C.V. Raman Global University
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Project report:

On

Development of analytical Dashboard for 3rd Year student's semester results.

Course Instructor: -   Asst. Prof. Dilip Rout

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Introduction

In the rapidly evolving landscape of higher education, data-driven decision-making is becoming increasingly essential. Academic institutions are under pressure to monitor and improve student performance, address learning gaps, and ensure that educational outcomes align with institutional goals. One of the most critical periods in a student's academic journey is the 3rd year, where the foundation laid in the earlier years culminates in more specialized and challenging coursework. Given the importance of this stage, there is a need for tools that can effectively analyze and present student performance data in a clear and actionable manner.

Problem Statement

The academic performance of 3rd-year students is critical to their success in higher education, as it often determines their readiness for more advanced studies or professional careers. However, the current methods of assessing and analyzing student performance are often limited to static reports and spreadsheets, which fail to provide a comprehensive and interactive view of the data. These traditional approaches make it difficult for educators, administrators, and students to quickly identify trends, compare results across different semesters, or pinpoint areas of concern. Moreover, the lack of a centralized platform for visualizing and analyzing semester results means that valuable insights into student performance are often missed, leading to delayed interventions and missed opportunities for academic support. This gap in data-driven decision-making can result in students not receiving the timely assistance they need to improve their academic outcomes. The problem, therefore, lies in the absence of an intuitive, user-friendly analytical tool that can consolidate and visualize 3rd-year students' semester results in a manner that is accessible to all stakeholders. Without such a tool, the process of analyzing academic performance remains cumbersome and inefficient, hindering the ability to make informed decisions that could positively impact student success.

Aim and objectives

This project aims to develop an analytical dashboard tailored to the needs of 3rd-year students, their educators, and administrators. The dashboard will aggregate semester results, offering a visual representation of individual and collective academic performance. By leveraging advanced data visualization techniques, the dashboard will enable users to explore various dimensions of the data, such as grade distribution, subject-wise performance, and longitudinal trends. The interactive nature of the dashboard allows for real-time analysis and comparison, making it a valuable resource for identifying areas of strength and opportunities for improvement. Through the deployment of this dashboard, the project seeks to empower stakeholders with the insights needed to support students in their academic endeavors and to foster a culture of continuous improvement within the institution.

The primary objective of this project is to design and implement an analytical dashboard that provides a comprehensive, interactive, and user-friendly platform for visualizing and analyzing the semester results of 3rd-year students. This dashboard aims to achieve the following specific goals:

- ➢ **Centralize Data:**

  - To consolidate semester results from various sources into a single platform, providing a holistic view of student performance. Enhance Data

- ➢ **Visualization:**

  - To present academic performance data through clear and intuitive visualizations, enabling users to easily identify trends, patterns, and outliers. Facilitate Performance Analysis:
  - To enable educators, administrators, and students to analyze individual and group performance across different courses and semesters, supporting data-driven decision-making. Support Academic Interventions:
  - To provide actionable insights that help identify students who may need additional support, thereby facilitating timely interventions to improve academic outcomes. Enable Comparisons:
  - To allow users to compare academic performance across different semesters, subjects, and student cohorts, helping to evaluate the effectiveness of teaching methods and curricula. Promote Accessibility:
  - To ensure the dashboard is user-friendly and accessible to all stakeholders, including educators, administrators, and students, with varying levels of technical expertise.

Proposed methodology:

To develop an analytical dashboard for 3rd-year students' semester results in KNIME, we can follow this proposed methodology:

1. Data Collection & Integration

Data Sources: Gather the data from various sources such as CSV files, Excel sheets, databases (SQL, etc.), or other educational software.

KNIME Nodes: Use the File Reader, Excel Reader, or Database Reader nodes to import data into KNIME.

2. Data Preprocessing

Data Cleaning: Handle missing values, outliers, and inconsistencies using nodes like Missing Value, Column Filter, and Rule Engine.

Data Transformation: Normalize or standardize the data if needed, using nodes like Normalizer, Math Formula, and String Manipulation.

Data Aggregation: Aggregate data for different dimensions like courses, semesters, and student demographics using the Group By node.

3. Data Analysis

Descriptive Statistics: Use nodes like Statistics, Box Plot, and Histogram to calculate and visualize key statistical measures (mean, median, mode, etc.).

Trend Analysis: Apply Line Plot, Time Series Analysis, or Moving Average nodes to identify trends in students' performance over time.

Correlation Analysis: Use the Linear Correlation or Pearson Correlation nodes to identify relationships between different variables such as study hours, attendance, and grades.

4. Dashboard Design

Visualization: Use the Table View, Scatter Plot, Bar Chart, Pie Chart, and other visualization nodes to create the graphical components of the dashboard.

