

## RESEARCH ARTICLE AN EMERGING ISSUE: FROM DATA TO DECISIONS: LEVERAGING MACHINE LEARNING FOR EFFECTIVE MANAGEMENT STRATEGIES

WALEED YOUNUS<sup>1\*</sup>, ABID JAMEEL<sup>2</sup>, TARIQ SADAD<sup>3</sup>

<sup>1\*</sup> Ministry Of Finance, Government of Pakistan; [waleed.younus@gmail.com](mailto:waleed.younus@gmail.com)

<sup>2</sup> Department Of Computer Science & Information Technology, International Islamic University, Islamabad, Pakistan; [abid.jameel@iiu.edu.pk](mailto:abid.jameel@iiu.edu.pk)

<sup>3</sup> Department Of Computer Science University of Engineering and Technology Mardan, Pakistan; [tariqsadad@gmail.com](mailto:tariqsadad@gmail.com)

(Corresponding Author: Waleed Younus Email Address: [waleed.younus@gmail.com](mailto:waleed.younus@gmail.com))

**Abstract:** With the emergence of ChatGPT, the application of artificial intelligence in university student affairs management has become a hot research topic. This article explores and analyzes the application of artificial intelligence in university student affairs management, including student information management, student services, and student mental health. Artificial intelligence can effectively improve the efficiency and quality of student affairs management, such as optimizing student services through data mining technology and improving student mental health management through natural language processing technology. However, artificial intelligence also faces some challenges and problems in university student affairs management, such as technical application limitations and privacy protection. Therefore, we need to strengthen legal and ethical constraints while applying artificial intelligence, protecting the privacy and rights of students.

**Keywords:** Artificial Intelligence; Machine Learning; Data Mining; Student Affairs Management; University Students.

### 1. Introduction

With the continuous integration of artificial intelligence technology into various sectors, including university student affairs management work, the potential for AI to revolutionize administrative processes becomes increasingly evident. AI, with its sophisticated technology utilizing machine learning algorithms, neural networks, and natural language processing (NLP), has demonstrated transformative impacts across diverse industries like healthcare, finance, and manufacturing. In the educational landscape, particularly in university student affairs management, AI holds the promise of better understanding the needs and behavior patterns of students. This translates into the ability to provide personalized support and advice while simultaneously reducing the workload on administrative staff. As universities embrace the possibilities offered by AI, this article aims to explore and analyze the application of artificial intelligence in university student affairs management. The goal is to assist universities in effectively responding to the changes brought about by the AI era, ultimately enhancing the efficiency and quality of student affairs management as presented in Figure 1.



Figure 1. AI in university student affairs management

While the integration of AI into educational management is still in its early stages, the promising outcomes witnessed in AI-driven learning systems provide a foundation for further exploration. These systems offer the potential to personalize the learning experience, deliver real-time feedback, and identify potential issues at an early stage. Additionally, AI can assist educators in recognizing individual student strengths and weaknesses, enabling them to tailor their teaching methodologies accordingly. However, it is crucial to acknowledge that the incorporation of AI in educational management brings forth ethical, legal, and social challenges, echoing concerns prevalent in other industries. Issues such as potential biases and discrimination, privacy concerns, and impacts on the labor market emerge with the widespread use of AI in education. Therefore, a meticulous evaluation of the application of AI in educational management is imperative to navigate and address these complexities, ensuring a balanced and ethical integration of this transformative technology.

### 1.1.Application of AI in Education

#### 1.1.1. The application of AI in university student information management work.

The application of artificial intelligence technology in university student information management work can help universities manage student information more efficiently, increase the value of information utilization, and improve the quality of information management [4]. Firstly, AI technology can be applied to the classification and management of university student information. Through intelligent data classification and storage technology, student information can be quickly and accurately classified and managed, making it convenient for university administrators to access and analyze information. Secondly, AI technology can also be applied to the analysis and mining of university student information. For example, by using AI technology to analyze students' personal information, course grades, and other data, universities can better understand students' learning habits, academic performance, and study status, thereby providing personalized teaching services for students [5]. Additionally, AI technology can also be applied to the security protection of university student information. Universities can use AI technology to monitor and assess student information in real-time, timely identify and prevent information security risks, and ensure the security and confidentiality of student information [6]. Finally, AI technology can also be applied to the sharing and openness of university student information. By establishing an open sharing platform, student information can become more transparent and convenient, while also facilitating information sharing and collaboration among university administrators, thus increasing the value of information resources.

