

**Artificial Intelligence in Veterinary Diagnostic Imaging and Radiation Oncology**  
**ACVR/ECVDI Expert Panel Summary**  
**April 2021**

This is the summary of a report prepared following panel discussions of a group of experts in artificial intelligence (AI) in veterinary radiology, including diplomates of the ACVR and ECVDI in diagnostic imaging and radiation oncology and medical physicists working to develop AI algorithms for veterinary radiology and radiation oncology applications. Panel members represented individuals from academia, teleradiology practice and commercial interests. A link to the full version of the report is available on the ACVR/ECVDI Artificial Intelligence webpage.

**What is artificial intelligence?**

For the purposes of this summary, artificial intelligence is considered to be any technique where a computer algorithm has the ability to modify itself, without requiring the specific input of a human programmer. It includes and is not limited to the terms machine learning, deep learning, radiomics and neural networks.

**Current state of AI in veterinary radiology**

Artificial intelligence techniques are being actively developed and starting to be implemented in veterinary radiology, namely: image quality and enhancement, interpretation workflow and image interpretation. Specific applications are still on the horizon for veterinary radiation oncology.

Image interpretation is the highest profile area with increasing numbers of recent publications describing the development of image interpretation algorithms and automated measurement tools. At least two commercial products for small animal thoracic radiographic interpretation have recently been released and several veterinary teleradiology companies are developing tools to facilitate interpretation by their radiologists. Thus far, veterinary radiologists have had at least a degree of oversight with these endeavors.

**A comparison with AI for image interpretation in human diagnostic imaging**

With respect to image interpretation, the development of algorithms in veterinary medicine is not specifically following the human medicine blueprint.

In human medicine in North America, the US Food and Drug Administration (FDA) considers AI algorithms as “software in a medical device”. Similar rules apply in individual European countries. Algorithms are usually developed for a very specific application (i.e. detection of pulmonary nodules) and must follow strict clinical trials for approval. There are no equivalent regulatory bodies to oversee the approval of AI algorithms in veterinary medicine. This allows the development of new AI algorithms despite more limited resources, but leaves the veterinary profession vulnerable to misleading and potentially harmful technological or diagnostic claims.

**Challenges in developing AI for image interpretation in veterinary medicine**

In order to develop a diagnostically accurate AI algorithm, a training set of cases must be developed using stringent requirements, including adequate dataset sizes, representative case variety and image acquisition systems and accurately coded (labeled) imaging findings and diagnoses. Once the AI algorithm is developed, it should undergo validation on a smaller, but equally representative and high-quality case set, independent of the original training set. There are not currently any widely available datasets for the training, validation and ongoing assessment of veterinary radiology/radiation oncology AI-algorithms. There are also legal and data-ownership issues for veterinarians to consider.

### **Benefits to developing AI for veterinary radiology**

Artificial intelligence should be seen as a potential aid to radiographic interpretation. Demand for veterinary radiologists still far outstrips the profession's ability to train a sufficient number of specialists. Well-developed AI algorithms would help maximize use of radiologists' expertise at 2 different levels: as a triage tool and as an add-on (AI facilitated diagnosis: a radiologist "enhancer").

AI could also improve the radiologist's diagnostic performance by providing a preliminary interpretation, improving consistency and reducing interpretation error rates. Additionally, radiomics have the potential to detect abnormalities within the imaging data that are not perceptible to the human visual system and could eventually be applied in conjunction with more traditional image interpretation. Finally AI facilitated diagnosis could also be used as a training tool for residents, to improve resident performance.

### **AI in veterinary radiation oncology**

Many of the same challenges exist as for radiology and image interpretation, with the additional challenges of smaller caseloads and therefore the development of training/validation datasets. Algorithms can be expected to improve normal tissue contouring, treatment planning, quality assurance, and lesion tracking during radiation delivery. Also, AI algorithms that can integrate image interpretation, pathology and biomarker data with radiation oncology clinical data will be of value to understanding and improving patient prognosis and treatment outcomes.

### **How can the ACVR and ECVDI promote the responsible development of AI applications in veterinary radiology?**

The ACVR and ECVDI are certification entities and professional organizations. They are not regulatory bodies and have neither the resources nor the mandate to act as such. Our role with regards to the advent of AI in veterinary radiology is to maximize our involvement as experts and educators.

The ACVR and ECVDI can:

- 1) Improve diplomate and trainee literacy with regards to AI applications and development;
- 2) Communicate and represent expertise in AI in veterinary radiology;
- 3) Facilitate networking and collaboration between veterinary radiologists/oncologists and other expert groups in AI;
- 4) Facilitate AI research and development by veterinary radiologists.

### **Beyond the ACVR and ECVDI: to those developing AI**

The ACVR and ECVDI are critical stakeholders in the development of AI in veterinary radiology. The following are some of the directions that we would like in the years to come:

- Development of AI to improve radiologist workflow and efficiency
- Development of AI-facilitated triage tools
- Development of AI-driven assessment and feedback tools
- AI algorithm transparency and access
- AI algorithm validation
- Radiomics