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Advancing the Understanding of Complex Data Through AI-Powered Automated Visualization: Techniques and Application A Case Study Of Heritage Christian University College Student Enrolment

Isaac Kwesi Adjei[1], Albert Sackey[2], Mary Immaculate Sheela Lourdusamy[3], Sasikala P[4]*

[1,2]UG - Information Technology, HCUC, Accra, Ghana, India.

[3]Professor, Computing and Engineering, HCUC, Accra, Ghana, India.

[4] Associate Professor, Department of Computer science, Lal bahadur shastri Government First Grade College, Bangalore, India.

Emails: *isaackwesiadjei@gmail.com[1], albertsackey@gmail.com[2], drsheela@hcuc.edu.gh[3], shakthesasi@gmail.com[4]*

Abstract

To increase student enrollment, Heritage Christian University College (HCUC) is pioneering innovative data visualization methods. This study is an analysis of using artificial intelligence to create charts and graphs automatically. This, in turn, makes the complex data more accessible and engaging. We design the graphical representations based on advanced algorithms and features of the data, as well as the students' personal tastes. To perform this project, we took the most of the possibility of the technique we created to engage the whole audience. Students compared these images to traditional versions, which were made by humans, and assessed the truth, interest, and compatibility of each image. It is obvious that AI-based visualization better accomplishment of data presentation, which makes it simpler for the students to have a grasp of the university's prestige and its various programs.

Keywords: *Artificial Intelligence (AI), Data Visualization, Student Enrollment, Machine Learning, Decision-Making, AI-generated Visualizations, Statistical Analysis*

1. Introduction

The revolution of analytics in higher education is promoting data-driven decision-making by the institutions, hence the increasing demand for institutions to utilize data for making better-informed decisions. (Gagliardi et al., 2018) Nevertheless, this process can be hard, as the fact that we have to deal with volumes of data can be discouraging, and the absence of bidirectional knowledge transfer among different data sources can make it tough to derive information in solution spaces. (Wyne et al., 2015)

Data visualization is the key to comprehending and communicating complex information, especially in the educational sector, where data-based insights have a significant impact on the procedures of decision-making. This research study has two aspects: one is the use of artificial intelligence (AI) in generating automatic charts and graphs (collegiate High School 2023)to interpret enrollment data in a university and the second one is the use of a similar AI algorithm to generate visualizations of data that target the needs of the prospective students. In a bid to embrace advanced AI technology, we intend to design better visualizations using techniques that take into account the data's features so they are student-friendly and the enrollment officers are not neglected. This research compares the effectiveness of AI-generated visualizations to common techniques that are used in education, as a result, we get to see the apparent power of AI to change the given data and thus the relevant strategy in the student enrollment process is solved. A major part of the study is transforming the data as humans react over a period of time when insights are provided, but machines have a common pattern. (Mąkosa, 2020) [1-3]

2. Literature Survey

The aim of this research is to use data analysis to

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support decision making based on information, about existing students (as stated by Kunlapat and colleagues in 2024). The use of intelligence (AI), in visualizing data is transforming the field of education (Bhattacharjee, 2019) significantly when it comes to student enrolment and decision-making processes according to a publication by the (Liberty University on 2024-11-05) U.S Department of Education titled "Artificial Intelligence and its Impact on Teaching and Learning." The report highlights how AI has the power to streamline tasks and customize learning experiences while also being applicable, to data visualization methods. ((Alotaibi & Alshehri, 2023; Charow et al., 2021) The article "AIs Impact, on Education 4th Generation. The Shift in Learning Paradigm by the World Economic Forum (university of Greenwich 2024) highlights the role of AI(National University Online) in transforming education methods. By streamlining tasks such as creating illustrations through automation AI enables educators to allocate time towards areas such, as enhancing enrollment techniques and strategic planning(World Economic Forum). The systematic review, (Salas-Pilco, S. Begin original source. Hu, X. (2022.)) by Education Sciences titled "Artificial Intelligence and Learning Analytics, in Teacher Education" (Taylor, L., Gupta, V., & Jung, K.. 2024.)underscores the role of AI in examining and interpreting information effectively. MDPI's paper "Leveraging Visualization and Machine Learning Techniques in Education" explores the synergy between machine learning and data visualization. The findings suggest that these technologies can improve educational outcomes by providing clearer insights into data, which is crucial for making informed decisions in student enrollment (MDPI). McKinsey & Company's article "Analytics in Education: How Colleges and Universities Can Transform Outcomes" emphasizes the importance of advanced analytics in higher education. It discusses how data visualization tools, powered by AI, [4] can help institutions better understand enrollment trends and enhance their decision-making processes (McKinsey & Company). Innovare's article "Why Interactive Data Visualization is the Key to Better Student Outcomes" highlights the impact of interactive visualizations on education. It asserts that engaging visual tools can significantly improve comprehension and engagement, which is vital for prospective students evaluating their educational options (Innovare). DataCamp's "Data Science in Education: Transforming the Future of Teaching and Learning" examines the opportunities and challenges of implementing data science in education. It supports the idea that AI-driven data visualization can provide educators with actionable insights, ultimately benefiting student enrollment (DataCamp). Moldstud's article "Utilizing Data Visualization in Admissions Decision-Making" discusses the practical applications of data visualization in the admissions process. It reinforces the concept that clear, compelling visualizations can streamline admissions decision-making and improve prospective students' understanding of the university's offerings (Moldstud). Thongkaew et al.'s study, "Data Analytics for Admission Process: Bachelor of Engineering Program," further supports the use of data analytics in improving the admissions process. This research highlights how data visualization can be applied in specific academic programs to enhance decision-making and attract prospective students (Thongkaew et al., 2023). Webber's paper "Using Data to Improve Admissions Processes," retrieved from the UGA.edu website, provides additional insights into the practical benefits of data-driven admissions strategies. It underscores the importance of leveraging data to make informed decisions that can positively impact enrollment outcomes (Webber, N.d.). In summary, the reviewed literature underscores the transformative potential of AI-powered data visualization in educational settings. The application of AI in automating and enhancing data visualizations can significantly improve the comprehension and presentation of enrollment data, thereby supporting informed decision-making and driving student admissions. [5]

