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Perspectives of Artificial Intelligence in Veterinary Medicine of Small Species

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Abstract

Alan Turing and John McCarthy (1950-1955) coined the concept of artificial intelligence (AI) 70 years ago. Today AI is a reality for some areas of medicine, both human and veterinary, and other technological areas. Materializing into a transformative force within the new human, animal and ecological reality of preservation and sustainable development. The importance of implementing better digital technologies arises, through which the different diseases can be solved in a faster and more effective way. AI for small-species veterinarians will not be left behind and will become a trend in the short term.

Keywords: Artificial intelligence; AI; Veterinary Medicine; Health; Wellness

Introduction

In the middle of the last century, Alan Turing and John McCarthy (1950-1955), coined the concept of artificial intelligence (AI; see figure 1). Recently, the combination of these two words has produced numerous reactions not only among scientific researchers but also worldwide, creating great expectation and even concern, due to the anticipated belief in the dominance that machines could exert over humanity in the future [1]. Currently, AI is a reality for some areas of medicine, both human and veterinary, as well as for other technological areas (2). The use and exponential increase in research and development of these technologies are here to stay since a possible broader social impact is sought in all areas of life on the planet, such as unrestricted access to the use of the implemented technologies. in a commercial manner based on a universal human right, reduction in cost to consumers, verification and correct validation of its use in any area, energy savings and reduction in the impact of environmental pollution, among other aspects related to the social impact that is required and that will continue to be evaluated in the coming years of this decade seeking common benefits [2,3].

