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A Literature Review on Artificial Intelligence Methods Related to Low Back Pain

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Abstract

Low back pain (LBP) is a worldwide health problem caused by various diseases. It is difficult to establish standards in medical applications because of the differences in the causes of its occurrence and the individual effects in treatment. The LBP diagnosis and treatment processes generate different numerical and visual data. Today, artificial intelligence (AI) techniques have begun to be developed, aiming to improve the understanding of LBP's causes, treatment processes, and effectiveness using patient data. In our study, we aimed to systematically search the literature on the diagnosis and treatment processes of LBP using AI techniques. We conducted a systematic review of studies on LBP utilizing AI methods between 01.01.2000 and 01.05.2023, using the PubMed database. While searching the database, combinations of the terms "Artificial Intelligence,""Machine Learning,""Deep Learning," and "Low Back Pain" were employed. A total of 369 articles were identified. According to the study inclusion criteria, 354 articles were excluded, and 15 studies were reviewed. Magnetic resonance images, biochemical parameters, kinematic variables, EMG signals, PET imaging, and other variables were used AI methods to diagnose LBP. The studies employing AI methods generally focused on classification and regression problems. The AI techniques developed for the diagnosis and treatment processes of LBP are promising. It is anticipated that multidisciplinary studies using artificial intelligence.

Introduction

Back pain (LBP) is a worldwide health problem caused by various diseases. It is difficult to establish standards in medical applications because of the differences in the causes of their occurrence and the individual effects of the treatment. Various numerical and visual data are used in the LBP diagnosis and treatment processes. Today, AI techniques have begun to be developed that aim to improve the causes, treatment process, and effectiveness of LBP by using data from patients. In our study, it was aimed to systematically examine the literature covering AI techniques related to the diagnosis and treatment processes of LBP.

LBP is a common and important health problem worldwide and is the cause of disability and loss of work. The lack of standard, measurable measurement models on which today's clinics can base their clinical profits, causes imprecise treatment practices, unnecessary surgeries, and high redundant health expenditures. With AI methods, it is possible to recognize patients' specific diseases, and studies that can help clinics with treatment and separation are promising. With AI technologies, pain analysis, treatment, and comprehensive health services can improve growth. It guides the use of comprehensive AI-based extractions related to pain assessment and management file development [1].

AI Methods Used in Low Back Pain

When the literature is examined, it is seen that AI techniques can be helpful in many areas such as diagnosing back pain, determining the relevant biochemical markers, detecting pathologies using magnetic resonance imaging, differentiating between neuropathic and nociceptive pain, analyzing electromyography signals, assisting clinicians in their decisions using clinical data, and planning treatment strategies. AI applications used in LBP can be grouped as follows.

AI methods used in the diagnosis of LBP are constantly evolving with the development of technology. Today, machine learning and deep learning, which are AI methods, are used in the diagnosis, treatment, and rehabilitation of low back pain. AI methods used in LBP are as follows;

Electromyography (EMG): Using AI techniques; It helps to analyze EMG signals by evaluating muscle activation patterns to distinguish between neuropathic and nociceptive pain (Seas et al., 2024). Yousif et al. (2019) examined the studies in which muscle fatigue was detected by processing the EMG signal with the time domain, frequency domain, and time-frequency domain of EMG

signals collected from muscles during static and dynamic movements. It was seen in the studies that it was frequently used to detect muscle fatigue and that EMG signals provided more information about muscle activities by analyzing them [2].

Magnetic Resonance Imaging (MRI): MRI scans are analyzed to detect LBP-related abnormalities (disc herniation, spinal stenosis, etc.) using AI methods [3].Showed in their study that MRI images can be classified with acceptable accuracy and precision for pain and cracks caused by discography using machine learning algorithms [3]. Studies show that using AI techniques can help radiologists detect anomalies more quickly and efficiently by classifying MRI images with a high degree of accuracy [4].

