RADemics

AI and ML-Based Sentiment Analysis of Employee Feedback for HR Decision-Making

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Abstract

The effective management of human resources increasingly relies on the timely and accurate interpretation of employee feedback, which serves as a critical indicator of organizational health, workforce engagement, and employee satisfaction. Traditional analytical methods, primarily based on manual assessment or structured survey data, often fail to capture the complexity and nuances of unstructured textual feedback, limiting the capacity for evidence-based HR decision-making. This chapter explores the integration of artificial intelligence (AI) and machine learning (ML) techniques for sentiment analysis, providing scalable and automated approaches to extract meaningful insights from large-scale employee feedback. The study examines supervised and unsupervised learning models, deep learning architectures, and advanced feature extraction methods to classify sentiment, identify latent themes, and detect patterns indicative of workforce morale and potential areas of concern. The chapter addresses critical challenges, including handling imbalanced sentiment classes, ensuring model interpretability, and maintaining data privacy, while emphasizing the role of visualization and interactive dashboards in translating analytical outcomes into actionable HR strategies. By bridging the gap between computational analysis and human resource management, AI and ML-driven sentiment analysis facilitates proactive decision-making, supports employee retention initiatives, and enhances organizational effectiveness. The chapter provides a comprehensive framework for leveraging advanced analytics to transform unstructured feedback into strategic intelligence, establishing a foundation for evidence-based workforce management and continuous organizational improvement.

Keywords: Employee Feedback, Sentiment Analysis, Machine Learning, Deep Learning, HR Analytics, Workforce Engagement

Introduction

Employee feedback constitutes a vital component of organizational intelligence, reflecting insights into workforce engagement, morale, and productivity [1]. Modern organizations increasingly recognize the strategic importance of analyzing feedback to inform decision-making processes, improve employee satisfaction, and enhance overall performance [2]. Traditional approaches for evaluating feedback, such as manual coding, structured survey scoring, and basic statistical analysis, often fail to capture the complexity of textual and unstructured responses [3]. These methods are labor-intensive, time-consuming, and prone to subjective biases, limiting their ability to provide actionable intelligence at scale [4]. The proliferation of digital communication platforms, including internal collaboration tools, emails, and online surveys, has resulted in

massive volumes of employee-generated textual data, creating opportunities for organizations to derive meaningful insights. The challenges associated with processing, interpreting, and summarizing these large and unstructured datasets necessitate the adoption of automated computational techniques [5].

Artificial intelligence (AI) and machine learning (ML) techniques have emerged as critical enablers for the analysis of large-scale employee feedback [6]. These technologies allow for the systematic classification of sentiment, identification of emerging themes, and extraction of patterns that may indicate underlying issues or opportunities within the workforce [7]. Supervised learning models, such as support vector machines, logistic regression, and random forests, provide structured approaches for sentiment classification, whereas unsupervised techniques, including clustering and topic modeling, help uncover latent insights without relying on predefined labels [8]. Deep learning architectures, particularly recurrent neural networks (RNNs), long short-term memory (LSTM) networks, and transformer-based models, offer enhanced capabilities for contextual understanding and sequence modeling, capturing subtle nuances and complex sentiment expressions [9]. By applying AI and ML methods, organizations can not only analyze historical feedback but also predict emerging trends, enabling proactive human resource interventions [10].

The application of AI-driven sentiment analysis in HR decision-making was not without challenges. Employee feedback often exhibits imbalanced sentiment distributions, where positive or neutral feedback dominates while negative feedback remains underrepresented [11]. Feedback data can contain ambiguous phrasing, domain-specific jargon, or multi-layered sentiment expressions that complicate classification [12]. Ethical concerns, such as privacy, confidentiality, and informed consent, must also be addressed to maintain trust and comply with regulatory standards [13]. The interpretability of complex AI and deep learning models was crucial for HR practitioners who require clear and actionable insights [14]. Addressing these challenges requires robust preprocessing, feature extraction, and dimensionality reduction techniques, as well as careful selection of evaluation metrics that reflect model performance across all sentiment categories [15].