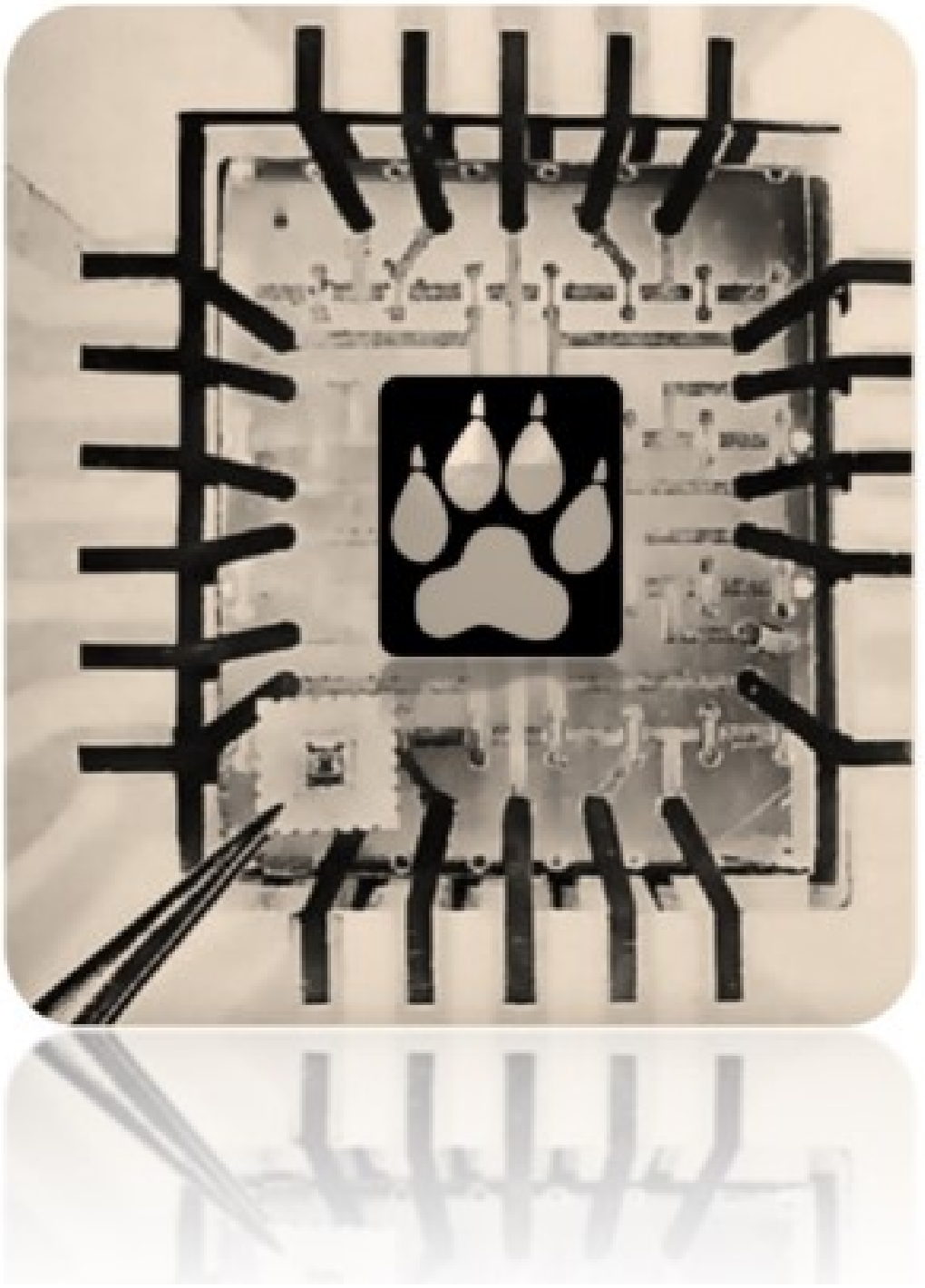

Figure 1: A Mosfet-type transistor, which allowed the creation of the first integrated circuits in History with a central footprint representing the fusion of AI in veterinary medicine

Furthermore, artificial intelligence and robotics have the potential to revolutionize the lives of pets close to humans to obtain a better biopsychosocial balance, which can range from improving food and its processing based on the pet's requirements (i.e., a clinical prescription for a specific disease or based on their body development -puppies versus adults- and function of physical activity), to improving their medical care and disease prevention. In this way, the purpose of AI is to facilitate and make work more efficient through the automation of immediate tasks and the resolution of problems using adjacent responses, thus avoiding manual activities that can divert the attention of human or veterinary physicians from their patients [3,4]. In addition, AI can provide support in clinical decision-making, such as in cases of veterinary medical emergencies (i.e. run over, heart attack, shock, serious ill-

ness), regardless of immediate action protocols.

AI supports the improvement of the surveillance of zoonotic or emerging diseases, as well as the detection of disease outbreaks (i.e. SARS-CoV-2), antimicrobial resistance in production animals, uses in clinical practice related to diagnosis, improvement in the prediction of diseases, evaluation of environmental risks in pets and people, discovery and monitoring of rare diseases. On the other hand, AI also contributes to improving the economic success of clinics and animal health professionals, which contributes to public health and safety, food, and increases the well-being of animals and anthropocentric humanity. Therefore, the use of AI is expected to improve the expected results and repeat them with much more security on a day-to-day basis [1-5].

In the field of veterinary medicine, automation through the use of AI has been applied since the last century, both on farm and companion animals. Particularly, at the farm level, different advances have been made. For example, in the case of domestic species such as dairy cows, efforts have been made to improve their nutrition (nutrigenomics), as well as their scheduled milking times, thus obtaining a better performance in milk production and a better use of its derivatives (i.e., cream, cheese). On the other hand, the manipulation of light hours in poultry pens has been carried out. However, in the case of small species (e.g., dogs, cats, ornamental birds, or rodents), a more accelerated approach to AI is required, since currently all these animals are treated as "humanized" or "objectified" pets; they are even considered as family members (in some societies, they have been called “non-human relatives”). Therefore, due to the international trend of this new family model (multispecies family), the importance of implementing better digital technologies arises, through which the different ailments and/or diseases can be solved in a faster and more effective way [3,5].

