Priority Matrix Algorithm

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1 ALGORITHM DESCRIPTION

This algorithm helps college students prioritize homework assignments based on their urgency and importance. Each assignment is positioned on a two-dimensional grid, where the x-axis represents the assignment's urgency score and the y-axis represents its importance score. Both scales are normalized to the range $[0, 1]$ to plot the data in a square region upon output.

1.1 Input

The algorithm takes the following inputs:

- The set of courses C in which the student is currently enrolled, where each course c has:
  - c_{id}: A unique identifier for the course.
  - c_{score}: The student's current score in the course, expressed as a percentage in the range $[0, 100]$.
- The set of assignments A from all of the student's courses, where each assignment a includes:
  - a_{id}: A unique identifier for the assignment.
  - a_{course}: The ID of the course to which the assignment belongs.
  - a_{due}: The due date and time of the assignment.
  - a_{points}: The maximum points possible for this assignment.

- t_{now}: The current date and time.

1.2 Processing

For each assignment $a \in A$, the algorithm performs the following calculations:

1.2.1 *Urgency Calculation*

The Urgency, $U(a)$, of each assignment represents the number of full days remaining until the assignment's due date. Items due in less than a day, as well as assignments already past due, will have $U(a) = 0$. $U(a)$ is given by:

$$U(a) = \max\left(0, \left\lfloor \frac{a_{due} - t_{now}}{1 \text{ day}} \right\rfloor\right)$$

1.2.2 *Importance Calculation*

The Importance, $I(a)$, of each assignment is derived as follows:

1. **Initial Importance:** The initial importance of an assignment represents its weight in the final grade of the course. Let $P(a_{course})$ denote the total possible points in the course to which assignment a belongs. The initial importance $I_{initial}(a)$ is given by:
$$I_{initial}(a) = \frac{a_{points}}{P(a_{course})}$$
2. **Course Importance:** If a student is performing poorly in a given course (relative to their other courses), we increase the importance of each assignment in that course, up to a maximum of five times its initial importance. Let $S_{\max}$ be the student's highest current score across all courses in C. Assuming the student's current score is nonzero, we define a scaling factor $\alpha(a)$ for the assignment as:
$$\alpha(x) = \min\left(5.0, \frac{S_{\max}}{c_{score}(a_{course})}\right)$$
If the student's current score in a course is zero, we increase the importance of the assignment by our maximum of five times its initial importance.
3. **Final Importance:** Calculate the final importance score $I(a)$ as:
$$I(a) = I_{initial}(a) \times \alpha(a)$$

1.2.3 *Normalization*

To standardize the Urgency and Importance values, each score is normalized as follows:

- Let $U_{\max}$ be the maximum Urgency score across all assignments. The normalized Urgency $U_{norm}(a)$ for assignment a is:

$$U_{norm}(a) = \frac{U(a)}{U_{\max}}$$

- Let $I_{\max}$ be the maximum Importance score across all assignments. The normalized Importance $I_{norm}(a)$ for assignment a is:

$$I_{norm}(a) = \frac{I(a)}{I_{\max}}$$

1.3 Output

The output can be used to plot an Eisenhower matrix, assisting students in visually prioritizing their assignments based on urgency and importance. For each $a \in A$, it provides:

- a_{id}: The unique identifier for the assignment.
- $U_{norm}(a)$: The normalized urgency score in the range $[0, 1]$.
- $I_{norm}(a)$: The normalized importance score in the range $[0, 1]$.

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