Deployment of Natural Language Processing in Education

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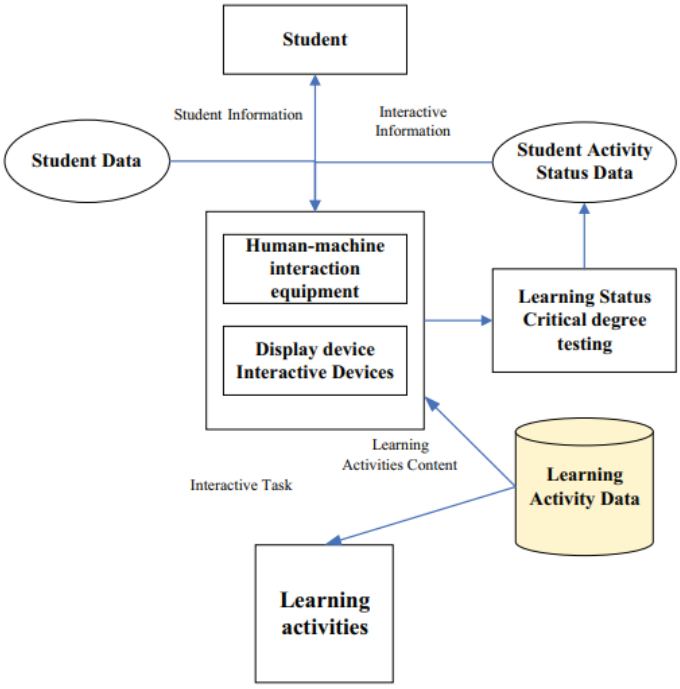
Abstract

This technical report explores the possibilities, difficulties, and results that arise from the convergence of deep learning technology and artificial intelligence (AI) and their revolutionary effects on education. The paper covers important topics including privacy, curricular integration, NLP model building, analytics, teacher training, and monitoring while keeping a focus on the SUM Values, Fast Track Principles, and PBG Framework. The study is enhanced by real-world case studies such as the DL-ALS project. The paper, which places a strong emphasis on the ethical use of AI, provides a thorough framework for the responsible integration of AI in education. It guides readers through the intricacies of artificial intelligence in education while offering a well-organized summary for future study and advancement.

1.1 Introduction

Artificial Intelligence (AI) and education have brought about a paradigm shift in how we approach and support learning in recent years. The integration of AI deep learning technology into the educational domain has become a fundamental concern, with the potential to impact the future of learning, as educators, students, and institutions contend with the constantly changing environment of educational techniques and technologies. This report is an investigation into the complex network of opportunities, difficulties, and outcomes that emerges from the convergence of AI deep learning technology with the educational field. This report's main goal is to dissect the complex layers of AI deep learning technology used in education. We will examine the essential elements of this developing paradigm, highlighting its potential to transform education, streamline administrative duties, and provide individualized learning programs. The PBG Framework, the Fast Track Principles, and the SUM Values are the three essential building pieces of the AI project delivery ecosystem that are at the center of our investigation and help in the deployment of NLP in education. These components offer the structure that will allow us to analyze the effects and consequences of NLP in education. Determining the limits of our investigation is crucial. Although Natural language processing (NLP) has many potential uses in education, this paper aims to present a clear, thorough review of the most important features while maintaining a manageable scope for further investigation. We will discuss the fundamental tenets of the ecosystem for NLP project delivery in education, appreciating its importance and implications. It is crucial to recognize that this vast topic has many complexities and case studies, and the report will not cover them all. Rather, it offers an organized synopsis that acts as a springboard for additional research.

Theoretical Framework



2.0 Background of the AI Project: Using Deep Learning Technology to Improve Education

Education is one field that artificial intelligence (AI) has had a significant impact on, among many other industries. AI technologies are essential to changing the way we teach and learn as educational paradigms continue to shift. An overview of an NLP-AI initiative that aims to transform education through deep learning technology is given in this background section.

2.1 The Four Educational Revolutions

Finding milestones in the rapidly evolving field of technology aids in our comprehension of the state of the art. Education has seen four major revolutions, following the example of the industrial revolution's "Industry 4.0":

Education 0.0: Based on oral traditions and spoken words, oral education is the oldest type of instruction.

Education 1.0: Recorded the printing press's development allowed for the mass creation and distribution of educational materials, which gave rise to education.

Education 2.0: The expansion of electronics and telecommunications during the second industrial revolution served as a catalyst for the development of audio-visual education.

Education 3.0: Linked Education emerged because of the internet and linked devices, changing how students engage with and obtain information from educational materials.