Interactive Components: Implement interactive elements using nodes like Interactive Value Filter, Slider Filter, and Color Manager to allow users to explore different aspects of the data.

6. Testing & Validation

User Testing: Conduct user testing sessions with a sample of the intended audience (e.g., faculty and students) to gather feedback.

Iterative Refinement: Refine the dashboard based on feedback to improve usability and functionality.

7. Documentation & Training

User Manual: Prepare documentation that guides users on how to interact with the dashboard.

Training Sessions: Conduct training sessions for end-users to ensure they can effectively use the dashboard.

8. Maintenance

Periodic Updates: Plan for regular updates of the data and any necessary revisions to the dashboard.
Performance Monitoring: Monitor the performance of the dashboard to ensure it runs efficiently as the data volume grows. This methodology ensures a comprehensive approach to developing an analytical dashboard for 3rd-year students' semester results using KNIME
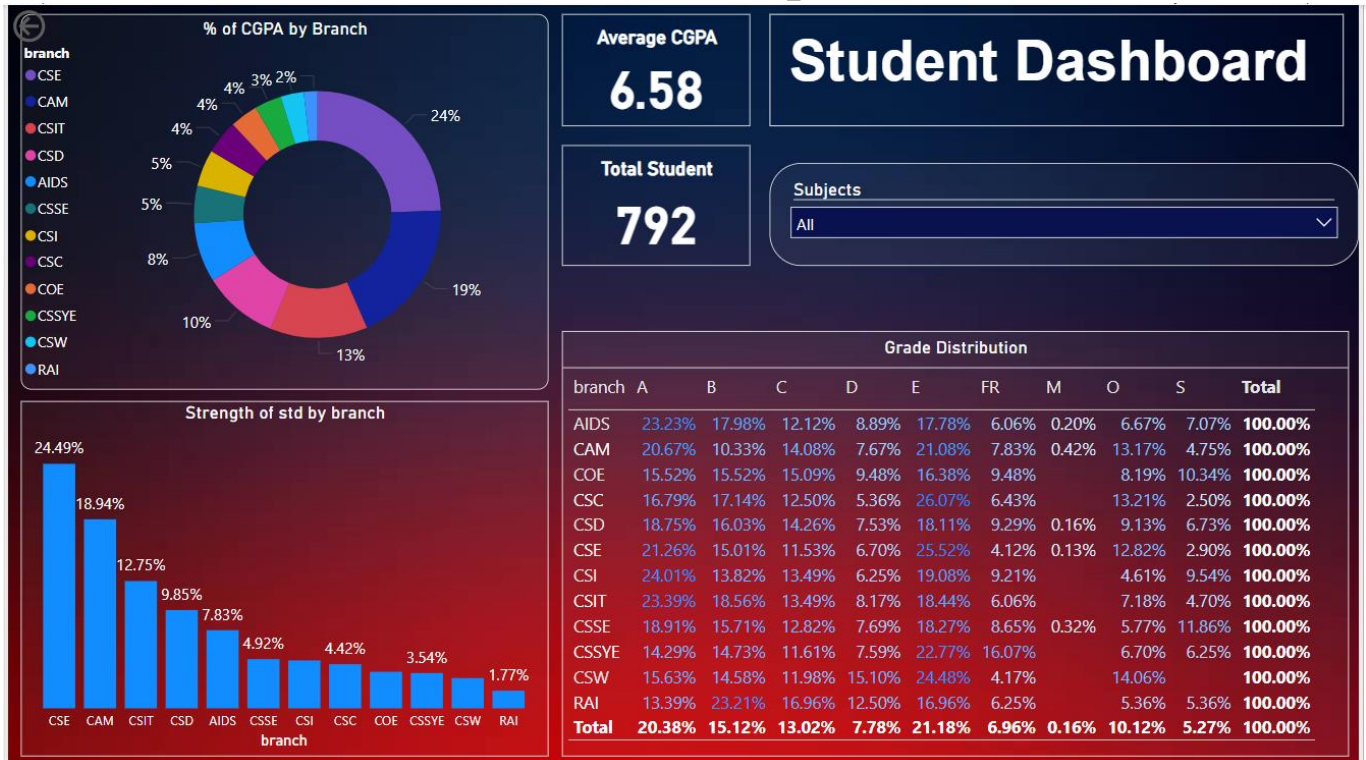
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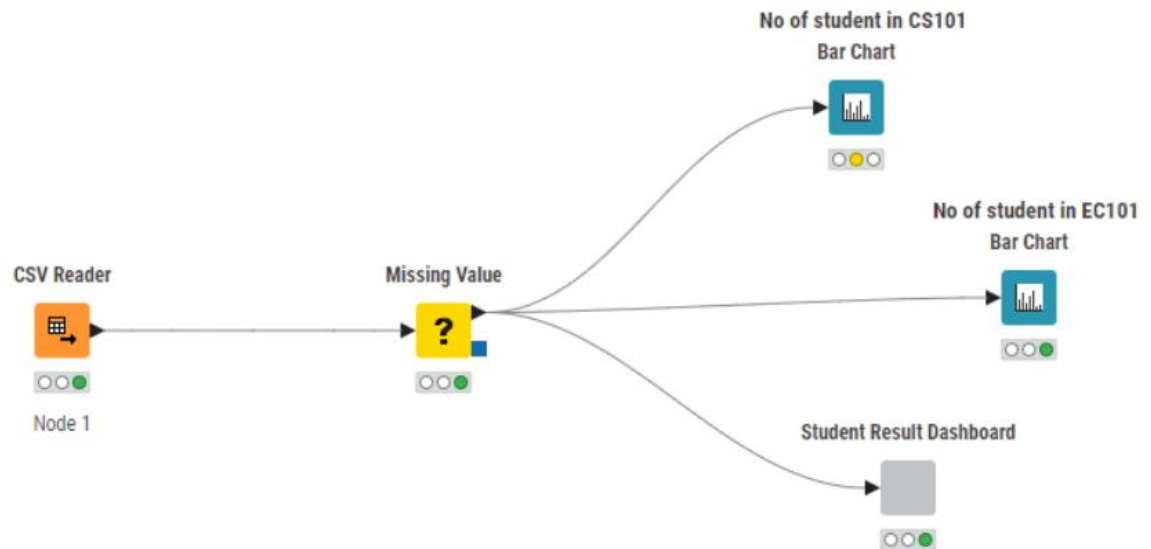
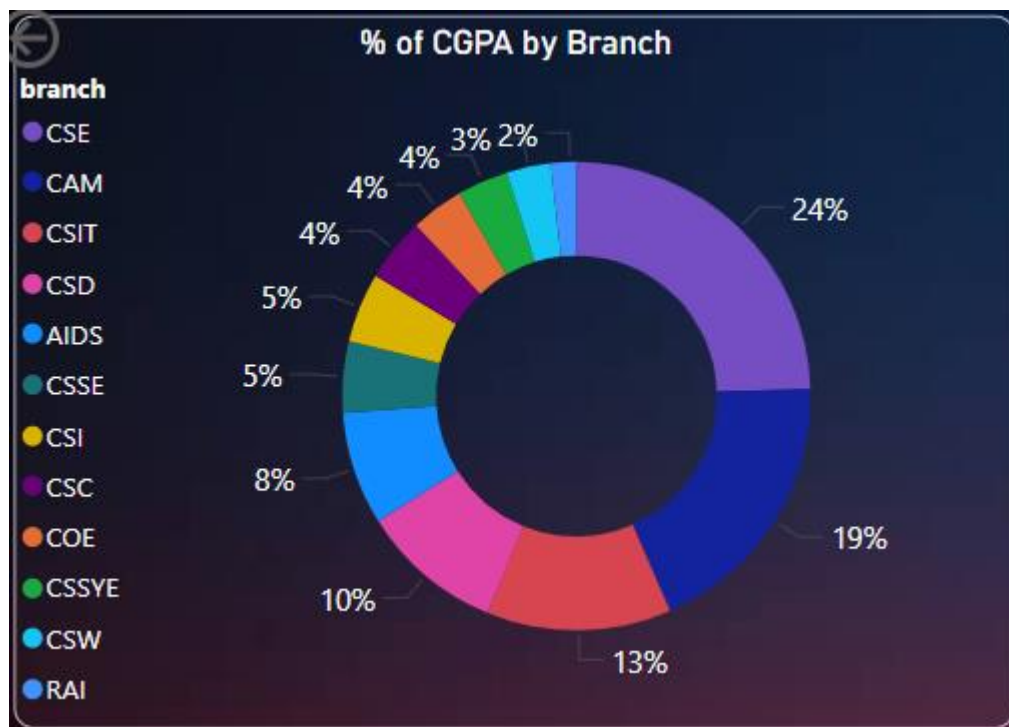## Missing Value node output

