Decision Tree 1 - Primary Classification Tree

Purpose: Classify users into learner categories
Inputs:

- **objective_scores.<topic>**
    - Take learning objectives from sme team
    - Diagnostic will test those objectives and provide initial scores
    - Scores updated continuously
        - each question in a quiz is tagged with an objective
- **confidence_score.<topic>**
    - Calculated based on formula

```
retry_rate = retries / max_retries if max_retries else 0
  hint_rate = hints_used / total_questions if total_questions else 0

  return round(
      (0.5 * quiz_score) + (0.3 * (1 - retry_rate)) + (0.2 * (1-hint_rate)),3)
```

- **skills[related]**
    - Take skills from sme team
    - Diagnostic will test those skills and provide initial scores
    - Scores updated continuously
        - each question in a quiz is tagged with an skill
- **confidence_score_trends**
    - Store the increase/decrease percentage from the previous topic confidence score in a list

- **flagged_topics**
    - Based on feedback under each topic (optional survey with radio buttons to input difficult topics) + feedback at end of module (mandatory survey with radio buttons for topics and additional q's)
- **learner_level**
    - categorical: basic, intermediate, advanced (how much proficiency they want to achieve from course)
    - thresholds will change acc to this, part of confidence_score formula
- **learner_purpose**
    - categorical: scratch, exploratory, revising
    - Thresholds will change acc to this, part of confience_score formula

Expanded to 18 learner categories

Learner Category	**Aggregated Rule**	**LLM prompt mapping**
Struggling Novice	avg_objective_score < 5.5, avg_confidence_score < 0.4, avg_skill_score < 4.0, confidence_trend < -0.05, learner_level = basic	"Provide beginner-friendly content for {next_topic}. Use simple examples and a motivational tone. Also review these topics with low scores: {redo_topics}."
Lost Climber	avg_objective_score < 5.5, avg_confidence_score < 0.4, confidence_trend ∈ [-0.05, 0.05], learner_level = intermediate	"Teach {next_topic} gently with scaffolding. Add revision for previous low-score topics {redo_topics}. Reinforce

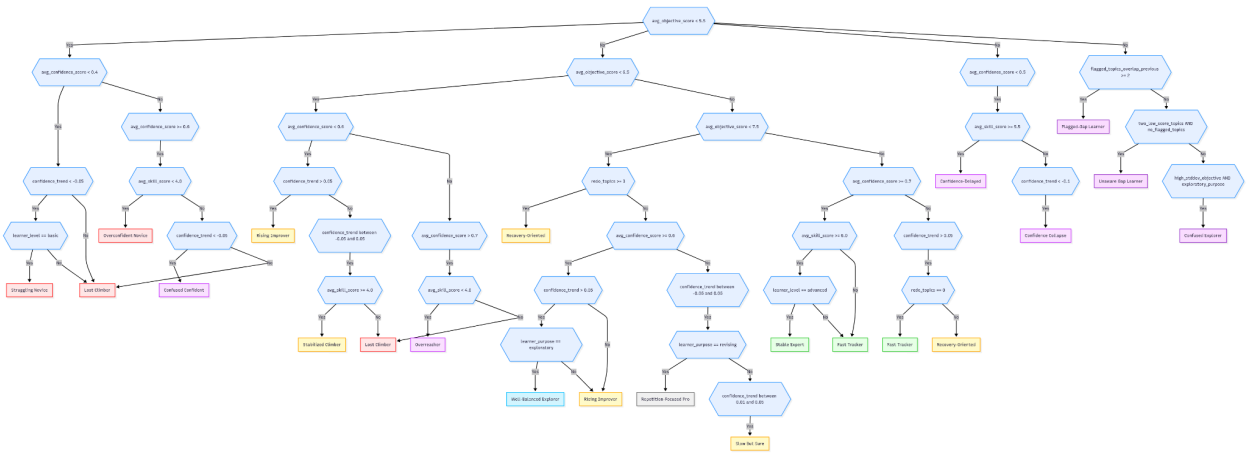
		concepts without overwhelming.”
Overconfident Novice	avg_objective_score < 5.5, avg_confidence_score ≥ 0.6, avg_skill_score < 4.0	“Create corrective content for {next_topic} using misconception targeting. Balance confidence and actual performance. Add soft guidance.”
Rising Improver	avg_objective_score ∈ [5.5, 6.5], avg_confidence_score ∈ [0.45, 0.6], confidence_trend > 0.05	“Encourage the learner in {next_topic}. Use light challenges, positive feedback, and adaptive questioning. Track flagged topics: {flagged_topics}.”
Stabilized Climber	avg_objective_score ≥ 6, avg_confidence_score ∈ [0.5, 0.6], avg_skill_score ≥ 4.0, confidence_trend ∈ [-0.05, 0.05]	“Provide standard-paced content for {next_topic}. Offer brief concept checks. Recommend revision of {flagged_topics} in future.”
Confused Confident	avg_objective_score < 5.5, avg_confidence_score ≥ 0.6, confidence_trend < -0.05	“Help recalibrate confidence by gently reinforcing concepts. Focus on {next_topic} with layered examples. Watch for misunderstanding.”

