Performance Pattern Analyser

Project Overview

This project analyses student performance across a series of tests to detect learning progress, identify inconsistencies, and provide actionable insights for educators. Students are categorized based on score trends, time trends, and consistency, and action items are suggested accordingly.

Steps involved

- For each student following parameters were computed
    - Score Trend: Linear regression slope of test scores
    - Time Trend: Linear regression slope of time taken (negative slope = improvement)
    - Score Consistency: Standard deviation of test scores
- Classifies students into **4 actionable categories**:
    - Learning in progress
    - Concepts are clear but needs time improvement
    - Needs both score and time improvement
    - Answering randomly, may be luck
- Generates a **Next Action** suggestion for teachers based on performance.
- Saves results in an Excel workbook with **multiple sheets**:
    - Raw Data
    - Calculation metrics
    - Analysis and Rank

Input

- Excel file: `student_tests_input.xlsx`
- Sheet name: `Student_Test_Data`
- Contains student id, test results and time taken for 5 tests.

Calculation

We calculate a **trend (slope)** for scores or times using **linear regression**. In Python, this is done using **np.polyfit(x, y, 1)[0].**

Interpretation

- **Score slope > 0:** Performance is improving
- **Score slope ≤ 0:** No improvement or declining
- **Time slope < 0:** Student is completing faster (improving speed)
- **Time slope > 0:** Student is slower (needs speed improvement)

Example Data and Analysis

ID	Test Scores	Test Times (min)	Score Trend	Time Trend	Std	Analysis	Action Item
S01	6, 7, 8, 8, 9	25, 23, 22, 21, 20	0.75	1.1	1.14	Score trend > 0, Time trend > 0, Score std ≤ 2	Ready to Move
S02	7, 8, 7, 8, 7	25, 24, 26, 25, 24	0.1	0	0.45	Score trend > 0, Time trend ≤ 0, Score std ≤ 2	Focus on time management / Tricks to improve speed
S03	4, 4, 5, 4, 4	27, 28, 27, 29, 28	0	-0.4	0.45	Score trend ≤ 0, Time trend ≤ 0, Score std ≤ 2	Review concepts / Revision
S04	3, 8, 2, 9, 1	30, 20, 25, 15, 35	0	0.5	3.85	Score std > 2 (inconsistent)	Investigate guessing behavior / Needs review

Output

- Excel file: `student_learning_analysis_output.xlsx`
- Sheets:
    1. **Raw_Data** → Original student test data
    2. **Calculation** → Metrics, slopes, category, next action
    3. **Analysis_and_Rank** → Student_ID, Rank, Learning_State, Category, Next_Action

Limitations

- Assumes all tests are of equal difficulty and time requirement
- Linear trend analysis only; non-linear patterns are not captured
- Limited to 5 tests per student for simplicity

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