A NEUTROSOPHIC FUZZY LOT FRAMEWORK FOR REMOTE HEALTHCARE

ABSTRACT

The remote healthcare industry faces significant challenges in data analytics, including handling complex, imprecise data while managing energy consumption and processing time. This paper introduces a novel and intelligent remote healthcare framework that integrates the Internet of Things (IoT) with Neutrosophic fuzzy systems. The proposed Blinder Oaxaca-based Shapiro Wilk Neutrosophic Fuzzy (BO-SWNF) method is designed to ensure precise data analysis with minimal time and energy consumption. The framework operates in three phases: data collection from the WESAD dataset using wearable sensors, a Blinder Oaxaca Linear Regression-based Preprocessing model for duplicate data elimination and energy efficiency, and a Shapiro Wilk Neutrosophic Fuzzy algorithm for robust data analysis. Experimental results demonstrate that the BO-SWNF method achieves a 12% improvement in data analysis accuracy, a 56% reduction in processing time, and a 54% minimization in energy consumption compared to existing methods.

EXISTING SYSTEM

The existing landscape of remote healthcare data analysis is populated by systems that leverage statistical and fuzzy methods. Prominent among these are the Neutrosophic MCDM method [1] for prioritizing vaccine groups and Grubbs's test under Neutrosophic Statistics [2] for identifying outliers in medical data. Other systems incorporate IoT for real-time monitoring [4] or employ fuzzy and neutrosophic sets for handling data uncertainty [6, 15]. The primary focus of these systems has often been on improving a single metric, such as classification accuracy or outlier detection.

Disadvantages of the Existing System:

1. High Energy Consumption: Systems like the Neutrosophic MCDM [1] do not dynamically manage the data sensing frequency of IoT devices, leading to inefficient energy use and swift depletion of sensor batteries.

2. Inadequate Data Analysis Accuracy: Methods such as Grubbs's test under NS [2] and the lightweight IoT model by Vedaei et al. [5] fail to incorporate robust normalization and fuzzification processes, resulting in lower accuracy in the final data analysis and decision-making.
3. Increased Processing Time: Many existing models, including those using T-Spherical Fuzzy sets [6], involve complex computational processes without efficient normality testing, leading to significant delays in data analysis and hindering timely medical interventions.

PROPOSED SYSTEM

The proposed system is a novel Blinder Oaxaca-based Shapiro Wilk Neutrosophic Fuzzy (BO-SWNF) framework for remote healthcare data analysis. This system is designed to holistically address the limitations of existing methods by integrating a specialized preprocessing stage with a robust data analysis model within an IoT sensor communication environment.

The framework operates in three distinct phases:

1. Data Collection: Health data is acquired from the WESAD dataset using two wearable devices: a chest-worn RespiBAN and a wrist-worn Empatica E4.
2. Blinder Oaxaca Linear Regression-based Preprocessing: This phase eliminates duplicate data and enhances energy efficiency. It uses a linear regression model for each device and applies the Kitagawa Blinder Oaxaca decomposition to dynamically adapt sensing frequency, followed by Min-Max normalization.
3. Shapiro Wilk Neutrosophic Fuzzy Data Analysis: This phase ensures robust and accurate analysis. It formulates a neutrosophic fuzzy set from the preprocessed data, performs union and intersection operations, and applies the Shapiro-Wilk test of normality to improve accuracy and minimize processing time.

Advantages of the Proposed System:

1. Significant Reduction in Energy Consumption: The Blinder Oaxaca preprocessing model dynamically adjusts the sensing frequency of IoT devices based on vital sign changes. This targeted approach minimizes redundant data collection, reducing energy consumption by 54% compared to existing methods.
2. Enhanced Data Analysis Accuracy: By applying Min-Max normalization to distinct data vectors and subsequent neutrosophic fuzzification, the system more accurately analyzes sample data. This results in a 12% improvement in overall data analysis accuracy.
3. Minimized Data Analysis Time: The integration of the Shapiro-Wilk test within the neutrosophic fuzzy decision-making process efficiently identifies data deviations from a normal distribution. This streamlines the analysis, achieving a 56% reduction in processing time and enabling faster medical decisions.

SYSTEM REQUIREMENTS

- **H/W System Configuration:-**
- Processor - Pentium –IV
- RAM - 4 GB (min)
- Hard Disk - 20 GB
- Key Board - Standard Windows Keyboard
- Mouse - Two or Three Button Mouse
- Monitor - SVGA

SOFTWARE REQUIREMENTS:

- **Operating system** **:** Windows 7 Ultimate.
- **Coding Language** **:** Python.
- **Front-End** **:** Python.
- **Back-End** **:** Django-ORM
- **Designing** **:** Html, css, javascript.
- **Data Base** **:** MySQL (WAMP Server).