



Health Policy and Practice / Santé: politique et pratique médicale

Canadian Association of Radiologists White Paper  
 on Artificial Intelligence in Radiology

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## Abstract

Artificial intelligence (AI) is rapidly moving from an experimental phase to an implementation phase in many fields, including medicine. The combination of improved availability of large datasets, increasing computing power, and advances in learning algorithms has created major performance breakthroughs in the development of AI applications. In the last 5 years, AI techniques known as deep learning have delivered rapidly improving performance in image recognition, caption generation, and speech recognition. Radiology, in particular, is a prime candidate for early adoption of these techniques. It is anticipated that the implementation of AI in radiology over the next decade will significantly improve the quality, value, and depth of radiology's contribution to patient care and population health, and will revolutionize radiologists' workflows. The Canadian Association of Radiologists (CAR) is the national voice of radiology committed to promoting the highest standards in patient-centered imaging, lifelong learning, and research. The CAR has created an AI working group with the mandate to discuss and deliberate on practice, policy, and patient care issues related to the introduction and implementation of AI in imaging. This white paper provides recommendations for the CAR derived from deliberations between members of the AI working group. This white paper on AI in radiology will inform CAR members and policymakers on key terminology, educational needs of members, research and development, partnerships, potential clinical applications, implementation, structure and governance, role of radiologists, and potential impact of AI on radiology in Canada.

## Résumé

L'intelligence artificielle progresse rapidement de la phase expérimentale à la phase de mise en œuvre dans de nombreux domaines, notamment la médecine. L'accès à de grands ensembles de données, la puissance croissante des ordinateurs et les avancées en matière d'algorithmes d'apprentissage ont permis de faire des pas de géant au chapitre du développement des applications d'intelligence artificielle.

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Au cours des cinq dernières années, des techniques comme l'apprentissage profond ont permis d'améliorer rapidement les capacités de reconnaissance d'images, de production de légendes d'images et de reconnaissance vocale. La radiologie est un domaine tout indiqué pour l'adoption précoce de ces techniques. L'intégration d'applications d'intelligence artificielle en radiologie au cours de la prochaine décennie devrait grandement améliorer la qualité, la valeur et la portée de la contribution de la radiologie aux soins des patients et à la santé de la population, en plus de révolutionner le travail des radiologistes. En sa qualité de porte-parole de la profession au Canada, l'Association canadienne des radiologistes (CAR) défend des normes de pratique élevées en imagerie centrée sur les patients, en apprentissage continu et en recherche. La CAR a mis sur pied un groupe de travail sur l'intelligence artificielle qui a pour mandat de discuter des enjeux liés à la pratique, aux politiques et à la prestation de soins relativement à l'introduction et à la mise en œuvre d'outils d'intelligence artificielle en radiologie. Le présent livre blanc formule à l'intention de la CAR des recommandations issues des délibérations des membres du groupe de travail. Il renseigne les membres de la CAR et les responsables de l'élaboration des politiques sur la terminologie à employer, les besoins en matière de formation, la recherche-développement, les partenariats, les applications cliniques potentielles, la mise en œuvre, la structure et la gouvernance, le rôle des radiologistes et sur les retombées potentielles de l'intelligence artificielle en radiologie au Canada.

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*Key Words:* Artificial intelligence; Machine learning; Deep learning; Radiology; Imaging; Medicine; Healthcare; Quality improvement

Artificial intelligence (AI) is permeating our personal and work environments. AI applications used every day include voice-powered personal assistants, behavioral algorithms applied to real-time phone conversations, shopping recommendations powered by predictive analytics, and self-driving vehicles. It is predicted that AI applications will become faster, smarter, and more convenient to implement and use.

Breakthroughs in medical imaging technology and research have led to the exponential growth of medical imaging data stored in digital format over the past 2 decades. These machine-consumable data must be curated so that they can be used with AI to optimize patient outcomes, ensure appropriateness, and enhance the efficiency and accessibility of the health care system. As clinical experts on the use of imaging to diagnose and treat disease, it is critical that radiologists participate and lead in the implementation of data-driven systems that will interface with clinical workflows to improve patient care.

In May 2017, the Canadian Association of Radiologists (CAR) established an AI Working Group with a mandate to discuss and deliberate on practice, policy, and patient care issues related to the introduction and implementation of AI in imaging. This mandate will ensure that the CAR remains at the forefront of the discussion about the use of AI in imaging in Canada, so that radiologists can shape the way that the technology influences and impacts their work and role as physicians. The working group includes members from a range of subspecialties (covering adult and pediatric radiology) and backgrounds (including imaging informatics, engineering, biophysics, and research).

In this white paper, we summarize the objectives of this working group as follows:

1. Essential AI terminology
2. Key issues and best practices pertaining to educational needs of CAR members
3. Importance of critical assessment of AI literature in compliance with principles of evidence-based medicine
4. Research and development

#### 5. Clinical applications and implementation

#### 6. Structure and governance

#### 7. Role of radiologists and potential impact of AI in the context of radiology in Canada

Based on the current state of the art, we summarize key issues and provide recommendations for each topic. Considering the rapid rate of technological advances in this field and the large impact they will have on radiology, it is intended that this white paper (and the policy and recommendations provided herein) will be reviewed and updated on a regular basis. It is the intent of the CAR that these AI-focused publications will be helpful to radiologists and policymakers as they work to integrate AI advances into practice in a manner that is beneficial to patients and the health care system.

### Objectives

The mandates of the CAR AI Working Group are to do the following:

1. Research and examine the potential impact of AI on radiology in Canada, in various practice models.
2. Guide the development of CAR policy regarding the use and deployment of AI in radiology.
3. Promote and facilitate research and development in AI applications led by imaging experts in collaboration with different stakeholders across Canada.
4. Provide guidance and support for the membership and help members integrate AI advances into their practices in a manner that is beneficial to our patients and health care system under the leadership of radiology.
5. At the appropriate time, lead in the development of practical solutions for implementation of AI into routine clinical practice in collaboration with different stakeholders.
6. Oversee the formation and work of specific working groups that may be formed in the future to address specific challenges or issues of interest in AI.

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