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Artificial Intelligence (AI): Productive Progress in Radiation Oncology

Lohith G*, Niti Narang Raizada, Sudhakar Sampangi, Shivakumar Swamy and Basavalinga Ajai Kumar

Consultant Radiation Oncologist, Healthcare Global enterprises limited, India

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***Corresponding author**: Lohith G, Consultant Radiation Oncologist, Healthcare Global enterprises limited, Bengaluru, India.

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Abbreviations: AI: Artificial Intelligence; CT: Computed Tomography; PR: Personalized Radiotherapy.

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AI is emerging as a productive and disruptive force in medicine and mainly in oncology due to its immense research potential and the huge amount of data already existent in the available formats and also the rapid integration of big data into multiple processes in oncology, Perhaps at present its more evident in transforming pathology to a digital processing mode using AI and diagnostic radiology in imitating the accuracy of human reporting and also to generate multiple predictive and prognostic analytical software spheres using deep learning analogy. Radiation oncology is a specialty largely built around complex interpretation of medical images and multiple mathematical calculation models, where the role of AI is increasingly seen as both a boon and a threat, AI is poised to reshape the oncological space in many ways and mainly radiation oncology due to its early adoption of software technology and the rapid transformation in the last decade.

The potential for errors in radiation oncology is created at crucial junctions due to involvement of humans and this effect can be minimized or eliminated by implementing AI. Since radiation oncology is a combination of multiple inter-related teams, such as physicians, physicists and therapists and all of them have developed models and systems that can be internalized, developed and improved using AI and could be accomplished by using methods and algorithms, applying specific processes, and incrementally improving on them. Below is a review of the areas where AI could impact the radiation oncology. Radiation oncology outpatients could be automated with shorter and organized patient appointments and visits with more iterative patient flow, which would help in rapid check-in, queuing and setups for treatment, imaging, and treating. AI could assist radiation oncologists in analyzing the scores of records available in the retrospective space and the link the present patient to an accurate diagnosis and also give an approximate prediction of side-effects due to radiotherapy and the outcome related to the same. Desta Mulatu et al. [1] in his review has concluded that robust data mining could help in prediction of breast cancer recurrence.

Radiation oncology depends on an huge amount of heterogeneous data including the use of computed tomography (CT), PET, MRI scans, multiple dosimetric calculations, and dynamic adaptive imaging performed before the delivery of each radiation treatment fraction and this has given rise to a huge cache of considerable flow of data that needs to be mapped and integrated to provide a phenotypic profile of patients that could be correlated multiple other domains of oncology to generate a robust analytical models for prediction ,prognostication and outcome modeling processes and this could be achieved with artificial intelligence using deep learning and machine learning algorithms.

Contouring involves radiation oncologists to review medical images , design specific volumes of tumors and surrounding tissues based on an individual disease pattern and diagnosis, and to decide on radiation dose, As a result, there's significant room for subjective human error and this could be eliminated or reduced drastically by using deep learning AI based neural networks to recreate radiation oncologist's contouring patterns and this could automate time-consuming processes like contouring and greatly benefit patient care in clinics with low resources, many of which are found in low- and middle-income countries.

Since tumors are heterogeneous in nature and 3-D mapping is possible by imaging, Radiomics has emerged as an exciting field of research in the diagnostic radiology space as well as in the radiation oncology space. Delta radiomics (quantitative imaging) can help in identifying the problematic areas in the tumor regions such as hypoxic and anoxic components which are radio-resistant and in-turn help in mapping these regions to probably escalate the doses of radiotherapy or compliment radiotherapy with an additional modality of treatment such as chemotherapy, immunotherapy or targeted therapy and to destroy the resistant clones and maintain therapeutic efficacy. Radiomics using AI can be used to develop imaging biomarkers to exactly map the tumor heterogeneity on a dynamic basis and incorporating the radiomics platform in the treatment console would help the radiation oncologist on a serial assessment adaptive radiotherapy.

Babier et al. [2] used artificial intelligence (AI) to mine historical radiation therapy data and used this information to generate an optimization engine to fasten the process of treatment planning using AI. And this software tool was applied in their study of 217 patients with throat cancer, who also received treatments developed using conventional methods. The therapies generated by this AI developed software achieved comparable results to patients' conventionally planned treatment and did so within 20 minutes. Synthesis of mega data sources into actionable knowledge-based analogy to improve patient outcomes and reduce side-effects is currently a major goal of modern precision and personalized radiotherapy (RT). Knowledge-based response-adaptive radiotherapy has emerged as an important framework to develop precise and personalized treatments by adjusting dose distributions according to clinical, anatomical, geometrical and physiological parameters in a dynamic iterative process observed during radiotherapy treatment course and such specific patient signals can be useful for adaptive decision-making [3].

AI can help in faster transformation of demographic, clinical and imaging information from hospital information technology to the contouring stations and into the treatment planning systems and also help in recording and verification of portal imaging and finally aid in treatment delivery. AI will adapt, evolve and learn optimized processes to improve treatment planning and post-treatment evaluation and in-turn improve efficiency and minimize errors. AI can help in verification of prescriptions at all crucial junctions of the radiation oncology process, such as prescription to radiation planning, planning to verification, and to the treatment couch implementation.

Conclusion

AI in radiation oncology reaffirms the diagnosis rather than replacing the physician and multidisciplinary based human approach. However, the machine-to-human handshake where physicians partner with AI challenges traditional healthcare culture and thinking. However, human knowledge and experience will not be replaced by an algorithm in cancer treatment any time soon. Instead, AI becomes a potent and trusted supportive tool and partner, enhancing each team member's cognitive abilities in providing customized, effective cancer treatment.

References

1. Desta Mulatu, Rupali R Gangarde (2017) Survey of Data Mining Techniques for Prediction of Breast Cancer Recurrence. International Journal of Computer Science and Information Technologies 8(6): 599-601.
2. Aaron Babier, Justin J Boutilier, Andrea L McNiven, Timothy CY Chan (2018) Knowledge-based automated planning for oropharyngeal cancer. Medical Physics 45(7): 2875-2883.
3. Lim-Reinders S, Keller BM, Al-Ward S, Sahgal A, Kim A (2017) Online adaptive radiation therapy. Int J Radiat Oncol Biol Phys 99(4): 994-1003.

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