### 1.1.2. The application of AI in university student service work.

The application of AI technology in university student service work can help universities provide personalized services more efficiently, improve service quality, and satisfaction [7]. Firstly, AI technology can be applied to the self-service system of university student services. Secondly, AI technology can also be applied to the intelligent consultation system of university student services as presented in Figure 2. Additionally, AI technology can be used in the personalized recommendation system of university student services. Finally, AI technology can also be applied to the predictive analysis system of university student services. By analyzing student behavior and trends, the system can predict the problems and needs that students may encounter and provide corresponding services and support in advance, avoiding situations where students are unable to solve problems in a timely manner [8]. One case of the application of AI in student work at universities is the Spartan Chatbot developed by Michigan State University in the United States. The Spartan Chatbot is an intelligent virtual assistant designed to provide students with fast and convenient question answering and information retrieval services. Students can interact with the university through Spartan Chatbot at any time and place without worrying about time and location restrictions. The functions of the Spartan Chatbot include but are not limited to course registration, course grading, course selection, campus activities, student life, campus resources, and other related issues. Students can use Spartan Chatbot on their phones, computers, or other devices, which allows them to access this information anytime, anywhere, without waiting or queuing. The development of Spartan Chatbot has significant advantages in improving student satisfaction, reducing labor costs, and improving work efficiency. Compared with traditional human consultation services, Spartan Chatbot can handle a large number of questions and provide accurate answers quickly, while also reducing the risk of human error. However, Spartan Chatbot still has some shortcomings. For example, in issues related to personal privacy and sensitive information, Spartan Chatbot's responses may not be as thorough and personalized as human consultants, and may not provide emotional and psychological support. In addition, Spartan Chatbot's responses are limited by its programming and semantic analysis algorithms, and may sometimes lead to misunderstandings or inaccurate answers [9].

