ABSTRACT

Objective pain detection remains a significant challenge in healthcare, as conventional assessments still rely heavily on patients' subjective self-reports. Advances in artificial intelligence (AI) have created new opportunities to assess pain through various biological signals and human expressions. Numerous studies have demonstrated the potential of AI in analyzing facial expressions to identify pain intensity (Shier & Yanushkevich, 2016), utilizing fNIRS signals as brain-activity-based pain biomarkers (Pourshoghi et al., 2019), and comparing the performance of deep learning models for decoding fNIRS signals in the context of pain detection (Fernandez-Rojas et al., 2024). However, to date, no structured review has comprehensively compared these AI-based approaches across different modalities within the period of 2015–2025. Therefore, this study conducts a Systematic Literature Review (SLR) to analyze the development of AI methods, trends in data utilization, and model effectiveness in pain detection. The findings of this review are expected to provide a comprehensive overview of the most effective methods, highlight limitations in previous studies, and identify future directions for the development of AI-based pain detection technologies.

Keywword : Pain Detection, SLR ,Facial Expresion, AI

ABSTRAK

Deteksi rasa sakit secara objektif menjadi tantangan penting dalam bidang kesehatan karena penilaian konvensional masih bergantung pada laporan subjektif pasien. Perkembangan kecerdasan buatan (AI) membuka peluang untuk mengukur rasa sakit melalui berbagai sinyal biologis dan ekspresi manusia. Berbagai penelitian telah menunjukkan potensi AI dalam menganalisis *facial expressions* untuk mengidentifikasi tingkat nyeri (Shier & Yanushkevich, 2016), memanfaatkan sinyal fNIRS sebagai biomarker nyeri berbasis aktivitas otak (Pourshoghi et al., 2019), serta membandingkan performa model *deep learning* untuk *decoding* sinyal pada fNIRS dalam konteks deteksi nyeri (Fernandez-Rojas et al., 2024). Namun, hingga kini belum ada tinjauan terstruktur yang membandingkan berbagai pendekatan AI dari berbagai modalitas tersebut dalam periode 2015–2025. Oleh karena itu, penelitian ini

melakukan *Systematic Literature Review* (SLR) untuk menganalisis perkembangan metode AI, tren penggunaan data, serta efektivitas model dalam mendeteksi rasa sakit. Hasil kajian ini diharapkan dapat memberikan gambaran menyeluruh mengenai metode paling efektif, kelemahan penelitian sebelumnya, serta arah pengembangan teknologi deteksi nyeri berbasis AI.

Kata Kunci : Deteksi Nyeri, SLR, Ekspresi Wajah, AI