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2	Row1	2301020003	PRAMIT KUM...	AIDS	B	O	C	E	AB	AB
3	Row2	2301020004	ANKIT KUMA...	AIDS	E	E	A	A	AB	AB
4	Row3	2301020005	SUBHAM KU...	AIDS	B	B	B	E	AB	AB
5	Row4	2301020006	BIDISHA GUR...	AIDS	C	A	B	B	AB	AB
6	Row5	2301020007	AADITYA RA...	AIDS	S	S	S	S	AB	AB
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9	Row8	2301020010	AMLAN PATRA	AIDS	B	E	B	A	AB	AB
10	Row9	2301020011	ANVI KASHY...	AIDS	A	O	E	B	AB	AB
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Student Result Dashboard Components
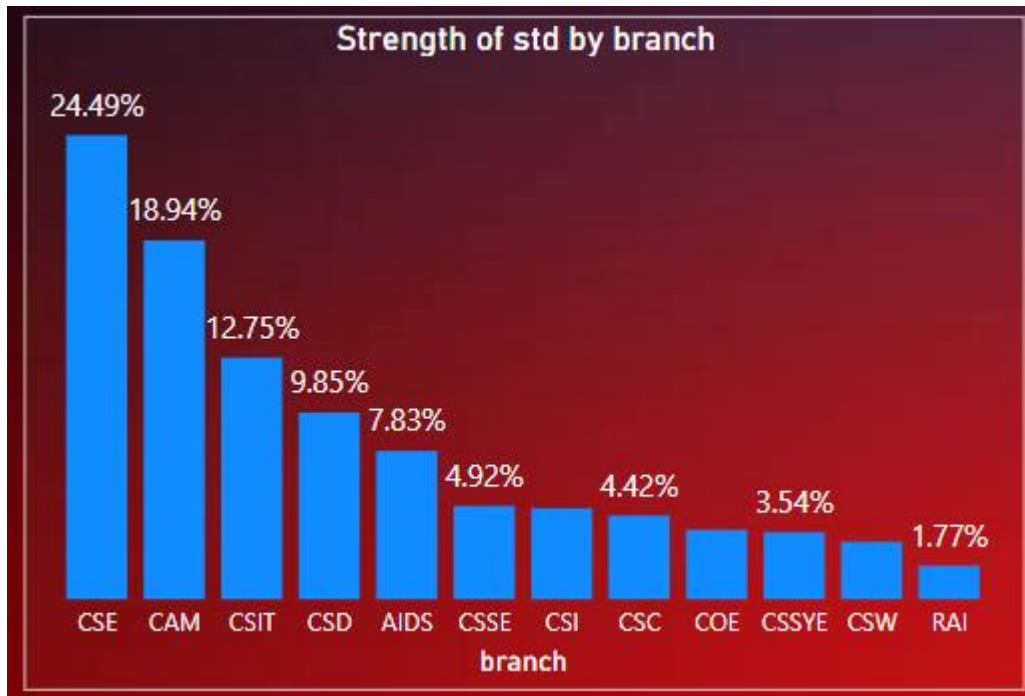

