

Chapter 6

Aiding in Prognosis of Fibromyalgia Syndrome Utilizing MCDM TOPSIS Method in Fusion With Fuzzy Logic


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ABSTRACT

The study addresses the complexity of Fibromyalgia syndrome (FMS) by integrating multi-criteria decision-making (MCDM) TOPSIS with fuzzy logic for accurate prognosis. A comprehensive set of criteria, including clinical, psychological, and physiological factors, is employed. Fuzzy logic models uncertainties and subjective expert opinions. The method systematically evaluates and ranks FMS prognoses, contributing to transparency in decision-making. Incorporating sensitivity analysis with small variations enhances reliability. Considering symptoms, patients, and expert ratings, the study identifies patient 5 as more likely to have FMS (closeness

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coefficient 0.881), while patient 1 is less prone (closeness coefficient 0.088).

INTRODUCTION

Fibromyalgia (FM) is a long-term condition that causes muscle and joint pain. The most common symptoms of this condition include muscle and joint stiffness, sleeplessness, fatigue, mood disturbances, cognitive impairment, anxiety and depression, sensitivity, and difficulty performing daily activities (Gerdle, 2008; Bennett, 2007). FM has also been linked to certain illnesses, including infections, diabetes, and rheumatic diseases, as well as neurological disorders (Bellato et al., 2012). Following the identification of areas of extreme sensitivity referred to as “pain points”, the term “Fibromyalgia” was subsequently developed (Smythe, H. A., & Moldofsky, H, 1977). As per the American College of Rheumatology, diagnosis of FM is based on two factors: (a) bilateral pain at or above the waist (centralized pain); and (b) chronic, generalized pain lasting at least 3 months (pain on palpation at or above 11 of 18 specified body sites) (Galvez-Sánchez et al., 2020). The prevalence of FM is estimated to affect approximately 5% of the global population. Women are more likely to develop FM than men, and the average age at which FM is present is between the ages of 30 and 35 (Wolfe et al., 1995). Accurate and early diagnosis is essential for providing timely treatment and improving the quality of life for individuals suffering from Fibromyalgia. Traditionally, Fibromyalgia diagnosis has relied on clinical judgment, which introduces subjectivity and may result in misdiagnosis or delayed diagnosis. However, advancements in computational and decision-making methodologies offer promising avenues for enhancing the diagnostic process. One of the methods that has been proposed for diagnosing Fibromyalgia is based on Fuzzy Multi-Criteria Decision Making (FMCDM). FMCDM is a technique that can handle uncertainty and vagueness in the decision-making process by using fuzzy sets and linguistic variables. Fuzzy sets are mathematical models that can represent imprecise or incomplete information, such as the degree of severity or frequency of symptoms. Linguistic variables are words or phrases that can express qualitative judgments, such as mild, moderate, or severe. One of the FMCDM methods that has been applied to diagnose Fibromyalgia is the fuzzy technique for order preference by similarity to the ideal solution (TOPSIS). In this context, the Fuzzy Technique for Order of Preference by Similarity to Ideal Solution (Fuzzy TOPSIS) emerges as a powerful tool for aiding healthcare professionals in the precise and systematic diagnosis of Fibromyalgia. Fuzzy TOPSIS is a multi-criteria decision-making method that accommodates the inherent uncertainty and vagueness often associated with medical diagnoses. It provides a structured framework for evaluating multiple criteria, each represented as fuzzy linguistic variables, to rank and select the most

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