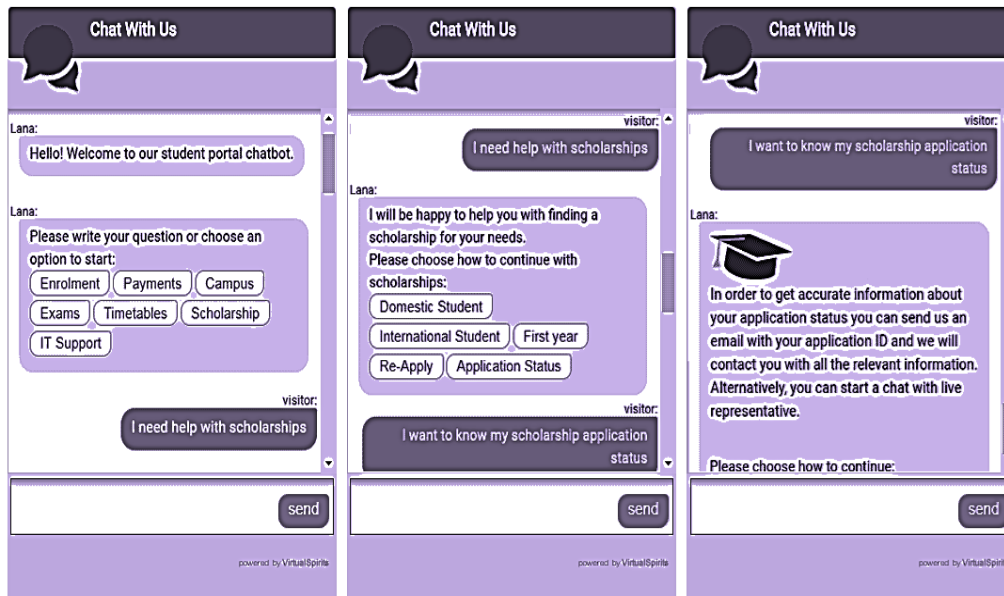


Figure 2. Chatbot for students

### **1.1.3. The application of AI in the mental health work of college students**

The application of AI technology in the mental health work of college students can help colleges and universities better understand the mental health status of students, provide personalized psychological support and assistance, and effectively prevent and address psychological problems [10]. Firstly, AI technology can be applied to the mental health assessment system for college students. By analyzing students' psychological questionnaire data and behavioral data, the system can automatically identify students' mental health status and provide corresponding recommendations and support. This helps colleges to understand students' mental state in a timely manner, prevent and address mental health issues in advance, and effectively reduce the incidence of mental health problems [8]. Secondly, AI technology can also be applied to the mental health counseling system for college students. For example, at the University of Michigan, the Counseling and Psychological Services (CAPS) uses natural language processing technology to analyze conversations between students and mental health professionals in order to better understand the students' mental health conditions. The center also utilizes machine learning algorithms to predict students' mental health conditions based on their answers, so that potential psychological problems can be identified and treated earlier. Additionally, AI technology can be applied to the intervention system for college students' mental health. For example, universities can automatically identify students' psychological problems and provide corresponding intervention plans based on the type of problem through an intelligent intervention system, such as using music therapy or interactive games for intervention, effectively improving the effectiveness of psychological intervention. Finally, AI technology can also be applied to the psychological crisis early warning system for college students. By analyzing students' behavior and language data, the system can automatically identify students' psychological crisis status, issue timely warnings and notify relevant staff and institutions, in order to intervene and provide support in a timely manner. For example, the Hefei National Comprehensive Science Center for AI and Anhui Baohulu Information Technology Group jointly released the "AI Behavior Analysis Intelligent Psychological Detection System". The system uses hierarchical evaluation and daily emotional evaluation using non-invasive information. For high-risk groups, it uses professional intelligent psychological health assessments and integrates evaluation, early warning, intervention, monitoring, and other information into visualized data, achieving dynamic management of psychological management. This AI system proactively intervenes in student psychological crises, records student counseling problems, goals, guidance teacher assessments, guidance suggestions, and other multiple dimensions to establish a complete student psychological health record, effectively avoiding student psychological health risks, and allowing every mind to see the sun.

### **1.1.4. The application of AI in the protection of privacy for college students.**

In the protection of student privacy in universities, AI technology can be applied in the encryption, secure storage, access control, privacy tracking, and protection of privacy data. Its main purpose is to protect the personal privacy and information security of students, prevent privacy leakage and abuse [11]. Firstly, AI technology can be applied to the encryption and secure storage of student privacy data in higher education. Through automatic encryption algorithms, personal privacy data of students can be encrypted to ensure the security of the data. At the same time, secure storage technology can store privacy data in secure cloud servers to prevent data from being attacked, stolen or altered by hackers during transmission and storage processes. Secondly, AI technology can be applied to access control of student privacy data in universities. Through intelligent identity authentication and access control technology, access permissions and usage scope of the data can

be restricted, preventing unauthorized personnel from obtaining students' private information. At the same time, the system can also automatically identify abnormal and illegal access behavior, and timely alert and report relevant departments and personnel. In addition, AI technology can also be applied to the tracking and protection of students' privacy in universities. For example, the system can automatically detect whether students' personal information has been leaked or abused, and monitor and dispose of abnormal situations in a timely manner. At the same time, AI technology can also provide students with tools and services for autonomous privacy protection, such as anonymous browsing, secure communication, etc., to help students better protect their privacy information.

## 2. Overview of Educational Management

Educational management encompasses the strategic coordination of resources—human, financial, and physical—within educational institutions to attain specific goals and objectives. This comprehensive process involves planning, organizing, directing, and controlling various activities, including curriculum development, teacher training, student assessment, and school budgeting. The efficacy of educational management is pivotal in ensuring the smooth and effective operation of educational institutions, ultimately delivering quality education to students. According to Bush et al. [1], educational management constitutes a crucial field of study, offering insights and methodologies that enable educational institutions to meet their objectives. The authors emphasize the significance of employing management techniques and tools, such as strategic planning, performance management, and financial management, to achieve effective educational management. Leadership emerges as a cornerstone in educational management, as highlighted by Leithwood, et al. [2]. Effective leaders play a vital role in creating a vision for the institution, setting clear goals, nurturing a talented staff, and fostering a positive school culture. Teacher development stands out as another pivotal aspect. Student assessment, according to Black et al. [3] is integral to educational management and should be formative, ongoing, and seamlessly integrated into the teaching and learning process. Lastly, budgeting and resource management are also critical for efficient allocation of resources to fulfill educational goals.