Biochemical Parameters: AI methods are used to identify and evaluate biochemical markers that are/may be associated with LBP. Although the literature largely focuses on the spine, neuroimaging of the human brain holds promise for identifying biomarkers that will improve LBP treatment. In a study conducted by [5], morphological changes in cerebral cortical thickness (CT) and resting state functional connectivity (rsFC) measurements were estimated using a machine learning algorithm as potential brain biomarkers for LBP [6].

Clinical Data Integration: Large data sets obtained from patients, such as anamnesis, physical examination findings, imaging, and laboratory results, can be processed and analyzed using artificial intelligence methods [7]. Using AI techniques such as natural language processing, machine learning, and convolutional neural networks, information can be extracted from clinical notes and patient data, helping clinicians make faster and more accurate decisions [8].

Predicting Responses to Treatment Methods: Studies are being conducted using AI methods to predict how different treatment methods may cause reactions in patients by taking into account various and past data such as radiology, laboratory, and physical examination findings. In this way, personalized treatment approaches are being developed by predicting the benefits that patients can obtain from which treatment method. A study by [1], shows that effective pain detection and evaluation can be achieved by using various artificial intelligence methods such as machine learning algorithms, natural language processing, and data mining to analyze patient-reported pain data, which effectively helps clinicians treat their patients [1].

Monitoring Rehabilitation: A wearable device created using AI-based technologies allows the patient to obtain real-time data during rehabilitation by monitoring the data obtained with mobile applications. Since AI-based systems are real-time, they help adjust the patient's treatment plan. The use of AI-based systems in the rehabilitation processes of LBP patients has been observed to significantly improve the patient's compliance with the rehabilitation process [1].

Telehealth and Virtual Care: Today, telehealth services can help clinicians by facilitating their decision-making processes by using artificial intelligence-based algorithms with the development of technology [9]. In a study conducted by [10], it is seen that artificial intelligence is used in telehealth services; teleassessment, telediagnosis, telemonitoring, and teleinteractions. Methods need to be developed and existing methods need to be improved for wider use in the health sector [10].

Decision Support Systems: Artificial intelligence-based clinical decision support systems can assist clinicians in the diagnosis, treatment, and rehabilitation processes of LBP [4]. The use of AI techniques in clinical practice is important for improving patient care [11]. It is anticipated that in the future, with the development of AI-based clinical decision support systems, healthcare services will be used more effectively and efficiently and clinical applications will be more successful [11].

In our study, it was aimed to systematically examine the literature covering artificial intelligence techniques related to the diagnosis and treatment processes of LBP.

Methods

To perform exhaustive research on AI, and articles related to LBP, we performed a detailed analysis with a set of inclusion criteria.In [Figure 1], the applied algorithm for paper selection is shown. As can be seen, studies on LBP using AI methods between 01.01.2000 and 01.05.2023 were examined using the PubMed database. Keyword combinations of "artificial intelligence", "machine learning", "deep learning" and "low back pain" were used in the database. A total of 369 articles were reached. According to the exclusion criteria from the study; Excluding 354 articles that were not full text, could not be accessed in full text, were not articles, and were not related to the research topic, 15 eligible articles were included. To diagnose LBP a variety of data types are used such as Magnetic resonance images, biochemical parameters, kinematic variables, EMG signals, PET imaging, etc.Studies using AI techniques are generally machine classification and regression using deep learning algorithms [Figure 2]. Summarizes the application areas of AI for lower back pain. While the main application areas are computer vision problems, computer-aided diagnosis, and decision support systems, most problems are considered prediction, regression, or classification problems.

