Digital Diagnostic Artificial Intelligence in Veterinary Medicine

—

THE FUTURE IS NOW

Digital microscopy with diagnostic artificial intelligence (AI) is not a new modality within the veterinary industry, but with the advent of improved AI product capabilities and services, it is stepping into the limelight to improve diagnostic processes and workflow in practices.

When you hear the words "artificial intelligence," or "AI," what do you imagine? For many people, the concept of AI elicits futuristic images of robots and talking computers, making it difficult to realize what it means in daily life. The truth is, veterinarians already have access to AI—for example, through technology that can help us interpret radiographs or predict development of kidney disease based on keywords in medical records.

To help veterinarians better understand the use of AI and digital microscopy in veterinary diagnostics, Zoetis has teamed with key opinion leaders to discuss the impact of this technology in our community. Here, we discuss broad aspects of veterinary diagnostic AI: benefits, fears, future possibilities, and how Zoetis is contributing to the advancement of diagnostic AI capabilities and services with the VETSCAN IMAGYST™ multi-use platform.[a]

[a]Currently, VETSCAN IMAGYST provides rapid analysis of blood smears, detection of intestinal parasites in fecal samples, and digital submission of slide images for expert cytology review.

What is "digital diagnostic AI"?
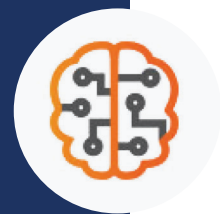
Let's dissect this term word by word. Describing a product or new technology as being "in the digital space" means that data is being stored or processed with electronic tools. For example, an electronic medical record (EMR) exists in the digital space because a software system is storing organized patient data. "Diagnostic" refers to tools used to reach a diagnosis. And "AI" was defined and explained in a recent *JAVMA* article as "…a branch of computer science in which computer systems are designed to perform tasks that mimic human intelligence."[1] So while an EMR is digital, it is not an example of AI: the software isn't thinking for us or making any conclusions about the condition of the patient…yet.

"Digital diagnostic AI" refers to software that can analyze data to deduce a medical diagnosis through highly sophisticated algorithms. These systems may compare high and low bloodwork trends, look for radiographic markers on bone structures, or identify defining characteristics of parasite eggs viewed on high-resolution, whole-slide images. All these software algorithms, programmed first by human minds and hands, can process information and reach medical diagnoses by similar methods used by clinicians, but exponentially faster.

> "
> **"We're in an age of instant gratification. Owners want as much information as quickly as they can get it, and they don't want to wait."**
>
> – Sue Ettinger, DVM, DACVIM (Oncology)

What is VETSCAN IMAGYST?

VETSCAN IMAGYST is a multi-use diagnostic AI and microscopy platform, initially released in 2020 for fecal AI analysis, that continues to grow and expand in its diagnostic capabilities. Presently, VETSCAN IMAGYST can:
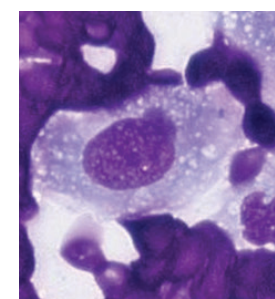
Provide clinicians with additional hematologic information, including cell abnormalities identified by AI blood smear review, to supplement their automated complete blood count (CBC) results

Detect and identify fecal pathogens using a simple, systematic examination process that is less influenced by individual fecal preparation methodologies or examiner experience[2]