## 3. Model for Decision Making Based on Data

Technology is having a big impact on education, changing how schools operate and how teachers carry out their jobs. Data-driven AI systems are essential in higher education because they automate operations like grading, exam evaluations, and administrative duties. This improves student evaluation and self-learning skills as well as operational efficiency, which boosts confidence and academic results. Because of their great accuracy, short processing times, and variety of algorithms that work well for classification or regression issues, AI and machine learning (ML) are becoming more and more common in information analysis. When used in conjunction with other decision-making tools, educational data mining can help educational institutions improve their admissions standards and recurring curricula. There are many indicators available to evaluate the performance of these models, but the efficiency of assessment varies depending on the particular field and the system's goals. The purpose of this study is to forecast students' GPAs and assess whether or not they are qualified to finish a course, with a focus on accuracy in these assessments. The study examines decision-making processes in postsecondary educational establishments and evaluates how well they serve institutional governance.

The proposed model shown in Figure 3 is employed to collect, retrieve, and examine student reports from several sources, hence resolving decision-making difficulties, reaching decisions, and

participating in interactive processes. As the decision-making process progresses, it becomes feasible to determine which resources are best for learning the most relevant skills and implementing an adaptable and participatory evaluation strategy that meets the needs of students and teachers alike. This makes it easier to match teaching-learning objectives and strategies with learners' preferences and the most appropriate competencies. The suggested model centers on decision-making through the prediction of outcomes for multiple graduate students, allowing higher authorities to act on data with a more profound comprehension when making strategic decisions about things like teacher management, resource planning, dropout rates, and student retention. In addition, this method shortens processing times, increases the trust in forecasts, and promotes the creation of theories and the discovery of latent patterns.

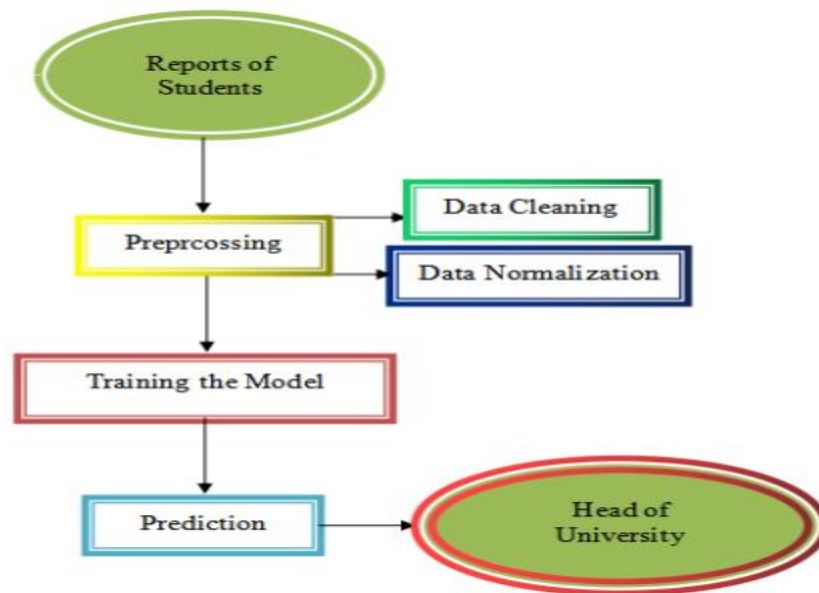


Figure 3. Proposed model

In the process of leveraging machine learning for student performance prediction, a systematic approach is followed, encompassing data input, preprocessing, model training, and prediction.

