status of animals directly rely on the feeding behaviour. Water meters is one effective way of monitoring the drinking pattern of the animals by measuring the water consumption . Sensors based devices, accelerators, microphones and video surveillance are used for automatic monitoring the feeding and drinking pattern of each individual animals.

Using AI technology, features of individual feeding and drinking behaviour can be extracted from the videos sequences to accurately detect the feeding behaviour pattern [1.2.3.4].

Live weight estimation animals. The health condition of animals can be monitored through growth performance. Therefore, regular weighing of live weight of the animals is necessary which is difficult in case of large animals. Traditionally, live weights are measured using weighing scale which cause injury and stress to the animals. To avoid such situation non-contact weighing of animals using RGB cameras, depth cameras, and image based volume calculation have implemented using AI technology.

The production rate of animals depends on several factors such as reproductivity, performance and mortality of animals. Using several computational AI models could help predict breeding values of meat quality, insemination outcomes, herd optimization, energy consumption, environmental related physiological responses etc [1.2.3.4].

Solutions focus on the quality of animal care as well as the state of animal welfare are considered as the effective ways to achieve an optimal and sustainable animal farming. To some extent, it is not easy to achieve good animal welfare () that covers with various condition of health, safety, behavioral and emotional expression with traditional measures. Fortunately, the emerging AI technology are sought to have the potential to cope with and improve animal welfare for improving production performance in animal farming [1.2,5.8].

Discussion and Conclusion. The current level of development of information and communication technologies and means of their implementation in various areas of agricultural production creates the preconditions for the formation of a qualitatively new information environment in the domestic agricultural sector, stimulating the process of accelerated modernization of its industries. Gradually, AI technologies penetrate agriculture, including the livestock sector helping to optimize and simplify many production processes, increase the profitability and profitability of the business [1.2.3.4].

The future of Ukrainian animal husbandry is seen in the development of intelligent digital production management systems, harmonization of the interaction of all elements and connections in the complex biotechnical system "man - machine - animal" [5.8].

To ensure the competitiveness of the livestock industry, it is necessary to increase the level of digitalization - AI at an accelerated pace, using new advances in information development.

The subject of further research should be the process of using information and analytical systems based on artificial intelligence to analyze and manage the efficiency of production processes in animal husbandry.

Artificial Intelligence has become an emerging tool in the field of animal science that have the potential to cope with and improve animal welfare leading to improvement in the performance of production in animal farming. AI technology can enable farmers in animal identification, behavior detection, monitoring disease, forecasting, environmental control, automatic weight estimation, and so forth. AI techniques focuses on accumulating data, processing, assessment and analyzing the data to accurately predict the behavioral patterns of the animals in farm environment, and also consumer behavior in marketing environment. Therefore, adopting AI techniques in farm may lead to minimize labour cost and overall improvement in management conditions and to reap economic benefits out of it.

References

1. Bao, J. and Xie, Q., 2022. Artificial intelligence in animal farming: A systematic literature review. *Journal of Cleaner Production*, 331, p.129956.
2. Brown, D.D.; Kays, R.; Wikelski, M.; Wilson, R.; Klimley, A.P. Observing the unwatchable through acceleration logging of animal behavior. *Anim. Biotelemetry* 2013,1-20.
3. Devi, S. J., Dheeraj, A., Doley, J., Madhavan, M. M. and Jaya. 2022 Artificial Intelligence for Welfare of Animals *Vigyan Varta* 3(5): 1-4.
4. Fehlmann, G.; O'Riain, M.J.; Hopkins, P.W.; O'Sullivan, J.; Holton, M.D.; Shepard, E.L.; King, A.J. Identification of behaviours from accelerometer data in a wild social primate. *Anim. Biotelemetry* 2017,5-47.
5. Hemsworth et al., 2015 [PH Hemsworth](#), [DJ Mellor](#), [GM Cronin](#) & [AJ Tilbrook](#) *New Zealand Veterinary Journal*, [Volume 63 \(1\), 2015](#) :24-30.
6. Jorquera-Chavez, M., Fuentes, S., Dunshea, F.R., Warner, R.D., Poblete, T., Unnithan, R.R., Morrison, R.S. and Jongman, E.C., 2021. Using imagery and computer vision as remote monitoring methods for early detection of respiratory disease in pigs. *Computers and Electronics in Agriculture*, 187, p.106283.
7. Neethirajan, S., 2020. The role of sensors, big data and machine learning in modern animal farming. *Sensing and Bio-Sensing Research*, 29, p.100367.

УДК: 636.22/.28.082.453

МОЛОЧНА ПРОДУКТИВНІСТЬ І ВІК ПЕРШОГО ОСІМЕНІННЯ КОРІВ

Безалтична О.О., к.с-г.н., доцент

Одеський державний аграрний університет

Інтенсивне ведення скотарства пов'язане з високим рівнем відтворення поголів'я, яке залежить від ступеня впливу генотипових і середовищних факторів. Відтворення молочної худоби – це складний процес, у якому поєднуються і взаємодіють біологічні, селекційні, технологічні й організаційно-економічні фактори. Одним із засобів інтенсифікації виробництва молока є скорочення терміну першого осіменіння корів, який обумовлюється віком, лінійним ростом і масою тіла тварин, призначених для осіменіння. А це залежить від господарських і технологічних умов вирощування ремонтних телиць.

Метою наших досліджень було визначення впливу першого осіменіння корів на їх молочну продуктивність.

Матеріал і методи досліджень. Дослідження проведені у СТОВ «Петродолинське» Овідіопольського району Одеської області на поголів'ї корів української червоно-рябої молочної породи у кількості 90 голів. Для цього було сформовано 4 групи корів з різним терміном першого осіменіння. Піддослідні корови були розподілені за віком першого осіменіння у такій кількості: у 15-16 місяців осіменіння – 18 голів, 17-18 міс – 21 гол, 19-20 міс – 24 гол, 21-22 міс – 27 гол. Тварини утримувалися в однакових умовах за методом міні – стада. У піддослідних тварин враховували величину надою молока за 305 днів лактації та вміст жиру у молоці за загальноприйнятими методиками.

Результати досліджень. Основними ознаками молочної продуктивності є величина надою та хімічний склад молока. Надій молока піддослідних корів наведено в табл. 1.

Аналізуючи наведені дані слід зазначити наявність впливу віку першого осіменіння корів на величину надою за 305 днів лактації. Так, незалежно від віку першого осіменіння надій молока підвищувався зі збільшенням віку першого осіменіння. Найвищий надій молока по першій лактації мали корови з найбільшим віком першого осіменіння. Корови, яких осіменили у 21 – 22 – міс. віці переважали за надоєм корів, яких осіменили у 15 – 16-міс. віці на 301,28 кг або на