

AI (Animal Intelligence)

By: Chandrika RK¹

¹Independent Film Maker

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Abstract

This article explores the transformative potential of Artificial Intelligence (AI) in enhancing the quality of life for animal conservation through improved welfare and communication. By examining ethical dilemmas in animal testing and groundbreaking research in animal communication, we highlight AI's role in fostering a more humane and interconnected world.

Introduction

When we discuss how we can improve the quality of life for the animals on our planet, the words attributed to Chief Seattle's speech in 1854 are most persuasive:

"I have seen a thousand rotting buffaloes on the prairie, left by the white man who shot them from a passing train. I am a savage and do not understand how the smoking iron horse can be made more important than the buffalo that we kill only to stay alive".

— Chief Seattle.

While we examine the 'how' for our animal friends, the chief of the defeated Native American tribes brings to the fore the all-important 'why', in deploying the latest tool in the human kit box – Artificial Intelligence – to take the human-animal equation to the next level.

The significance of improving animal welfare cannot be overstated, as it not only aligns with ethical considerations but also has far-reaching implications for biodiversity and ecosystem stability. According to a report by World Animal Protection, advancing animal welfare can lead to healthier ecosystems and more sustainable practices in agriculture and wildlife management. Moreover, technology, particularly Artificial Intelligence (AI), offers unprecedented opportunities to address these challenges effectively and efficiently.

We may still consider artificial intelligence nascent. However, it is already being deployed in several areas, including wildlife conservation, the welfare of domesticated animals and animals bred for food, and veterinary practice. It has begun delivering on its promise to drastically ameliorate the quality of life of animals in these areas.

Here we are examining two aspects of the animal-human interface where application of Artificial Intelligence can bring in a welcome wave of change.

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‘Vivisection’ is the practice of performing operations on live animals for the purpose of experimentation or scientific research. It is a controversial area where we have left ‘a thousand rotting buffaloes’ from the passing train of tenuous animal testing methods for medicines, cosmetics and pesticides so that they can be declared apparently safe for human consumption. For example, AI algorithms can analyze vast amounts of biological data to identify potential drug candidates and predict their effects on the human body. Machine learning models, such as those developed by the company Insilico Medicine, can simulate the interactions between molecules and biological targets, significantly speeding up the drug discovery process and reducing the reliance on animal testing. Additionally, AI can help refine in vitro methods (experiments conducted with cells or biological molecules outside their normal biological context) to make them more predictive of in vivo outcomes (experiments conducted in living organisms), further decreasing the need for vivisection.

The Ethical Dilemma of Animal Testing

Every year, humans experiment on about 50-100 million animals. They suffer maiming, burning, crippling, unimaginable pain, and slow death in our civilized scientific laboratories. The claimed purpose of all this is to ensure safety for all the needed as well as superfluous cosmetics, drugs, and chemicals manufactured and sold for human use.

Beginning with the dissection of roaches, frogs, and mice at the school level, and extending to extensive animal experiments on rats, dogs, cats, rabbits, sheep, monkeys, and many other animals in pharmacological and medical education, the practice continues unabated. Extensive toxicity tests are conducted on these animals for drug research and safety compliance, determining what products reach the market. This has led to persistent and vehement public criticism of subjecting animals to such abuse.

Animal activists have even declared that “92% of experimental drugs that are safe and effective in animals fail in human clinical trials because they are too dangerous or don’t work.”

Data shows that animal models often poorly predict human drug responses, leading to wasted resources and unnecessary suffering during drug discovery when drugs fail in clinical trials despite performing well for animals.

On the other hand, it is also fervently argued that most of today’s drug discoveries were possible because of the use of animals in research. This brings us to the potential of AI to power the three Rs principle of Replacement, Reduction, and Refinement alternatives in animal experimentation.

AI and the Three Rs Principle

Advancements in science and ethics are steering research toward more humane, reliable, and relevant methodologies, aligning with the Three Rs principle: Replacement, Reduction, and Refinement. Here's how AI is enhancing these principles:

1. AI-driven drug development

AI accelerates drug discovery by generating and evaluating drug candidates based on specific molecular criteria. This process, once dependent on multiple laboratories collaborating, now optimizes drug pipelines quickly. Virtual screening enhances the use of animal models, reducing the risk of adverse effects on animals from unsatisfactory testing.

2. Toxicity Prediction

AI analyses extensive data to find patterns linking chemical properties to toxicity outcomes, creating accurate models to predict substance harm. This reduces the need for animal testing, enhancing efficiency and addressing ethical concerns.

3. Animal modeling

AI creates Animal Digital Clones for pharmaceutical development, mimicking animal biology and modeling disease progression. This can replace the need for testing on genetically modified organisms, addressing ethical and safety concerns.

4. Chip Organs

AI combined with organ-on-a-chip technology mimics human organs for realistic substance testing. Harvard University's Wyss Institute first developed these microculture devices mimicking real human organs' intricate structures and functions. They enable scientists to see how the organs function and how drugs affect them, all replacing the use of animals or humans for testing. Analyzing the complex data from these models improves predictive accuracy.

5. Human relevant data

AI employs deep-learning algorithms to generate accurate human-relevant data. Companies are developing "in-vitro" platforms using human micro-physiological systems from ethical biobanks. They have developed digital workstations to predict safety concerns by comparing data with benchmark patterns from trained models. This is all aimed at replacing the need for data from animals.