- **Data Input:** The data input consists of student reports containing relevant information such as academic performance, attendance, and any other pertinent variables. Each report serves as an input instance for the machine learning model.
- **Preprocessing:** Before training the machine learning model, data preprocessing is crucial to enhance the quality and reliability of the input data. This involves two main steps: data cleaning and normalization.
- **Data Cleaning:** Identify and handle missing or erroneous data points, ensuring the dataset is free from inconsistencies.
- **Data Normalization:** Standardize numerical features to a common scale, preventing any particular feature from dominating the model training due to its magnitude.
- **Training the Machine Learning Model:** The preprocessed data is then split into training and testing sets, with an 80-20 ratio. The training set, comprising 80% of the data, is used to train the machine learning model. Support vector machine (SVM) is employed for the prediction task.

- Prediction: Once the model is trained, it is ready for prediction. Employing the trained model, student reports are inputted, and predictions are generated. These predictions serve as a valuable tool for higher authorities in the university to make informed decisions.
- Collect, Retrieve, and Examine Student Reports: The model is employed to collect and retrieve student reports from various sources, consolidating information for analysis.
- Resolve Decision-Making Difficulties: The predictions provide insights into student performance, aiding in resolving decision-making difficulties faced by university authorities.
- Reach Decisions and Participate in Interactive Processes: The predicted outcomes contribute to decision-making processes, allowing higher authorities to participate in interactive discussions based on data-driven insights.

The objectives set by higher management significantly influence the strategies, plans, and activities undertaken by institutions. ML model is employed to analyze data and offer a more profound interpretation of information within a specific context. In the context of higher education institutions, machine learning algorithms are applied to analyze student data, graduation rates, and curriculum development, informing decisions at various levels. Among other things, this model may enhance decision-making procedures, learning objectives, and performance measures. It is an important instrument for improving the general efficacy and efficiency of universities by utilizing knowledge gained from the examination of student, graduation, and curriculum development data as presented in Figure 4.

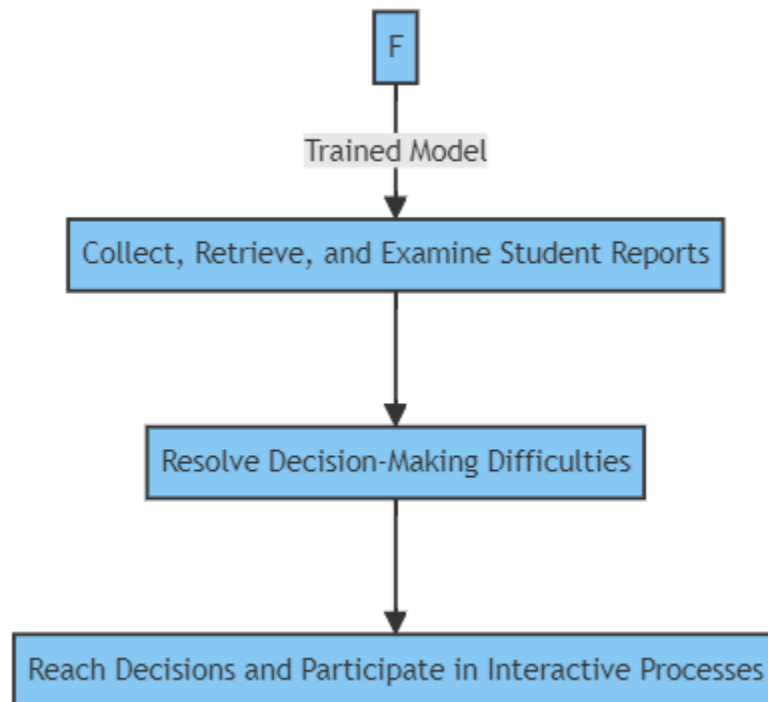


Figure 4. Model for decision

### 3.1.Support Vector Machine (SVM)

For problems involving regression and classification, supervised machine learning algorithms such as SVM are employed [13]. It works especially well for issues involving binary classification.

Finding the hyperplane that optimally divides the data into distinct classes while maximizing the margin between the classes is the fundamental notion behind SVM. The distance between the closest data point from either class and the hyperplane is known as the margin. This margin should be maximized by SVM.

