Chapter 1
A New Algorithm to Determine the Density of a Balanced Neutrosophic Graph and Its Application to Enhance Education Quality

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ABSTRACT

The education system of a country to its citizens determines its success. The primary goal of providing education is to mold a person's entire personality and shape his career. Everyone, regardless of caste, creed, religion, gender, or any other factor, must have access to their choice's high-quality and indiscriminate education. At present, poverty, gender discrimination, regional imbalance, family background, and other unknown factors contribute to education inequality. In particular, the regional imbalance concerning academic opportunities and infrastructure plays a vital role. When there is uncertainty, balanced fuzzy graphs can resolve it. Furthermore, if indeterminacy exists, it can be efficiently dealt with by employing balanced neutrosophic graphs. A new algorithm for determining the density of a neutrosophic graph and establishing equilibrium in a neutrosophic graph is proposed in this study. A balanced neutrosophic graph structure is also modelled to demonstrate the proposed algorithm in the field of education to provide quality education with the selected parameters.

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INTRODUCTION

The theory of fuzzy sets (Zadeh, 1965), intuitionistic fuzzy sets (Atanassov, 1986; Atanassov, 1999), interval-valued fuzzy sets (Rashmanlou et al., 2021), and interval-valued intuitionistic fuzzy sets (Atanassov, 2020) are all generalisations of the fuzzy set theory. When compared to intuitionistic fuzzy sets, which cope with the incomplete, ambiguous, and inconsistent information seen in the actual world, neurosophic sets give the system greater precision. Smarandache first proposed the concept of the Neutrosophic set (Smarandache, 2010) in 2010. Smarandache added falsity-membership degree independently, which is not constrained in the normal interval [0,1], in line with fuzzy sets and intuitionistic fuzzy sets. The neutrosophic set provides the degree of a truth-membership (t), an indeterminacy-membership I and a falsity-membership (f) independently in the range [0,3], whereas the intuitionistic fuzzy set provides the degree of membership and the degree of non-membership of an element in the range [0,1]. Applications for communication networks, medical complexity, and traffic networking in neutrosophic graphs use pathways, walks, and circuits. This results in the development of new concepts and theorems.

Numerous real-time applications and research areas, including networking, image segmentation, medical diagnosis, data collection, system grouping, artificial intelligence, and problem-solving with incomplete information, make extensive use of the concepts of graph theory and its fuzzy graphs (FG) extension due to uncertainty. This representation of the terminology Balanced neutrosophic graph is based on the density functions provided in Al-Hawary (2011) and Karunambigai et al. (2013). Balanced graph extension has been the subject of multiple articles (Akram et al., 2014; Karunambigai et al., 2017; Sivasankar & Broumi, 2022), and it has a wide range of uses in artificial intelligence, robotic systems, computer networks, image analysis, and decision-making. Balanced fuzzy graphs and a few fuzzy graph operations first covered by Talal Al Hawary (2011). Balanced intuitionistic fuzzy graphs were defined and some of its properties were researched by Karunambigai et al. (2013). Balanced neutrosophic graphs were defined and their characteristics were examined by Sivasankar and Said Broumi (2022). Balanced bipolar fuzzy graph (Akram & Waseem, 2018) and balanced bipolar fuzzy graph (Akram et al., 2014) were introduced by Akram et al., and its applications were addressed.

A neutrosophic graph, as compared to fuzzy graphs, can handle the ambiguity and inconsistency of any information in any real-world circumstance. Neutosophic graphs (NG) were introduced as a new level of graph theory by Florentin Smarandache et al. (2005, 2016, 2019, 2022) as a generalisation of the fuzzy graph and the intuitionistic fuzzy graph. Single valued neutrosophic graphs (SVNG) are used in communication links where the link performance cannot be predicted. A great technique to achieve network-wide equilibrium for high-edge density flow is to balance the network. Motivated by the idea of a balanced graph and its expansions (Broumi et al., 2019), we focused on defining the condition to check the given graph is balanced or not (Mahapatra et al., 2019, 2020; Rashmanlou et al., 2014, 2021). We have proposed two algorithms in this paper, to check the given graph in balanced or not and to establishing equilibrium among nodes by converting the graph into balanced neutrosophic graphs. This paper organized as follows. In preliminaries, we discuss necessary definitions and theorems. The balanced neutrosophic graph and its properties are explored in the next section. In Algorithms section, two algorithms are discussed: 1. To check the given graph is balanced or not, 2. To convert unbalanced graph to balanced graph and illustration of the algorithms are also presented in this section and in next section, a balanced neutrosophic graph is modelled for providing quality education to all the people by maintaining equilibrium with the selected parameters, and the paper is concluded in final section.

Related Content