In addition to reliable results powered by its convolutional, deep learning neural network trained by human experts, VETSCAN IMAGYST offers users access to expert human evaluation. By giving clinicians the option to digitally submit automated captures of high-resolution, whole-slide scans of cytologic samples, including blood smears, VETSCAN IMAGYST combines the best of digital AI technology with the safety net of human expert oversight.
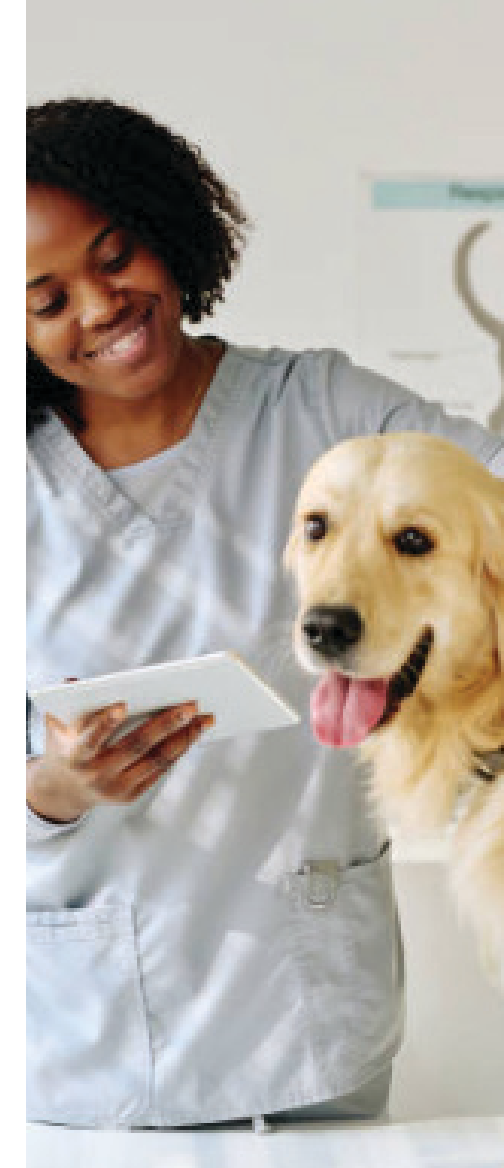
> "
> **"Delays can negatively impact treatment decisions and patient outcomes."**
> – Sue Ettinger, DVM, DACVIM (Oncology)

VETSCAN IMAGYST

Compact high-resolution scanner + **Artificial intelligence powered by experts and/or a remote clinical pathologist** = **Fast results, more efficiency in the clinic**

Should I want digital diagnostic AI in my practice?

The short answer is yes. Why? To save valuable time for you, your hospital staff, and your patients. Using advancements in technology—such as sorting and filtering lab results by computer or transmitting real-time video to a remote specialist for consultation—can improve your daily workflow, produce expedient diagnoses, and thereby permit quicker interpretation of vital medical results and initiation of treatments.

Dr. Nick Dervisis, a board-certified veterinary oncologist, understands all too well the importance of reaching an early, accurate diagnosis in initiating medical treatment. As he points out, "From an oncology perspective, that would be a great help because it would take minutes instead of hours to make decisions."

By providing on-site analysis, diagnostic AI may also eliminate problems associated with sample transport.[b] Traditionally, samples are prepared, transported to a veterinary diagnostic laboratory, processed at the receiving facility, and subsequently reviewed by board-certified clinical pathologists. When a sample goes missing or gets damaged at

any point between collection and review, it can add days to reaching a final diagnosis, with associated delays in treatment.

"I think everyone's probably had lost samples; they're the worst," notes Dr. Julie Allen, board-certified veterinary clinical pathologist. "Something that was really hard to obtain—you spent 3 hours in radiology aspirating a lymph node—and then somehow or other, it doesn't turn up, it got lost somewhere along the way. I think the fact that the samples don't leave the clinic with digital diagnostic AI is helpful. You cut out some of the potential issues with shipping."

Problems with loss in transit are not the only possible drawbacks of common sample storage and submission procedures. Delays in sample processing—particularly prolonged storage—can affect diagnostic accuracy. Even if a sample never leaves the facility where it is obtained, the lack of 24-hour access to clinical pathology processing and review can lead to storage artifacts and degradation. As Dr. Dervisis puts it, when cases are admitted through a typical hospital emergency department, "Many times we get this sample of peritoneal effusion or thoracic effusion and it sits in the fridge for the weekend until it's submitted. So, are the cells alive? Did it make it?" **If overnight clinicians had the ability to process samples immediately after collection, sample quality could be better preserved, thus increasing the chances of timely diagnosis.**

But can I trust what a machine says?

There are hurdles to adopting any new technology. Business barriers to implementing new products in the veterinary workflow include cost concerns, table space for equipment, staff training, and maintenance requirements. But when finances and machine maintenance are removed from the bigger picture, another, uniquely human barrier to AI adoption becomes clear: trust in the machine's analysis.