Education 4.0: The newest revolution in education is called "smart education," which offers intelligent and adaptable learning experiences through the intricate fusion of deep learning technologies and natural interfaces. (Kloos et al., 2020)

2.2 The AI Inclusion in Education

AI technology has been at the forefront of pedagogical and educational advancements for the past ten years. As artificial intelligence (AI) develops quickly and becomes more widely used, study in the discipline is increasingly focused on how NLP could improve intelligence and teaching effectiveness. The idea of an intelligent classroom has become more popular in this context. The intelligent classroom is an example of how artificial intelligence (AI) technology has been deeply incorporated into the educational ecosystem. It makes it easier to integrate subject knowledge and guidance in the classroom, which fosters deeper learning and the overall development of students. (Liu Y. et al., 2022)

2.3 Challenges in Existing Educational Technologies

Universities are facing a number of difficulties in using the current information technology. According to Agung and Gaol (2012) and Roberto et al. (2020), there are problems with teacher-student and human-computer interactions, outdated teaching approaches, and low student awareness of independent learning. The development of an intelligent and effective in-class teaching model built on AI technology is important to address these issues. This strategy seeks to improve the effectiveness and caliber of teaching and learning by motivating both teachers and students. (Agung & Gaol, 2012 add page number)

2.4 Deep Learning Techniques in Education

Although adopting deep learning in the classroom is a positive move, it adds analytical aspects and several points of view. There are challenges and disagreements associated with using AI in education. A method to predictive modelling called Deep Knowledge Tracing (DKT) has generated a lot of discussion among educators. These discussions include social, semiotic, and

epistemological aspects. The DKT issue demonstrates how the domains of learning analytics, educational data mining, and data science interact to influence the creation, interpretation, and commercial interests of the artificial intelligence community (Perrotta & Selwyn, 2020).

2.5 Future of Continuous Interrogation

Education research must critically examine presumptions and unsolved tensions as AI develops further and introduces new prediction paradigms. Premature closes should be avoided, and continuous critical inquiry should be encouraged (Drežewski & Solawa, 2021). Even while it's not without its challenges, integrating AI into education has the potential to greatly improve student learning. For instance, it is crucial to recognize the important information that current models have produced about cognition and learning even as we critique their shortcomings and take this into account when determining how education will develop in the future (Liu et al., 2021).

2.6 The Project DL-ALS

The DL-ALS project, which stands for Deep Learning-Based Adaptive Learning System, offers an impressive method in conjunction with the larger AI in the education scene. Responsive Web Design (RWD) is used as the learning interface, which makes use of the refined ResNet50 model and gives students the freedom to contribute their artwork whenever they choose, regardless of the time, place, or device. This method boosts learning accomplishment and art performance while strengthening professional information retention in pupils. Students are motivated, encouraged to practice a lot, and their self-efficacy, learning attitude, and motivation are all increased by offering a variety of interactive animations (Chiu et al., 2022).

3.0 Responsible AI Assessment

To ensure responsible and ethical implementation, a thorough assessment is required before integrating AI technology into the education sector. The AI technology is assessed in this part using FAST, PBG, and SUM values (Respect, Connect, Protect, and Care).

3.1 SUM Values in the Education

The SUM values Respect, Connect, Protect, and Care are essential for assessing how ethically and responsibly NLP is being used in education.

3.1.1 Respect

The foundation of respect in education is the recognition of the autonomy and dignity of both students and teachers. The text demonstrates respect in several ways:

- "Requires students to be able to learn independently": This statement respects students' capacity for autonomy-promoting self-directed learning (Roll & Wylie, 2016).
- "An effective way to realize deep learning" is to emphasize critical thinking, provide students the freedom to actively develop their own knowledge, and acknowledge the importance of deep learning.
- "Deep learning scheme based on PBL mode": Project-based learning (PBL) is embraced as a considerate method that promotes profound student involvement (Kriegeskorte & Golan, 2019).

3.1.2 Connect

In the context of education, "Connect" refers to facilitating meaningful connections while putting user safety and wellbeing first. The investigation finds components that encourage connections. The statement "College B social security law majors are used as research samples" highlights the dedication to improving the educational experience while establishing a link between the NLP project and real students. "The SPOC-AIoT Teaching Model" is intended to help students gain relevant learning experiences by facilitating connections between their AIoT knowledge and abilities (Zhu & Zhang, 2022).