Mathematically,

$$M = 2/\|w\|$$

Where,  $\|w\|$  is the Euclidean norm of the weight vector  $w$

A key element that enables the technique to function in a high-dimensional environment without directly computing the coordinates of data points in that space is the kernel function of a SVM [14]. The kernel function computes the dot product of the data points in a higher-dimensional space as opposed to working directly with the input features. When dealing with non-linear decision limits, this is especially helpful as illustrated I Figure 5.

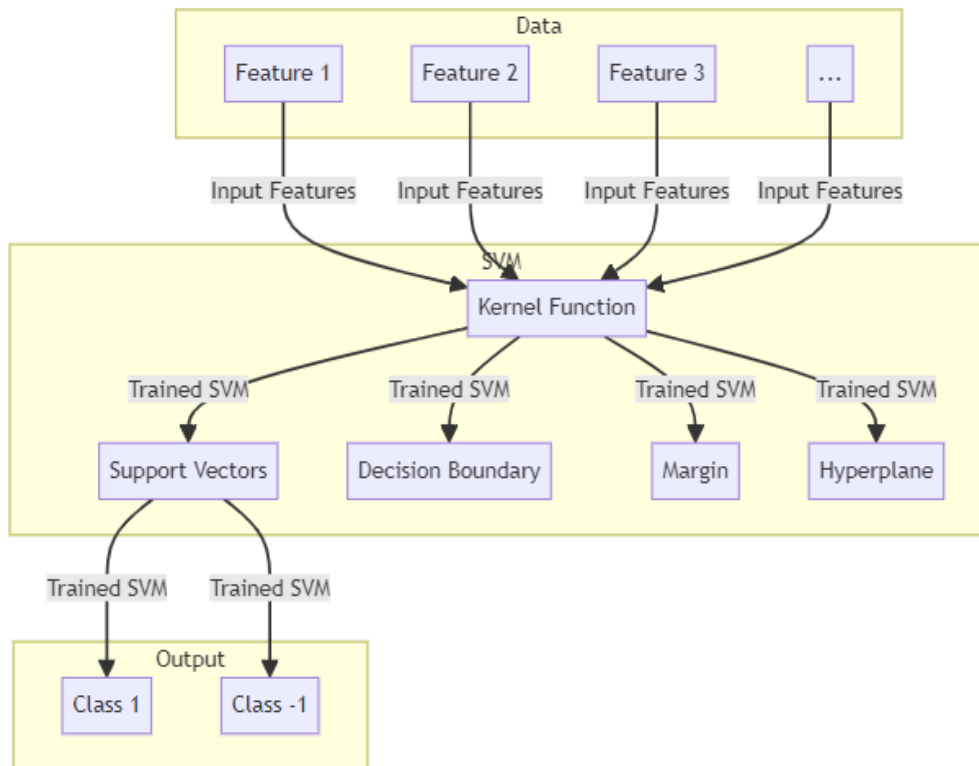


Figure 5. Illustration of SVM.

#### 4. The challenges and issues faced by AI in college student affairs management.

As AI technology is gradually applied in college student affairs management, it also faces some challenges and problems [12]. Firstly, the limitation of technology application is a major issue. Although artificial intelligence technology has great prospects for application in university student affairs management, some functions cannot be fully implemented due to current technological limitations, such as the identification and intervention of student mental health management. Secondly, privacy protection is also a matter that needs attention. When using AI technology to



collect, process and use student information, how to protect the privacy and personal information security of students is an urgent issue that needs to be addressed. Finally, ethical issues also need to be taken seriously. For example, biases and discrimination in artificial intelligence algorithms may result in unfair treatment of certain students, and relevant ethical guidelines and regulatory mechanisms need to be developed to regulate their application. Therefore, while applying artificial intelligence technology, we need to strengthen legal and ethical constraints to protect the rights and interests of students, and continuously promote technological innovation and improvement to better serve the work of student affairs management.