Trust in technology must be earned over time and with repeated clinical validation. "A lot of ER docs I know would have a hard time just accepting what the machine says and acting on it," says Dr. Benjamin Brainard, a dual-boarded small animal emergency and critical care specialist and veterinary anesthesiologist. Likewise, Dr. Brainard notes, clients can also exhibit an initial distrust of machine-derived diagnoses. "You're absolutely going to get some people who say, 'Well, can you go find a human to read it for me?'" he says.

Even with rigorous validation studies showing that VETSCAN IMAGYST's AI-derived diagnostic results are comparable to results from expert parasitologists[2] and clinical pathologists, human distrust of a machine's deductive capabilities poses a significant barrier to adoption in the veterinary workspace. Dr. Sue Ettinger, globally renowned board-certified veterinary oncologist, explains it best: "There are still some people that will worry 'Is it as good as a clinical pathologist?'" she says.

To alleviate this fear, and to build trust in their product's diagnostic capability, Zoetis has coupled the VETSCAN IMAGYST digital diagnostic AI platform with the optional service of clinical pathologist review.[c] Dr. Jane Sykes, a board-certified small animal medicine specialist who is known worldwide for her focused work in companion animal infectious diseases, explains why provision of this extra "human" service is vital to the adoption of diagnostic AI: "When you're bringing in a new technology like this, that expert review reinforces the findings of AI diagnostic methods. If these technologies continue to improve, and even show themselves to be better than a human being, the expert review part of it will be less needed for routine diagnostics. **But initially when you're bringing in a new technology like this, having an expert review for validation is absolutely essential.**"

Dr. Sykes's sentiment is shared by Dr. Catharine Scott-Moncreiff, a nationally and internationally boarded veterinary internal medicine specialist. "I think the verification step is such an important step, which is something that many of the newer technologies don't have," she says. "That, to me, would be the thing that pushes me to use this—that there is a backup if you get weird results or you really just want someone else to look at it. They're not just putting all their eggs in one basket. There's an opportunity to say, 'this doesn't fit with the case, I want this reviewed.'" And for those working the fast-paced life in the veterinary emergency room, Dr. Brainard adds, "You can get the speed and the AI aspect of it, but then you still have a backup."

> ❝ **"I think the verification step is such an important step, which is something that many of the newer technologies don't have."**
> – Catharine Scott-Moncreiff, Vet MB, MA, MS, DACVIM (SAIM), DECVIM-CA

How can VETSCAN IMAGYST help my daily workflow?

1 Comprehensive fecal AI analysis

Without digital diagnostic AI, fecal samples are typically processed either for submission to outside labs or for in-house manual review, then stored until transport or until they are reviewed by internal veterinary staff. With VETSCAN IMAGYST, you no longer need to submit the fecal flotation sample to an outside lab, nor have your staff spend valuable time staring into a microscope. VETSCAN IMAGYST can interpret the entire slide, capture pictures of targeted parasite life stages, record the findings, and either integrate with your EMR or print a page for your records. The images and report can also be sent directly to a client for added value, creating the opportunity for a quality client discussion.

2 Lab-quality blood film analysis

Similarly, VETSCAN IMAGYST can now interpret blood smears with AI blood film analysis to complete the patient's hematologic picture. Your technicians no longer need to perform hematologic slide review and are instead freed to perform other critical tasks. Reliable results similar to those of a commercial lab are ready within minutes, making the CBC analysis easy, fast, and accessible. As with fecal analysis, a report and images are available to share with the client or to send with the patient for further specialty workup. And if you ever want to supplement the AI blood film results provided by VETSCAN IMAGYST, you can submit the automatically captured microscope images for review by a clinical pathologist 24/7/365.[d]

3 Rapid results for real-time discussion

With in-house sample evaluation, digital microscopy with diagnostic AI helps improve the speed of information delivery. Same-day—even same-appointment!—results become possible. Think of all the time that could be saved on callbacks when diagnostic information reaches your hands before a pet is discharged from the hospital. "[When] you walk in the room, you have the results. You could talk about them in the room with the owner. We all know that face-to-face communication is so much better than breaking bad news on the phone and in email. This will give you the ability to have those conversations in person with the owner. **It's going to allow for better communication of challenging conversations,**" says Dr. Ettinger.

