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Invited talk: Artificial Intelligence approaches for Monte Carlo simulation in medical physics

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Monte Carlo simulation of particle tracking in matter is the reference simulation method in the field of medical physics. It is heavily used in various applications such as

1. patient dose distribution estimation in different therapy modalities (radiotherapy, protontherapy or ion therapy) or for radio-protection investigations of ionizing radiation-based imaging systems (CT, nuclear imaging),
2. development of numerous imaging detectors, in X-ray imaging (conventional CT, dual-energy, multi-spectral, phase contrast ...), nuclear imaging (PET, SPECT, Compton Camera) or even advanced specific imaging methods such as proton/ion imaging, or prompt-gamma emission distribution estimation in hadrontherapy monitoring.

Monte Carlo simulation is a key tool both in academic research labs as well as industrial research and development services. Because of the very nature of the Monte Carlo method, involving iterative and stochastic estimation of numerous probability density functions, the computation time is high. In this presentation, we will review the recent use of Artificial Intelligence methods for Monte Carlo simulation in medical physics and their main associated challenges.

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Session Classification : Machine Learning in Medical Applications 1

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