Student Result Dashboard Output

Data Visualization

No of students in each Branch

Strength of std by branch

24.49% 18.94% 12.75% 9.85% 7.83% 4.92% 4.42% 3.54% 1.77%

CSE CAM CSIT CSD AIDS CSSE CSI CSC COE CSSYE CSW RAI

branch

Conclusion

The development of an analytical dashboard for 3rd-year students' semester results using KNIME provides a powerful and comprehensive solution for academic performance analysis. This dashboard integrates various data processing, statistical analysis, and visualization techniques, making it an invaluable tool for educators, administrators, and students alike.

Through careful data collection and preparation, the dashboard ensures that all relevant information is accurately captured and ready for analysis. By employing KNIME's data transformation and cleaning capabilities, we mitigate potential data quality issues, ensuring the results are reliable and meaningful.

The analytical phase of the dashboard offers a deep dive into student performance across multiple dimensions. Descriptive statistics provide a clear overview of the data, highlighting trends and distributions that can inform academic strategies. The ability to compare performance across different groups—such as by subject, gender, or department—allows for a nuanced understanding of the factors influencing student outcomes. Furthermore, trend analysis and predictive modeling enable stakeholders to identify patterns over time and anticipate future performance, aiding in proactive decision-making.

The interactive visualizations created within KNIME make complex data accessible and understandable. By using components like bar charts, line plots, and scatter plots, the dashboard presents the data in an intuitive and user-friendly manner. The interactivity provided by KNIME's widgets and quickform nodes ensures that users can explore the data from different perspectives, catering to their specific needs and interests.

The final dashboard is not only a powerful analytical tool but also a dynamic reporting solution. It provides stakeholders with a holistic view of student performance, facilitating informed decisions that can lead to improved academic outcomes. The potential for deployment on KNIME Server further enhances its accessibility, allowing for broader collaboration and real-time analysis.

In conclusion, this KNIME-based analytical dashboard for 3rd-year students' semester results stands as a testament to the capabilities of modern data analytics platforms. It transforms raw data into actionable insights, driving academic excellence and ensuring that educators and administrators have the tools they need to support student success. The dashboard is not just a static report; it is a living, interactive tool that evolves with the needs of its users, reflecting the ongoing commitment to enhancing educational outcomes.