3.1.3 Protect

"Protect" stands for "implementing mechanisms to secure sensitive data, prevent bias, and guarantee the security of NLP systems." The investigation identifies the following protective elements, "The SPOC-AIoT Technology Acceptance Model Structure" is a framework designed to evaluate and guarantee the efficacy and safety of the NLP teaching model while adhering to the protection principle. "Ethical considerations and privacy concerns associated with these technologies”: Respecting students' and teachers' rights and well-being is emphasized by acknowledging ethical and privacy concerns (Eaton, 2017).

3.1.4 Care

Even though the word "Care" might not be used explicitly, the text demonstrates aspects of fostering a welcoming learning environment. The approach of "learning participation based on the Technology Acceptance Model" demonstrates a compassionate disposition by giving students' happiness and engagement with the NLP learning model priority (Tsai et al., 2022).

3.2 FAST

3.2.1 Fairness

Technology for Instrument Recognition: The use of this technology in children's piano instruction is discussed in the text. It is imperative to consider accessibility for all children, including those with impairments, to achieve justice. To ensure that no learner is unfairly disadvantaged, the technology should be made to accommodate a wide range of learners (Safdar et al., 2020).

AI in English education: To ensure fairness in AI-based English education, it is necessary to make sure that the AI systems are cognizant of each student's unique demands. To promote equal chances for all students, these systems should offer personalized learning experiences that adjust to each student's needs and pace (Saade et al., 2007).

3.2.2 Accountability

Tracking the development and results of piano students falls under the category of accountability in the context of instrument recognition technology. This could be accomplished by evaluating the extent to which technology fosters students' self-motivation to learn the piano and whether it results in quantifiable advancements in their technical proficiency (Li, 2021).

AI in Courses on Visual Communication: Accountability for AI-assisted visual communication courses would entail assessing if the rendering system's design enhances instruction. By tracking changes in students' involvement and understanding of the material, teachers can evaluate its efficacy (Wang et al., 2021).

3.2.3 Sustainability

Instrument Recognition Technology: Technology for instrument recognition must be flexible enough to change with the needs of education to be sustainable. To accommodate an increasing

number of students, the technology should be scalable and quickly upgraded to incorporate new features and enhancements.

AI in Visual Communication Courses: To ensure accountability for AI-assisted visual communication courses, it is necessary to assess if the system's design for rendering images enhances instruction. By tracking changes in students' involvement and understanding of the material, teachers can evaluate its efficacy.

AI in English Teaching: To ensure sustainability in AI-based English instruction, the AI system must be updated often to meet the evolving needs of the students. To guarantee long-term efficacy, this may entail changes to the AI's learning algorithms and language models (Zhou et al., 2021).

3.2.4 Transparency

Instrument Recognition Technology: To understand how the instrument recognition technology functions, transparency is crucial. It is imperative that users, including instructors and students, possess a comprehensive comprehension of the technology's workings, algorithms, and effects on their educational journey.

AI in Collaborative Teaching: Being transparent in NLP based collaborative teaching means revealing the ways in which AI technology helps educators with student engagement, collaborative task design, and content selection. A greater understanding of AI's function in these procedures may improve user confidence (Wang & Liu, 2021).

4.0 PBG Framework for AI Deep Learning in Education

An effective Process-Based Governance (PBG) Framework is essential when it comes to AI deep learning in the classroom. In line with the SUM Values and the FAST Track Principles, this framework serves as a strategic road map to guarantee the safe, equitable, and moral application of AI technology. Modern technology must now be seamlessly integrated into education to ensure a dynamic and productive learning environment in the ever-changing educational landscape. One branch of artificial intelligence called natural language processing, or NLP, has the potential to completely transform the way we think about teaching. A strong process-based governance framework is necessary, nonetheless, to responsibly utilize NLP's benefits (Carey et al., 2010).

4.1 Privacy and Data Collection

Data Sources: Identifying the sources of data is a crucial first step in integrating NLP in the classroom. Records of students, exchanges within educational environments, and any other information needed for language analysis fall under this category (Alhawiti, 2014).

Privacy Procedures: To protect sensitive student data, implement strict privacy procedures. Assure adherence to data privacy laws and maintain open lines of communication regarding the data gathering procedure with parents, teachers, and students.

4.2 Integration of Curriculum

NLP Curriculum Alignment: Specify the learning goals and outcomes that NLP technologies are intended to accomplish. To improving language-related skills, such as writing ability, reading comprehension, and language fluency, smoothly incorporate NLP technologies into the curriculum (Turan et al., 2016).

Tailoring to Various Requirements: NLP applications should be customized to meet a range of learning demands. This includes making sure the technology can adjust to various educational settings and the needs of specific students.