The digital technologies (i.e., gadgets) that accompany AI not only create concrete opportunities to face the health challenges of these patients but also generate peace of mind and conviction among their owners, offering an improvement in coverage, quality of practices, and faster, more efficient, effective, and safer health services, as well as more appropriate and personalized monitoring. Despite technological advances in other areas, few AI applications have been successful in companion animal health care. Therefore, this could imply improving the existing link between data science and technical experience in the clinical context in which medical professionals dedicated to safeguarding the health of this type of species operate [5,6]. Algorithms created for research purposes and technologies generated in laboratories can be used to increase the ability to delegate responsibilities to staff working in clinics and hospitals [7]. In this way, AI will be able to focus more on the performance of professionals, thus improving the lives of these companion animals through more effective health responses (including behavioral problems). For example, through AI, it will be possible to make almost exact replicas of ergonomic prostheses for patients who require them in cases of trauma, degeneration, or musculoskeletal malformations [6]. In addition, AI will be able to facilitate the adequate and almost immediate interpretation of diagnoses through X-ray images extracted from its database, as well as computed tomography and magnetic resonance imaging, and even help in the search for therapeutic resolution of patients, all this under individual logarithmic schemes, depending on personal clinical cases, which is a necessity in today's highly technical world [8,9].

In this globalized environment, AI for small species (including pets closest to humans) has been developing and sustaining better databases, slowly but with great prospects for the coming years (for example, within the area of radiology, just as it has been done in humans). The use of recognition algorithms based on medical experiences and clinical diseases of small species, together with the support of X-ray images and predictive models on the collection of the main ailments of pets and their clinical histories regardless of the species, in addition to the experience in the organization and co-management of database records, will allow obtaining more accurate diagnoses of diseases in less time; thus generating immediate and personalized therapeutic responses, whose ultimate purpose will be to evaluate the probability of improvement in the expected results 6-10).

Given the fact that many diseases have better outcomes if detected and treated early, AI-based predictive models have the potential to be transformative for most veterinary care. The same is expected from the use of ultrasound equipment, which will provide a diagnosis as close as possible to the condition and even its probable therapy, in order to offer better monitoring of the patient [10].

The support of information technology endorsing programs or apps for computer equipment or gadgets designed even within the equipment (i.e., ultrasound), is already a reality. These will allow us to make pertinent comparisons and find similarities to carry out more accurate diagnoses under certain operations based on their logarithms. In addition to self-learning, these technologies will also be key to implementing a better quality of care for patients in the short term, as they will more efficiently address different types of challenges, such as medical, surgical, biotechnological, diagnostic, patient recovery, monitoring, and probably more updated and innovative therapies; thus, generating the presence of intelligent digital assistants [1,6]. In addition to the above, AI can be used in the interpretation of different types of data generated by pets, such as overweight or obesity, as well as in the innovation of activity trackers, which quantify the number of steps that a pet has taken for hours or days, to help generate results aimed at interpreting and identifying different types of behavior patterns that can impact their health. For example, monitoring animals that scratch and lick can help owners and veterinarians assess whether there is an underlying cause when these behaviors increase or change and find appropriate ways to correct them.

The basic study of the safest uses of AI must continue since these advanced technologies will continue to play a fundamental role in improving pet care such as identifying, classifying or detecting abnormalities in diagnostic images of the locomotor system, nervous system and thorax and abdomen regions of dogs and cats with the use of radiographs (X-rays), CT scans, MRIs and ultrasounds, continue testing AI algorithms to differentiate diseases (i.e. ophthalmic), seeking increasingly greater precision in compiling training and validation data to achieve a high percentage of effectiveness [9,10]. Finally, the use of veterinary marketing, as well as the use of chatbots to facilitate and improve communication between veterinarians and clients to improve visibility and attention for users who attend the veterinary clinic with their pets.

Conclusion

Lastly, for decades, it had been predicted that AI would increasingly outperform doctors, both human and veterinary, in specific tasks, facilitating and enabling time and cost reductions in favor of the health of patients. In this way, the increase in the use of AI-based solutions by veterinarians specializing in small species will become a trend or "way of life" in the short term, due to the importance that pets have today. In addition, personalized attention through holograms (remote holographic medicine and telemedicine), better uses of automatic learning, implementation platforms, biotechnologies as transformation tools in favor of animals and the environment (digital ecosystems) that allow living in balance with the environment, faster and more accurate diagnoses, as well as the use of new innovative therapies and other existing resources in the near future, will generate other forms of interaction with the help of digital multiverses, thus impacting the next generation.

Author contributions

F.J.T., C.A.C., L.A.H. and K.L.J.G. they wrote the main manuscript text and K.L.J.G. prepared the figure 1. All authors reviewed the manuscript.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Availability of data and materials

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