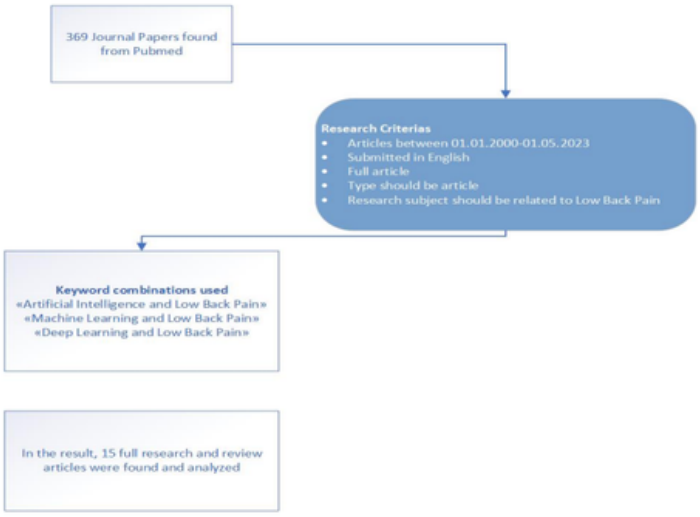

Figure 1: Algorithm for paper selection

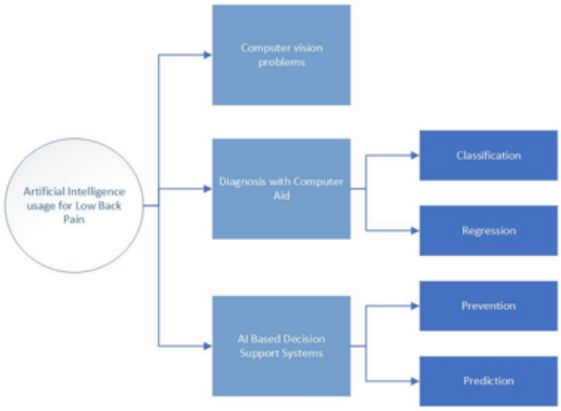

Figure 2: Division of Studies with AI related to LBP

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In [Table 1], above, the list of studies, year of the study, and number of patients are analyzed, AI methods used, and their results are summarized. As can be seen from the table, all studies focus on classification problems. Majority of studies in which kinematic variables are used, the SVM algorithm is preferred. In studies where visual data is processed, different CNN models are preferred.

Researcher	Year	Number of Patients	AI Method Used	Results
Sanders & Mann	2000	250	Feed forward Neural Network	Sensitivity = 49%
Parsaeian et al.	2012	>34,00	Feed forward Neural Network & Logistic Regression	Area Under the Curve=0.75
Karabulut & Ibrikci	2014	310	Synthetic Minority Oversampling Technique & Logistic Model Tree	Accuracy=89.7%
Anan et al.	2021	92	Logistic Regression	75% improvement in the Control Group
Ashouri et al.	2017	52	Support Vector Machine	Accuracy=96%
Hu et al.	2018	44	Long Short-Term Memory	Accuracy=97.2%
Lee et al.	2019	53	Support Vector Machine	Accuracy=92.5%
Lamichhane et al.	2021a	24	Support Vector Machine	Accuracy=74.51%
Shen et al.	2019	90	Support Vector Machine	Accuracy=79.3%
Staartjes et al.	2020	262	Fuzzy Rule-Based Classification on Chi's Method	Accuracy=96.2%
Abdollahi et al.	2020	94	Support Vector Machine	Accuracy=75%
Ketola et al.	2021	518	Logistic Regression &Texture Feature Extraction	Accuracy=83%
Liew et al.	2020	49	Logistic Regression	Area Under the Curve=0.97
Torrado et al.	2021	33	Random Forest	Area Under the Curve=0.88
Lamichhane et al.	2021b	51	Support Vector Machine	Accuracy=78,7%

Table 1: Summary of Studies Regarding Diagnosis and Classification of LBP

Results and Discussion

The studies examined in this study show that AI methods, especially in classification and regression tasks, have promising results in LBP diagnosis, treatment, and rehabilitation. In this section, the findings in the literature, clinical application and implications, and future research directions are discussed.

AI-based algorithms show high diagnostic accuracy in LBP determination. In a systematic study, LBP classification was used to define and categorize the disease, and the best performance was found in the diagnosis of degenerative changes of the spine from imaging data, with average accuracy rates higher than 80% [4]. With such findings, it is shown that AI will increase the diagnostic capabilities of radiologists, reduce diagnostic errors, and facilitate early diagnosis and interventions. It shows that AI can increase the capabilities of clinicians and reduce potential errors.