3. Research Gap

While there has been research conducted regarding the application of AI, in educational data visualization there are significant areas that warrant further investigation. Numerous studies highlight the advantages of AI; however, they do not delve deeply

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into its potential to enhance the enrollment process for students. Additionally, most research fails to examine how individuals without expertise, such as students, perceive AI-generated visual representations compared to methods. Furthermore, defined criteria are absent, for assessing the effectiveness of these visual aids. The exploration, into AI's ability to generate representations tailored to individual preferences, remains relatively alien territory. [6]

4. Problem Formulation

Data visualization is a tedious and skill-demanding practice causing obstacles for departments such as the student enrollment office at Heritage Christian University College if they do not belong to that department. While the enrolled data is usually required, fast and clear reporting is critical to the management of the operation and to the success of recruitment campaigns. The goal of our project is to come up with a system that leverages artificial intelligence by producing spectacular visualizations from the enrollment data. Therefore, this tool is not only able to generate authentic and interesting pictorials but is also easy to be handled by non-skilled end-users. Through the means of this method, we hope to simplify one of the university's tasks of data visualization, thus we will make the whole process quicker and more accessible consequently the university's enrollment efforts will be supported.

5. Methodology

Research Type: Quantitative research

Unit: Enrollment data from the student enrollment department at Heritage Christian University College (HCUC)

5.1.Methods and Tools of Data Collection / Analysis

5.1.1. Data Collection

- To gather enrollment data from the Heritage university's student enrollment department.
- To ensure accuracy and consistency after clean and preprocess the data.

5.1.2. AI Model Development

Design and implement an AI model To generate visualizations. using the prepared HCUC enrollment data to Train the AI model.

5.1.3. Visualization Generation

- Use the AI model to create various visualizations based on the HCUC enrollment data. [7]
- Ensure that the visualizations cater to different user preferences.

5.1.4. Evaluation

- Conduct a survey with a sample group of prospective students and staff in HCUC.
- Use a structured questionnaire to collect feedback on the visualizations.
- Measure the accuracy, user satisfaction, and ease of comprehension of the visualizations.
- Compare the AI-generated visualizations with traditional human-created ones. [8]

5.1.5. Analysis

- Perform statistical analysis on the survey data. Collected at HCUC.
- Evaluate the performance of AI-generated visualization model in terms of accuracy, user satisfaction, and ease of comprehension.
- Determine the impact of AI-generated visualizations on decision-making and student attraction.

5.1.6. Steps to Achieve Objectives

- Collect and prepare the enrollment data.
- Develop and train the AI model.
- Generate visualizations using the AI model.
- Conduct surveys to gather feedback on the visualizations.
- Analyze the survey results to compare AI-generated and traditional visualizations.
- Present the findings and assess the potential benefits of AI-driven data visualization. [9]

6. Expected Outcomes

This study of the research aims to build an AI system that is able to instantlyproduce high-level visualizations of the enrollment data. This will beuseful in the student's enrollment at the Heritage Christian University College as they will find the complex data easier to handle and besides, the presentation job will be an easy task. A program is

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under development that presents images that are accurate, convenient, and attractive even for those who are non-experts in using them. The project for the sake of AI-generated visualizations will argue that AI can contribute very significantly to the decision-making applications, improvement of user satisfaction, and potential students as well to see clear and appealing data presentations. To sum up, this paper will act as a sign of the capabilities of AI in data visualization strengthening learning institutions.

Conclusion and Future Scope

Ultimately, this paper underlines the possible effects of AI-based automatic data visualization on the efficiency and readability of statistical data in the enrollment of HCUC. By creating an AI-enabled system that develops easy, effective, and user-friendly visualizations, our goal is to advance decision-making processes and draw more probable students. This could be a very positive outcome of this project as AI-generated conceptualizations will be able to make the users happy and feel that they have a better understanding of the information and thus the non-experts will have an easier time using data. As far as future applications go, the current project has laid the path to a variety of directions. Further investigation on this direction can be carried out by delving into the customization of visualizations specific to the users' individual choice and situation, thus introducing personalization. Furthermore, the use of AI-powered data visualization not only within the university, but in other departments could provide the institution with more substantial information and advantages. Moreover, long-term research can probe why some institutions in higher education still have experienced enrollment shortages even though there was a great deal of assistive Technology. Therefore, this project is a first step toward a data-driven approach in education, thus highlighting the powerful and disruptive effects that AI may have in data visualization. [10]

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