



Systematic review, Artificial Intelligence Use of Machine Learning in Osteoarthritis Research: a Systematic Literature Review

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Use of Machine Learning in Osteoarthritis Research: a Systematic Literature Review

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Background:

Artificial intelligence techniques, in particular machine learning (ML), are increasingly used in rheumatology and especially in osteoarthritis (OA). ML studies in OA are very heterogeneous, hence the need to have an overview of their field of application

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Objectives:

The aim of this systematic literature review is to provide a comprehensive and exhaustive landscape of the use of ML in the clinical care of OA.

Methods:

A systematic review of the literature was performed in July 2021 using the Medline database with key words and MeSH terms referring to ML methods in OA. Only original articles in English were considered. Articles related to replacement surgery, theoretical imaging, rehabilitation, molecular biology, and spinal or temporomandibular OA were excluded. For each selected article, the number of patients, the ML algorithms used, the type of data analyzed, the validation methods, and the data availability were collected

Results:

From 1,148 screened articles, 46 were selected and analyzed, most of which were published after 2017 (figure 1). Twelve articles were related to diagnosis, 7 to prediction, 4 to phenotyping, 12 to severity and 11 to progression. The number of patients included ranged from 18 to 5,749. Deep learning (DL) was used in 35% of the cases. Imaging analyses represented 74% of the studies. Knee OA was studied in 85% of these articles while 15%

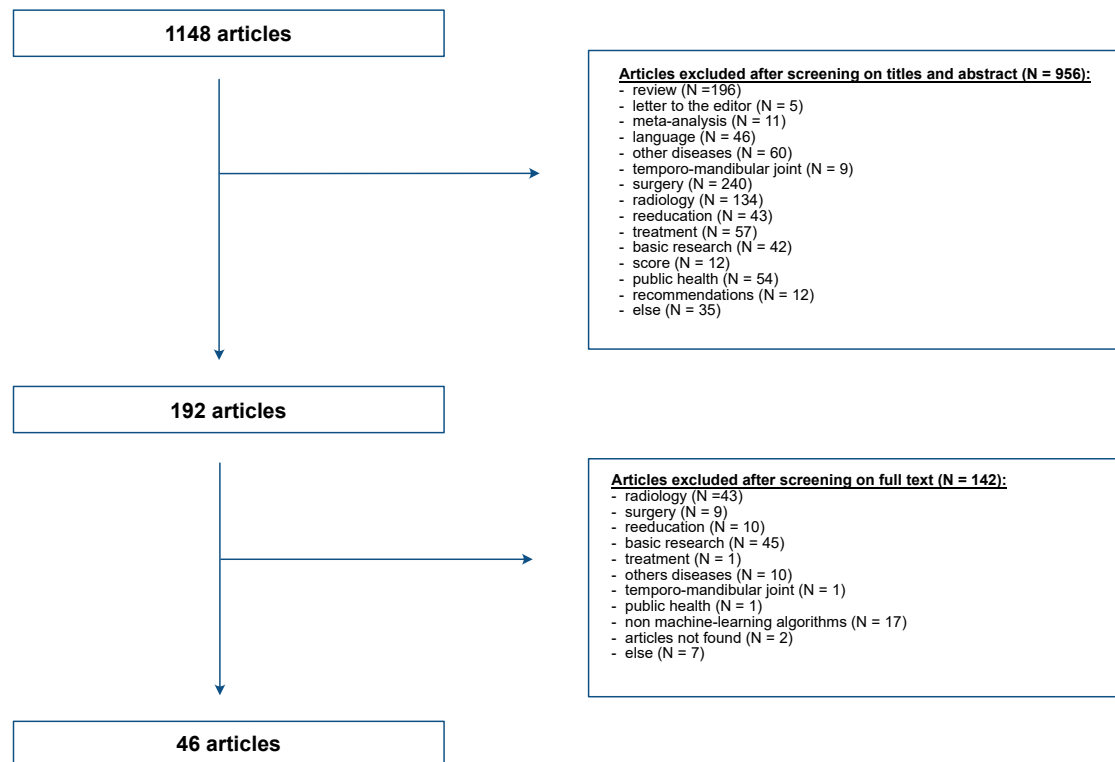
investigated hip OA. None were on hand OA. Most of the studies were done on the same cohort with data from the Osteoarthritis Initiative (OAI) used in 46% of the articles whereas the Multi-Center Osteoarthritis Study (MOST) and the Cohort Hip and Cohort Knee Study (CHECK) cohort were respectively used in 11 % and 7 % of the articles. Data and source code were publicly available in 54% and 22% of the articles. External validation was provided in only 7 % of the articles.

Conclusion:

This review provides a comprehensive update of ML in OA research. The number of ML articles in OA has increased exponentially over the last 5 years with applications across all major research themes. However, there is methodological heterogeneity, with articles based mainly on radiological data, but also on knee OA. To date, there is no ML article on digital osteoarthritis. This work also shows the need to develop clinical cohorts to bring more diversity in ML work and to allow external validation. This article is the first systemic review of the literature in OA and provides an overview of ML in OA, its applications, limitations and perspectives.

References:

Figure 1: Article selection flow chart



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