A study provided by an AI-supported health program shows that it improves both neck/shoulder pain/stiffness and lower back pain in 12 weeks. In this way, more studies are needed to spread AI-supported health programs [12]. The study shows that AI-supported exercise recommendations cause a decrease in daily pain in patients with low back pain compared to standard care [13]. In another study, a methodology was developed by analyzing supervised and unsupervised AI methods and combining their predictions. In this way, it is shown that estimating treatment effectiveness can improve and simplify treatment [14]. It shows that AI enables clinicians to make more informed decisions by integrating it with traditional clinical assessments.

In addition to the promising results of AI in LBP, some limitations and ethical problems continue to be seen. Since most of the studies in the literature are preliminary, they lack verification. Large-scale and repeatable studies are needed to prove that the results obtained are reliable and generalizable [15]. To conduct AI-based studies, care must be taken to ensure the confidentiality of the data used. It brings up the issues of security of patient data used to develop AI models, consent, and protection of sensitive information [15-28]. Integrating AI into the management of LBP offers important opportunities for increasing diagnostic accuracy and estimating treatment effectiveness. In addition, it raises questions in terms of ethical issues and provability of results. As research in this area continues, multidisciplinary studies are needed to reveal the potential of AI in LBP. AI-based image processing techniques are used to classify, segment, and detect objects in medical images. Supervised and unsupervised training techniques are used to train the AI models for these tasks. These processes act as a decision-support mechanism in the diagnosis and treatment phases. AI techniques developed for the diagnosis and treatment processes of LBP are promising.

Conclusions

It is thought that multidisciplinary studies using artificial intelligence techniques will become widespread. Further studies are needed to better define LBP and improve treatment processes. Patients with LBP problems are increasing in demand and the patient management process requires faster decision support and diagnosis mechanisms. AI can obtain an important place given the opportunities it presents. With the contributions of AI, doctors can tackle the diagnosis and treatment phases in a faster manner. Eventually, processes involving AI and medical devices running with AI will be more common. Regardless of the opportunities and improvements in artificial intelligence, doctors maintain their position as the decision-makers in diagnosis and treatment processes.

References

1. Zhang M, Zhu L, Lin SY, Herr K, Chi CL, Demir I, et al. (2023). Using artificial intelligence to improve pain assessment and pain management: a scoping review. J Am Med Inform Assoc. 30:570–587.
2. Yousif HA, Zakaria A, Rahim NA, Salleh AFB, Mahmood M, Alfarhan KA, et al. (2019). Assessment of muscles fatigue based on surface EMG signals using machine learning and statistical approaches: a review. IOP Conf Ser Mater Sci Eng. 705:012010.
3. Kerstin L, Hanna H, Helerna B (2021). Identification of potentially painful disc fissures in magnetic resonance images using machine-learning modelling. Eur Spine J.
4. D'Antoni F, Russo F, Ambrosio L, Bacco L, Vollero L, Vadalà G, et al. (2022). Artificial intelligence and computer aided diagnosis in chronic low back pain: a systematic review. Int J Environ Res Public Health. 19:5971.
5. Lamichhane B, Jayasekera D, Jakes R, Glasser MF, Zhang J, Yang C, et al. (2021). Multi-modal biomarkers of low back pain: a machine learning approach. Neuroimage Clin. 29:102530.
6. Lamichhane B, Jayasekera D, Jakes R, Ray WZ, Leuthardt EC, Hawasli AH (2021). Functional disruptions of the brain in low back pain: a potential imaging biomarker of functional disability. Front Neurol. 12:669076.