In the realm of educational management, AI emerges as a transformative force poised to revolutionize various facets of education. One key area of impact lies in data analysis and decision-making, where AI systems process extensive educational data, providing administrators with valuable insights into student performance, attendance patterns, and resource utilization. Additionally, AI facilitates personalized learning experiences by tailoring educational content to individual student needs, fostering engagement and accommodating diverse learning styles. Administrative tasks such as scheduling, grading, and resource allocation are streamlined through AI, allowing institutions to focus on strategic planning and overall efficiency. Predictive analytics enable early intervention for at-risk students, while AI technologies recommend up-to-date learning materials for educators, ensuring dynamic and aligned curricula. Virtual assistants powered by AI handle administrative tasks, grading processes are automated for quick and consistent feedback, and adaptive assessments adjust difficulty based on individual student performance. AI identifies areas for teacher improvement and supports teacher professional development. Chatbots offer instant support to students, enhancing the overall student experience. However, the transformative potential of AI in university education comes with limitations and challenges. Biases in training data may lead to unfair outcomes, particularly in admissions. Despite advancements, not every student's unique needs may be addressed, raising concerns about educational disparities. Ethical and privacy concerns surround the processing of sensitive student data, and overreliance on technology may diminish the human touch in education. Lack of transparency in AI decision-making processes and financial and technical constraints pose challenges to implementation. Resistance to change, the inability of AI to fully replace human interaction, unintended consequences, and the dynamic nature of education further highlight the need for careful consideration in integrating AI into educational systems. Addressing these limitations is crucial for harnessing the full potential of AI while ensuring ethical, inclusive, and effective educational practices.

## 5. Conclusion

The application of AI technology in university student affairs management has important significance and practical value. Universities need to strengthen research and application of AI technology, continuously optimize service and management systems, improve student satisfaction and campus experience, and inject new energy and vitality into the information construction and development of universities. In the future, universities need to strengthen research and application of artificial intelligence technology, continuously optimize service and management systems, improve student satisfaction and campus experience, and inject new energy and vitality into the information construction and development of universities.

## References

- [1] Bush, T., & Glover, D. (2014). *Educational management: Major themes in education*. London: Routledge.

- [2] Leithwood, K., Seashore Louis, K., Anderson, S., & Wahlstrom, K. (2004). How leadership influences student learning. New York: The Wallace Foundation
- [3] Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice*, 5(1), 7-74. doi: 10.1080/0969595980050102
- [4] Wang Ke. The Current Situation and Countermeasures of College Students' Mental Health Issues. *Social Development Research*, 2018(3):122-124.
- [5] Hu Guanghui, Chen Li. On the Role and Effectiveness of College Counselors in University Students' Mental Health Education. *Modern Education Management*, 2020(2):70-72.
- [6] Wang Guixia. On the Current Situation and Countermeasures of Mental Health Education in Colleges and Universities. *Education Modernization*, 2021(4):32-34.
- [7] Wang Hongwei, Zheng Lin. On the Importance and Strategies of Psychological Health Education for College Students [J]. *Chinese Youth Research*, 2019(6):77-79.
- [8] Zhou Zhenzhong. On the Role Positioning of Counselors in College Mental Health Education [J]. *Youth Teacher Education Forum*, 2020(5): 66-68.
- [9] Sun Xiaofeng. On the Prevention and Intervention of College Students' Mental Health Problems. *Humanities and Social Sciences*, 2018(6): 94-96.
- [10] Ma Xiaolong. On the current situation and countermeasures of college students' mental health education. *Youth Teacher Education Forum*, 2021(1): 63-66. [8] Jiang Dong, Ma Yamei. On Strategies and Countermeasures for Mental Health Education in Colleges and Universities. *Chinese Journal of School Health*, 2019(4): 107-110.
- [11] Lv Ying. On the role positioning of college counselors in college students' mental health education. *Youth Teacher Education Forum*, 2021(2): 59-61.
- [12] Wang Xiaoqiang. On the Current Situation and Countermeasures of College Students' Psychological Health Education. *Higher Education Research*, 2020(4):96-98.
- [13] Almutiry, Omar, et al. "A Novel Framework for Multi-Classification of Guava Disease." *Computers, Materials & Continua* 69.2 (2021).
- [14] Alyami, Jaber, et al. "Cloud computing-based framework for breast tumor image classification using fusion of AlexNet and GLCM texture features with ensemble multi-kernel support vector machine (MK-SVM)." *Computational Intelligence and Neuroscience* 2022 (2022).