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| TE Comp-V **Mini Project** Date of Submission :16 November 2024 |
| **Name: ANKIT MAITY Roll number : 9975** |
| Course outcomes: To Understand and implement the selected research paper for case study |
| **Rubrics for assessment of Lab Experiment :**   |  |  |  |  | | --- | --- | --- | --- | | **Indicator** | **Average** | **Good** | **Excellent** | | **Presentation (3)** | **Presentation reflects average subject knowledge only (1)** | **Presentation reflects good subject knowledge,**  **Student used clear voice (2)** | **Presentation reflects good subject knowledge, and student maintains eye contact and clear voice (3)** | | **Implementation (4)** | **Able to partially perform the experiment (2)** | **Able to perform the experiment for certain extent (3)** | **Able to perform the experiment considering most of the aspects (4** | | **Novelty and use of Algorithms(3)** | **Only algorithms (1)** | **Novelty and use of Algorithms(2)** | **Novelty and use of Algorithms justified (3)** | | **Rubrics** | **Presentation (3)** | **Implementation (4)** | **Novelty and use of Algorithms(3)** | | **Score** |  |  |  | |
| **Teacher's Sign : Total (10):** |

DWMN MINI PROJECT

**Aim:**To develop a deep learning-based Education Decision Support System (EDSS) to accurately predict and enhance student performance in e-learning environments, aiding timely and informed academic decision-making.

**Problem Definition:**The problem that the paper addresses is that despite advancements in e-learning systems, educational institutions face significant challenges in accurately measuring and predicting student performance and participation due to limitations in current data processing and decision support methods, which impacts the ability of educators to make informed and timely academic decisions.

**Summary:**The document discusses the development of a Deep Learning-Based Education Decision Support System (EDSS) aimed at predicting student e-learning performance. It emphasizes the transformative impact of Information Technology on education, highlighting how traditional classrooms have evolved into modern e-learning environments that facilitate interaction between faculties and students. Despite advancements, challenges such as assessing student performance and ensuring active participation remain. The research introduces a solution using deep learning, specifically a Deep Graph Convolutional Neural Network (DGCNN), integrated with processes like data preprocessing, Extraction-Transformation-Load (ETL), and Online Analytical Processing (OLAP) to enhance decision-making.

The methodology involves four main phases:

1. Data Preparation: This phase collects structured and semi-structured data, essential for comprehensive analysis. It includes data extraction using an API, selecting attributes related to student engagement (e.g., resource visits, participation in discussions, and response rates), and transforming this data for consistency and normalization.
2. ETL Process: This step manipulates data to enhance decision-making by ensuring it is clean, balanced, and normalized. Methods like the Synthetic Minority Over-Sampling Technique (SMOTE) address data imbalance, while Yeo-Johnson transformation and Min-Max scaling standardize data values.
3. Data Mart and OLAP: The data mart, constructed using a star schema, acts as an intermediate storage and facilitates efficient retrieval through OLAP operations. This structured approach supports quick data analysis, which is crucial for timely educational decisions.
4. Decision-Making with DGCNN: Unlike traditional CNNs, DGCNNs maintain feature data integrity during pooling, enabling precise predictions even with complex data structures. The DGCNN aggregates node information in a spatial domain, improving classification accuracy.

The system was tested using the Kaggle-sourced Kalboard 360 dataset, which includes demographic, academic, and behavioral features of 480 students. Performance metrics like accuracy, precision, recall, and F1-score were used to evaluate the model. The proposed EDSS achieved significant performance improvements over existing systems, including decision support models like C4.5, artificial neural networks, and ensemble machine learning models. Specifically, it demonstrated a 95% accuracy rate and a reduced detection time of 0.034 seconds, compared to the slower rates of previous models.

The research underscores the superiority of the DGCNN-based EDSS in predicting student performance across "low," "medium," and "high" categories. The enhanced decision-making capabilities provide educators with timely insights that can help tailor learning strategies to improve student outcomes. Limitations include the sensitivity of DGCNNs to data quality and their reliance on well-structured input data, which may affect performance if data is noisy or complex.

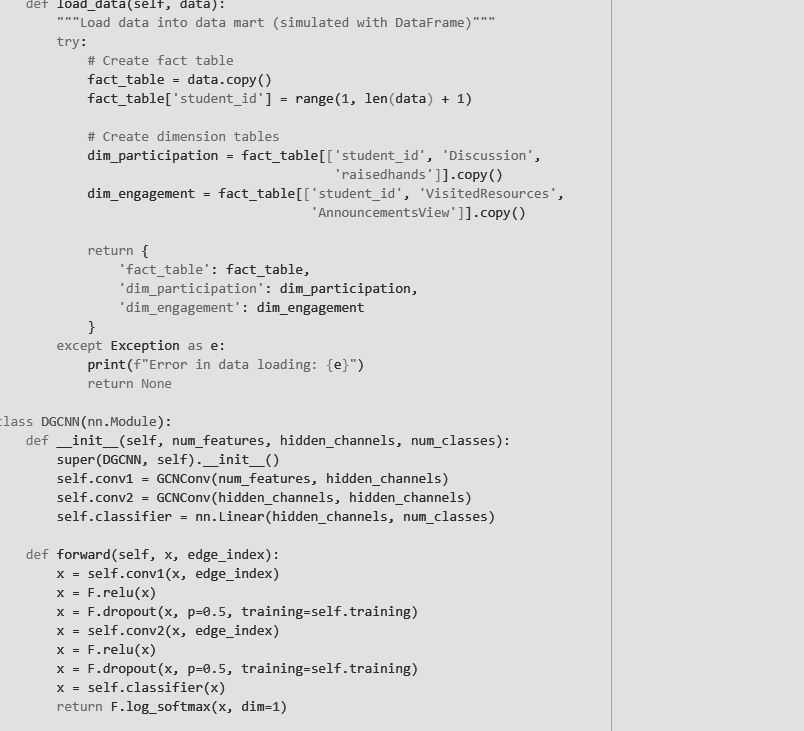
In conclusion, the proposed EDSS model significantly boosts the ability to predict and monitor student e-learning performance, paving the way for better educational strategies. The study advocates for future research to explore real-time applications with larger datasets and integration with cloud and IoT systems to expand its applicability.

**Technology stack:**

* Python
* Pandas
* NumPy
* Scikit-learn
* PyTorch
* PyTorch Geometric (PyG)

**Implementation:**

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