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7. Park CW, Seo SW, Kang N, Ko B, Choi BW, Park CM, et al. (2020). Artificial intelligence in health care: current applications and issues. J Korean Med Sci. 35.
8. Singh RP, Hom GL, Abramoff MD, Campbell JP, Chiang MF (2020). Current challenges and barriers to real-world artificial intelligence adoption for the healthcare system, provider, and the patient. Transl Vis Sci Technol. 9:45.
9. Zeb S, Nizamullah FNU, Abbasi N, Fahad M (2024). AI in healthcare: revolutionizing diagnosis and therapy. Int J Multidiscip Sci Arts. 3:118–128.
10. Kuziemsky C, Maeder AJ, John O, Gogia SB, Basu A, Meher S, et al. (2019). Role of artificial intelligence within the telehealth domain. Yearb Med Inform. 28:35–40.
11. Pererva V, Maltsev D, Hruzevskyi O, Gai L, Dekhtiar Y (2024). Analysis of trends in the use of artificial intelligence in diagnosis and treatment. Salud Cienc Tecnol. 4:586.
12. Anan T, Kajiki S, Oka H, Fujii T, Kawamata K, Mori K, et al. (2021). Effects of an artificial intelligence–assisted health program on workers with neck/shoulder pain and low back pain: randomized controlled trial. JMIR Mhealth Uhealth. 9:e27535.
13. Hartmann R, Avermann F, Zalpour C, Griefahn A (2023). Impact of an AI app-based exercise program for people with low back pain compared to standard care: a longitudinal cohort study. Health Sci Rep. 6:e1060.
14. Wirries A, Geiger F, Hammad A, Redder A, Oberkircher L, Ruchholtz S, et al. (2021). Combined artificial intelligence approaches analyzing patients with back pain: predicting treatment efficacy and diagnostic groups. Diagnostics. 11:1934.
15. Stahl BC (2021). Ethical issues of AI. Artif Intell Better Future. 35–53.
16. Abdollahi M, Ashouri S, Abedi M, Azadeh-Fard N, Parnianpour M, Khalaf K, et al. (2020). Using a motion sensor to categorize nonspecific low back pain patients: a machine learning approach. Sensors. 20:3600.
17. Ashouri S, Abedi M, Abdollahi M, Manshadi FD, Parnianpour M, Khalaf K (2017). A novel approach to spinal 3-D kinematic assessment using inertial sensors. Comput Biol Med. 89:144–149.
18. Hu B, Kim C, Ning X, Xu X (2018). Using a deep learning network to recognise low back pain in static standing. Ergonomics. 61:1374–1381.
19. Karabulut EM, Ibrikci T (2014). Automated prediction of vertebral column pathologies using logistic model tree. J Med Syst. 38.
20. Ketola JH, Inkinen SI, Karppinen J, Niinimäki J, Tervonen O, Nieminen MT (2021). MRI texture as predictor of low back pain. J Orthop Res. 39:2428–2438.
21. Lee J, Mawla I, Kim J, Loggia ML, Ortiz A, Jung C, et al. (2019). Machine learning–based prediction of clinical pain using neuroimaging. Pain. 160:550–560.
22. Liew BX, Rugamer D, De Nunzio AM, Falla D (2020). Interpretable machine learning models for classifying low back pain. Eur Spine J. 29:1845–1859.
23. Parsaeian M, Mohammad K, Mahmoudi M, Zeraati H (2012). Logistic regression vs neural network in low back pain prediction. Iran J Public Health. 41:86.
24. Sanders NW, Mann NH (2000). Automated scoring of patient pain drawings using neural networks. Comput Biol Med. 30:287–298.
25. Seas A, Zachem TJ, Valan B, Goertz C, Nischal S, Chen SF, et al. (2024). Machine learning in the diagnosis and management of low back pain: a scoping review. Spine J.
26. Shen W, Tu Y, Gollub RL, Ortiz A, Napadow V, Yu S, et al. (2019). Brain connectivity alterations in chronic low back pain. Neuroimage Clin. 22:101775.
27. Staartjes VE, Quddusi A, Klukowska AM, Schröder ML (2020). Machine learning applied to diagnostics of low back pain. Eur Spine J. 29:1702–1708.
28. Torrado-Carvajal A, Toschi N, Albrecht DS, Chang K, Akeju O, Kim M, et al. (2021). Thalamic neuroinflammation in chronic low back pain. Pain. 162:1241–1249.

Citation: Veranyurt U, Akalin B, Gercek A (2026). A Literature Review on Artificial Intelligence Methods Related to Low Back Pain. Int J Health Sci Biomed. 3(2): 1-4. DOI: 10.5281/zenodo.19740260