4.3 NLP Model Development

Training Data Quality: The caliber of training data has a major impact on how well NLP models perform. Establish stringent guidelines for the gathering and annotation of data, placing a focus on accuracy and applicability to educational settings (Mathew et al., 2021).

Encourage a culture of continuous improvement by upgrading and improving NLP models on a regular basis in response to student and instructor feedback as well as ongoing developments in the field.

4.4 Analytics for Education

Tools for interpretable analytics generated from NLP results should be developed. Teachers' ought to be able to comprehend and apply the insights produced by NLP models to guide their lesson plans and intervention techniques (Ghosh, 2009).

Ethical Use of Analytics: Establish moral standards for the application of educational analytics to guard against prejudice and guarantee that students are treated fairly. Put precautions in place to prevent unforeseen effects from NLP-based discoveries.

4.5 Development of Professional Teachers

Training Programs: To acquaint educators with NLP technologies, develop extensive training programs. Assist educators in smoothly incorporating NLP tools into their lesson plans by providing them with tools and assistance.

Collaborative Educational Environments: Establish cooperative learning communities where teachers can exchange novel approaches, problems, and best practices for using NLP to improve instruction.

4.6 Surveillance and Assessment

Define key performance indicators (KPIs) to assess the efficacy of natural language processing (NLP) applications in the classroom. Evaluate these technologies' contributions on a regular basis to learning objectives, student involvement, and overall educational goals (Shaukat et al., 2020).

Mechanisms for User Feedback: Provide simple ways for educators, administrators, and students to provide feedback on their experiences using NLP tools. Over time, make use of these suggestions to enhance and improve the apps.

Problem Statement	**Objectives**	**Data Gathering**	**Solution**
Inconsistent Data Quality: Educational data for NLP varies in quality, impacting model performance.	**Define Standards**: Establish clear standards for data collection, annotation, and storage to ensure consistency.	**Audit Data Sources:** Regularly audit data sources for accuracy and relevance. Implement automated checks for data quality.	**Data Quality Framework:** Develop a comprehensive framework to assess and maintain data quality throughout the NLP process.
Lack of Curriculum Alignment: NLP applications lack alignment with specific learning objectives.	**Define Learning Outcomes:** Clearly define language-related learning outcomes that NLP tools aim to enhance.	**Integrate NLP into Curriculum:** Seamlessly integrate NLP tools into the curriculum to support defined learning objectives.	**Customization Features**: Implement customization features in NLP applications to adapt to different educational levels and individual student needs.
Limited Teacher Familiarity: Educators may lack the necessary training to effectively utilize NLP tools in teaching.	**Develop Training Programs:** Establish comprehensive training programs for educators on NLP technologies.	**Provide Resources:** Offer resources and support materials to assist teachers in incorporating NLP into their teaching methods.	**Collaborative Learning Communities:** Foster collaborative communities where educators can share best practices and challenges in utilizing NLP effectively.
Uninterpretable Analytics:	**Define Key Metrics:** Establish key	**User-Friendly Analytics:** Develop tools	**Ethical Guidelines:** Define ethical guidelines for the use of

Insights generated by NLP models may be difficult for educators to interpret and apply.	performance indicators (KPIs) to measure the effectiveness of NLP applications.	that provide interpretable educational analytics derived from NLP outputs.	educational analytics, ensuring fair and unbiased treatment of students.
Inadequate Monitoring and Evaluation: Lack of a systematic approach to assess the ongoing impact of NLP in education.	**Define Evaluation Criteria:** Clearly define criteria for assessing the impact of NLP on learning outcomes and student engagement.	**Regular Assessment:** Conduct regular assessments using defined criteria and seek feedback from stakeholders.	**Continuous Improvement:** Establish a culture of continuous improvement, using feedback to refine and enhance NLP applications over time.

Conclusion

This technical research investigates the revolutionary nexus between deep learning and artificial intelligence (AI) in education. By employing the SUM Values, FAST Track Principles, and PBG Framework in a methodical manner, the paper clarifies the significant effects of incorporating AI into education, addressing obstacles associated with existing educational technology, and capitalizing on the possibilities presented by deep learning methodologies. The analysis of the DL-ALS project provides an example of how AI can be used in education, and the SUM Values and FAST Track Principles are used to examine ethical issues. A strategy roadmap for the successful integration of AI is offered by the PBG Framework, which addresses important issues including privacy, curricular alignment, NLP model building, analytics, teacher professional development, and assessment. The paper promotes a thorough and responsible approach, acknowledging complexity and opening the door for additional study and application in the subject as education enters a new era molded by AI.

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