As ethical, accuracy, expense, and time concerns deepen, and countries make a conscious decision to reduce or eliminate animal experimentation, the need and progress of AI is only

going to grow exponentially. All of it is balm for Chief Seattle's and millions of kindred souls – both human and animal.

Furthermore, AI can enhance the refinement of existing animal testing protocols to minimize suffering. By improving the accuracy of dosage and administration techniques, AI can ensure that fewer animals are used in experiments and that those that are used experience less pain and distress. The application of AI in monitoring animal welfare during experiments can also provide real-time data to scientists, enabling immediate adjustments to reduce suffering.

Overall, the integration of AI in research and development holds the promise of not only improving the quality of life for animals but also advancing scientific progress in a more ethical and efficient manner. By addressing the challenges associated with vivisection, AI paves the way for a future where animal welfare is prioritized alongside scientific innovation.

Understanding Animal Communication through AI

“And what is there to life if a man cannot hear the lonely cry of the whip-poor-will or the arguments of the frogs around the pond at night?”

— Chief Seattle

In our quest to protect and save the animals with whom we share the earth, what could be more revolutionary than understanding what they are saying among themselves and even to us? Being able to act upon their demands with due jurisprudence would be transformative.

This concept isn't confined to the realm of Alice in Wonderland or exotic tribes and shamans sitting in quietude for hours around the pond, nodding sagaciously at the speech of birds and the whispers of the wind.

Case Studies and Applications

One of the most exciting areas of research is the application of Artificial Intelligence in understanding animal intelligence. Human observation of animal communication has invited widespread criticism of its dangerous tendency to anthropomorphize. Professor Karin Bakker, professor of 'behavioral Ecology' at the University of British Columbia and an authority on animal communication, notes that humans and animals communicate very differently. This decidedly skews the way humans interpret verbal and non-verbal animal-speak. Our perception conditioning is further confounded by our weak or differently-abled senses from those of most birds, reptiles, insects, and animals, who hear, sense, and see things that we do not.

Researchers have welcomed AI systems that eliminate the distortion caused by human presence in the study of animal intelligence. We now have the potential to bridge the gap between humans and animals, gaining insights into their complex language and behaviors.

Animals communicate with each other in various ways, using a combination of vocalizations, kinesics, and even chemical signals. By training AI algorithms to analyze and interpret animal sounds and behaviors, we can decode patterns and meanings that were otherwise gibberish to us.

By using machine learning algorithms, researchers can analyze vast amounts of recorded sounds and identify specific patterns or calls associated with different behaviors or emotions. Researchers are also using digital bioacoustics, which employs small, portable recorders, to study species' communication without disrupting their ecosystems.

A breakthrough example can be illustrated by the case of Shane Gero, a resident scientist at Carleton University in Ottawa. For 20 years, he painstakingly recorded the vocalizations of two clans of sperm whales called codas. After manually decoding some sperm whale codas, Gero and his team used AI to drastically speed up the process. They fed recordings to a neural network, which correctly identified individual whales 99% of the time. Now, their Project CETI aims to train a computer to speak whale by using an underwater microphone on a buoy to record Dominica's whales around the clock (Beguš et al., 2023; Bronstein et al., 2022).

Aza Raskin, co-founder of the Centre for Humane Technology believes that "The point is not really to talk to animals, the point is to understand them." This understanding not only deepens our appreciation for the natural world but also has practical applications in fields like conservation, wildlife management, and animal welfare. It can also help us develop more effective strategies for managing animal populations and protecting ecosystems.

Hundreds of AI tools analyze species' vocalizations. Kevin Coffey, a neuroscientist at the University of Washington, co-created DeepSqueak. The machine learning tool decodes rodent chatter, identifies rodent calls from raw audio, compares them, and provides behavioral insights. "Rats use ultrasonic vocalizations (USVs). High-pitched 50 kHz calls are like laughter, occurring during play, courtship, or drug rushes," Coffey explained. Rats also make 22 kHz calls in negative situations of distress, like pain or sickness. Coffey uses these frequencies to gauge his lab rats' distress. While humans can't hear these calls, DeepSqueak and similar tools decode them, helping us better understand and treat animals in experiments (Coffey, Marx, and Neumaier, 2019; Coffey, Nickelson, and Dawkins, 2023).

AI has also been used to study bird songs and decipher animal body language. By analyzing video footage or images of animals in their natural habitats, AI algorithms can identify subtle movements or postures that convey specific messages.

The application of AI in decoding chemical signals used by animals is another area with immense potential. By analyzing the chemical composition of pheromones or other scent cues, AI algorithms can identify specific chemical signatures that convey information about mating readiness, territorial boundaries, or even health status.

Conclusion

For that part of human nature that tends to ask, “What’s in it for me?” we are already late in realizing that while animals may be part beneficiaries of all these AI endeavors to connect better with their intelligence, it is ultimately man, a strand in the web of life, who stands to gain by improving his own human experience. Something he can only arrive at by nurturing the whole web.

AI stands at the forefront of a transformative shift in how we interact with and care for animals. By addressing ethical concerns in animal testing and decoding the complexities of animal communication, AI helps create a more compassionate and interconnected world. The insights gained through these technologies not only enhance animal welfare but also enrich the human experience, affirming our place within the web of life.

“If all the beasts were gone, men would die from a great loneliness of spirit, for whatever happens to the beasts also happens to the man.”

— Chief Seattle

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