HYBRID ADMISSION SYSTEM USING FUZZY LOGIC AND BAYESIAN REASONING

Rationale

Notably, the widening of educational access has been facilitated by the Free Tuition Law in the Philippines, which provides tuition-free enrollment. However, some citizens' opportunities are hindered by limited slots in State Universities. Relying solely on score-based exams for admission may not be equitable, as they may not accurately gauge a student's comprehension or performance. The introduction of fuzzy logic into admission processes can mitigate this by accommodating the inherent variability in student understanding. The integration of Fuzzy Analytical Hierarchy Process into a Decision Support System to aid in determining scholarship awardees is explored by Mundzir, Zulkarnain, & Hardi (2023), while the suitability of fuzzy logic in crafting knowledge-based academic advising systems is underscored by Iatrellis et al. (2022), preserving the inherent fuzziness in learner models.

In Özok's (2023) article, the versatile applications of fuzzy logic beyond engineering problem-solving are highlighted, encompassing domains such as biological processes, neural networks, artificial intelligence, and genetic algorithms. Moreover, Bayesian Reasoning emerges as a pivotal concept in both probability theory and applied sciences, particularly in scenarios laden with uncertainty, as stated by Büchter et al. (2022). This approach entails grappling with Bayesian situations, added by Alencar Neto (2023), facilitating a more nuanced assessment process by incorporating pre-test probabilities and individual contextual factors to yield more precise post-test probabilities. Such a personalized approach not only enhances the fairness and accuracy of evaluations but also enables a more nuanced recognition of academic prowess. By discerning students' excellence in specific domains rather than solely

focusing on overall scores, the system can offer a more comprehensive evaluation of academic achievement.

The integration of fuzzy logic and Bayesian reasoning in admissions offers a nuanced approach to representing academic performance. By accommodating variability in student understanding, fuzzy logic ensures accuracy, while Bayesian reasoning incorporates contextual factors for personalized assessments. Together, these methods deepen understanding of student capabilities beyond numerical scores, enabling recognition of excellence in specific areas.

This approach not only recognizes excellence in specific academic domains but also ensures a more comprehensive understanding of students' capabilities beyond numerical scores. By embracing these innovative methods, the education system can better serve its diverse student population, fostering inclusivity, fairness, and excellence in higher education. As educational system continues to evolve, leveraging these sophisticated techniques holds the potential to reshape assessment practices, promoting a deeper and more comprehensive approach to evaluating learning outcomes.

Significance of the Study

The proposed research on " A Hybrid Approach to State University Admissions: Fuzzy Logic and Bayesian Reasoning for Holistic Evaluation " holds substantial importance in the educational landscape and aligns with key Sustainable Development Goals (SDGs), thereby addressing critical challenges and fostering positive societal impacts. Addressing educational inequities, the faces persistent challenges in ensuring equitable access to quality education, with disparities existing among socio-economic groups and geographic regions. Another is enhancing educational quality.

Scope and Limitations

This study focuses on the development and implementation of a hybrid approach to university admissions that integrates fuzzy logic and Bayesian reasoning for a more holistic evaluation of student applicants. The proposed system will consider multiple factors beyond traditional score-based assessments, incorporating contextual, behavioral, and socioeconomic variables to ensure a fair and comprehensive admissions process.

Specifically, the study will:

1. Develop a Decision Support System (DSS) that utilizes fuzzy logic to account for uncertainties in student performance metrics and Bayesian reasoning to update assessments based on prior and new evidence.
2. Apply machine learning techniques to analyze academic performance trends and assess students' likelihood of success.
3. Utilize Python (scikit-fuzzy, PyMC3) or MATLAB to implement the fuzzy and Bayesian models.
4. Conduct simulated testing using historical university admissions data to validate the effectiveness of the proposed approach.
5. Align the research with the Sustainable Development Goals (SDG 4 - Quality Education and SDG 10 - Reduced Inequalities) by promoting equitable access to higher education.

Limitations

Despite its potential, the study has several limitations:

1. **Data Availability** – The accuracy of the model depends on the availability and quality of historical admissions data. The study may be limited by incomplete or inconsistent datasets.

2. **Subjectivity in Fuzzy Logic Criteria** – The selection of membership functions and rule sets for fuzzy logic introduces subjectivity, which may affect the system's decisionmaking.
3. **Computational Complexity** – Bayesian reasoning requires significant computational resources, which may limit real-time processing for large datasets.
4. **Scope of Factors Considered** – While the study aims to incorporate multiple factors beyond test scores, it may not account for all possible socio-economic and personal variables influencing a student's potential.
5. **Institution-Specific Constraints** – The model will be tailored to a specific university setting, which may limit its generalizability to other institutions with different admission policies.
6. **Ethical and Privacy Concerns** – Using personal and socio-economic data in admissions decisions may raise concerns about data privacy and ethical considerations.

Objectives of the Study

Propose a novel method for evaluating university admissions applications in a more comprehensive and nuanced manner. This approach combines fuzzy logic, which deals with uncertainty and imprecision in data, with Bayesian reasoning, which allows for the incorporation of prior knowledge and updating beliefs based on new evidence.

Expected Outputs

Utilizing a fusion of fuzzy logic and Bayesian reasoning algorithms, this implementation aims to enhance evaluation processes by seamlessly integrating fuzzy logic for handling uncertainties and Bayesian reasoning for updating beliefs with new evidence. The approach seeks to offer a more precise assessment of each applicant's potential for success by considering a comprehensive array of factors, extending beyond mere academic grades and

test scores. By the use of Programming languages such as Python, MATLAB, or similar, Fuzzy logic libraries (e.g., scikit-fuzzy for Python), and Bayesian inference libraries (e.g., PyMC3 for Python).

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