4 Access to expert clinical pathologists

Beyond saving time, VETSCAN IMAGYST's digital microscopy with clinical pathologist slide review connects clinicians with the safety net of a specialist. Dr. Mollyann Holland, board-certified small animal internal medicine specialist, reflects on the workflow changes experienced after graduation from veterinary school, internship, and residency. "You get really spoiled with being able to walk down the hall and say, 'Hey, look at this for me,' and this [VETSCAN IMAGYST Digital Cytology Platform] is the next best thing to that," she says.

With its 24/7/365 access to clinical pathology review of digital cytology samples and a 2-hour benchmark turnaround time, VETSCAN IMAGYST can also be a resource for anyone working holidays, overnights, and weekends, when access to clinical pathologists is inherently limited. Interns and residents, whose slide interpretation can have a massive impact on critical decisions such as the need for emergency surgery, might especially benefit. "This is a big decision. You're about to spend a lot of money on a person's pet. You want to be confident that you're making a good decision," Dr. Brainard states. Dr. Julie Allen believes that VETSCAN IMAGYST's clinical pathologist slide review could provide valuable support for these doctors. "I think having that backup for the newer grads, having that extra support, would be huge for them," she says.

> **"When you're bringing in a new technology like this, expert review reinforces findings."**
> – Jane Sykes, BVSc, PhD, MBA, DACVIM (SAIM)

What will my clients think?

Seeing is believing. VETSCAN IMAGYST helps the clinician go beyond words by capturing photographic proof that can be shared with the pet owner. As VETSCAN IMAGYST scans slides from fecal, blood, or cytologic samples, representative pictures are stored and can be printed on the final report, serving as diagnostic documentation in the pet's medical record. These pictures can also be shared with other veterinarians involved in the patient's medical care or even other global health professionals, supporting the unified One Health approach.

Dr. Holland reflects on how the pictures in the final report enhance her client communication: "I can print up the report and the report has the images embedded in it, so they can see the images themselves." And even if clients don't recognize the picture in the report—for example, a picture of their dog's hookworm egg—they appreciate it. "They may not have a clue what they're looking at, but they love that they have it in their hands," Dr. Holland relates.

[d]Additional fees may apply.

Where are digital diagnostics taking us?

Digital diagnostic AI and microscopy may lead to earlier disease detection, leading to improved and expedient patient care. Identifying disease before significant morbidity develops means more treatment options remain available for the patient, such as earlier referral for advanced diagnostic and treatment modalities, or additional in-practice treatment options with their primary care veterinarian.

These technologies can also be used to enhance human learning in veterinary training programs. The relative ease and clarity of picture capture and image sharing can supplement continuing education for everyone in the veterinary profession, from students, interns, and residents to technicians and clinicians in practice.

"One of the things that I like about it [VETSCAN IMAGYST] is the teaching perspective—having these images scanned in and being able to share them with people and evaluate them all together. Not everyone has a multiheaded scope in their practice, so being able to look at images as a group and discuss them, I think that's another advantage for specialists who are in training situations," says Dr. Allen.

As AI algorithms are created and evolve, what could an increased adoption of digital diagnostic AI and microscopy mean for changes to the veterinary workflow? Dr. Allen shares, "My hope would be that it would not replace clinical pathologists, not be a substitute, but something to augment their review. I could see AI being very useful for a more standardized approach to certain things. I think we've struggled as clinical pathologists to come up with uniform approaches, but AI could, at least with simpler diagnoses, help by looking at uniform features across samples. So for things like grading, having diagnostic AI look at samples and decide, 'well this is a high-grade or a low-grade mast cell tumor' could be super helpful. **I think over time, hopefully, AI will be smart enough to come up with a more standardized approach to diagnosis."**

References
1. Appleby RB, Basran PS. Artificial intelligence in veterinary medicine. *J Am Vet Med Assoc.* 2022;260(8):819-824.

2. Nagamori Y, Sedlak RH, DeRosa A, et al. Further evaluation and validation of the VETSCAN IMAGYST: in-clinic feline and canine fecal parasite detection system integrated with a deep learning algorithm. *Parasit Vectors*. 2021;14(1):89.

zoetis