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Future of artificial intelligence applications in Joint trauma

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Abstract
Joint trauma constitutes a substantial proportion of emergency room visits and patients requiring urgent care, imposing considerable financial burdens on society. Diagnostic imaging is essential in the evaluation and treatment of trauma victims. Diagnostic imaging constitutes a complex, multifaceted system, with numerous elements of its workflow susceptible to inefficiencies or human error. Recent advancements in artificial intelligence and machine learning have the potential to transform our medical care delivery systems. This review will offer a comprehensive analysis of the present status of artificial intelligence and machine learning applications in various facets of trauma imaging and propose a vision for how these applications could be utilized to improve diagnostic imaging systems and optimize patient outcomes.

Keywords: machine learning; artificial intelligence; joint trauma; geriatric trauma; trauma imaging

Machine learning and joint trauma

Trauma constitutes a primary cause for visits to the emergency department. Trauma imposes significant societal costs, with extremity injuries being 50% of the overall expenses associated with nonfatal injuries. [1] Contemporary medical practice for trauma patients invariably include diagnostic imaging, encompassing comprehensive computed tomography trauma scans as well as specialized radiography, MRI, or ultrasound examinations. [2] Inaccurate or postponed diagnosis in trauma imaging can result in heightened mortality and morbidity. The interpretation of medical imaging examinations constitutes a complex cognitive and psychophysiological process that is susceptible to inaccuracy. It is believed that the overall error rate in picture interpretation by a qualified radiologist is roughly 4%. Extrapolating to roughly 1 billion radiologic imaging assessments annually, this results in an estimated 40 million errors by radiologists each year. [3] The utilization of medical imaging in the USA is on the rise, with the Medicare patient demographic alone comprising 20.2 million emergency medical imaging examinations in 2014. [4] As imaging utilization continues to rise, radiologists face mounting pressure to expedite imaging interpretations while preserving diagnostic accuracy. Radiologists in the USA are facing significant burnout, with escalating workloads identified as a primary contributor to occupational stress. Furthermore, in the emergency room context where imaging is conducted outside regular hours, timely access to urgent radiological consultation by a fellowship-trained physician may be lacking. In this practice environment, non-radiology clinical staff face an elevated risk of misinterpreting diagnostic imaging studies, with a notable increase in fracture misdiagnosis occurring between 8 PM and 2 AM, likely due in part to the absence of consulting radiologists. [5] Amidst these prevailing and escalating issues, machine learning and artificial intelligence are perfectly positioned to aid radiologists in the reading room. These technologies possess the capability to enhance radiologists' performance, enabling them to sustain or maybe elevate diagnostic precision, notwithstanding the rising workload. This can be partially accomplished by automating a segment of the radiologic interpretation process. This may consequently result in a reduction in radiologist burnout and diagnostic inaccuracies. Furthermore, artificial intelligence [6] is expected to significantly enhance the speed of imaging acquisition and facilitate automated imaging segmentation, which can be utilized to derive valuable imaging biomarkers from diagnostic investigations for patient management. [7]

In a decade, artificial intelligence will unquestionably be essential in the routine operations of radiologists and other healthcare professionals, with collections of AI-driven algorithms enhancing and supporting our regular tasks. Envision the subsequent scenario: An old woman is admitted to the emergency hospital overnight by automated patient assessment after sustaining a fall in her shower. Upon arrival, portable radiographs reveal pelvic ring and hip fractures, accurately identified by artificial intelligence and flagged for prompt evaluation by the attending radiologist, who verifies the diagnosis within minutes. An integrated trauma management system alerts the on-call trauma team, who do an immediate computed tomography assessment, which identifies a pelvic hematoma and hemoperitoneum. Artificial intelligence segmentation automatically calculates hemorrhage volume, predicting a high probability of necessitating embolization, major transfusion, or pelvic packing. An urgent consultation to interventional radiology is automatically initiated to alert the on-call interventional radiology staff to remain on standby. Additionally, opportunistic body composition values derived from the computed tomography scan reveal sarcopenia in this elderly patient and recommend assessment by geriatric specialists at the hospital for additional care. The patient is subsequently sent to the operating room for pelvic packing, followed by open reduction and fixation of a femoral neck fracture. Post-surgery, the patient is overseen in the intensive care unit by a multidisciplinary team of trauma surgeons and geriatricians who maximize post-operative care. The utilization of artificial intelligence hastened and streamlined the care of this geriatric trauma patient, enhancing the likelihood of recovery. In this hypothetical scenario, artificial intelligence influences various facets of trauma patient treatment and management, ultimately enhancing patient outcomes. This analysis indicates that the potential uses of artificial intelligence in trauma therapy are extensive. The advancements in artificial intelligence are expected to enhance clinical efficacy for physicians, optimize research priority in radiology workflows, and reduce radiologists' turnaround times without aiming to replace them.

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