Overreacher	avg_objective_score ∈ [5.5, 6.5], avg_confidence_score > 0.7, avg_skill_score < 4.0	“Design challenging yet clarifying content for {next_topic}. Use just-in-time hints. Insert review prompts from {flagged_topics}.”
Well-Balanced Explorer	avg_objective_score ∈ [6, 7.5], avg_confidence_score ≥ 0.6, confidence_trend > 0.05, learner_purpose = exploratory	“Deliver content for {next_topic} that promotes exploration. Include optional deep-dives. No redo needed, but revisit {flagged_topics} later.”
Stable Expert	avg_objective_score ≥ 8.0, avg_confidence_score ≥ 0.7, avg_skill_score ≥ 6.0, learner_level = advanced	“Generate concise, expert-level content for {next_topic}. Focus on advanced application. Skip review unless learner marks topics.”
Repetition-Focused Pro	avg_objective_score ≥ 7.0, avg_confidence_score ≥ 0.6, confidence_trend ∈ [-0.05, 0.05], learner_purpose = revising	“Summarize key ideas of {next_topic} quickly. Add advanced refreshers for {flagged_topics}. Assume learner is competent.”
Flagged-Gap Learner	≥ 2 topics in flagged_topics ∩ previous_covered_topics	“Focus new content on {next_topic}, but interleave key explanations from {flagged_topics}. Use

		learner-specified weaknesses as emphasis.”
Confidence Collapse	avg_confidence_score < 0.4, confidence_trend < -0.1	“Build emotional safety in {next_topic}. Use confident tone, relatable mistakes, and peer-style feedback. Defer challenges.”
Fast Tracker	avg_objective_score ≥ 8.0, avg_confidence_score ≥ 0.7, confidence_trend > 0.05, len(redo_topics) = 0	“Deliver fast-paced content for {next_topic} with deeper challenges. No review necessary. Acknowledge rapid mastery.”
Slow But Sure	avg_objective_score ≥ 6.5, confidence_trend ∈ [0.01, 0.05], avg_confidence_score ∈ [0.5, 0.6]	“Continue steady progress in {next_topic}. Keep pacing moderate. Reinforce recent mastery lightly.”
Unaware Gap Learner	≥ 2 topics where objective_score < 6 AND flagged_topics = ∅	“Highlight implicit weaknesses in {redo_topics} while teaching {next_topic}. Use probing questions to surface gaps.”
Recovery-Oriented	len(redo_topics) ≥ 3, confidence_trend > 0.05	“Alternate between recovery ({redo_topics}) and new ({next_topic}) content. Celebrate

		progress. Emphasize structure."
Confidence-Delayed	avg_objective_score ≥ 7.0, avg_skill_score ≥ 5.5, avg_confidence_score < 0.5	"Encourage self-trust in {next_topic}. Emphasize learner competence. Limit hints to build independent thinking."
Confused Explorer	avg_confidence_score ∈ [0.5, 0.7], stddev(objective_score) > 1.5, learner_purpose = exploratory	"Help stabilize learning in {next_topic}. Reduce variability with consistent patterns. Include review of {flagged_topics}."

[decision tree 1 design - mermaid]



Decision Tree 2 - Intervention Type Tree

Purpose: To enable change in format style and chunk size based on if user is revisiting the module or going to next one.

Input Parameters

These parameters describe the learner's preferences and current learning context.

- **1. revisiting_module**
  - **Definition:** A boolean indicator specifying whether the learner is currently revisiting a previously covered module or progressing to new content.
  - **Data Type:** Boolean
  - **Allowed Values:**
    - True: Learner is revisiting a module.
    - False: Learner is progressing to a new module.
  - **Purpose:** To adapt the intervention strategy based on the learner's stage in the curriculum (review vs. new learning).

- **2. session_preference**
  - **Definition:** The learner's expressed preference for the typical length or structure of a learning session.
  - **Data Type:** Categorical String
  - **Allowed Values:**

        - 'short_chunks': Prefers learning content broken into brief, manageable segments.
        - 'long_sessions': Prefers longer, more comprehensive learning sessions.
    - **Purpose:** To align content delivery with the learner's preferred study duration.

- **3. attention_span**
    - **Definition:** A continuous numerical measure representing the learner's typical duration of focused attention during a learning session, in minutes.
    - **Data Type:** Float (Continuous Numerical)
    - **Allowed Values:** Positive real numbers (e.g., 1.0,7.5,15.0).
    - **Purpose:** To gauge the learner's capacity for sustained focus and adjust content length and complexity accordingly.
    - **Key Thresholds for Categorization:**
        - Low: <9 minutes
        - Intermediate: ≥9 AND <11 minutes
        - High: ≥11 minutes

- **4. format_preference**
    - **Definition:** The learner's preferred medium for consuming educational content.

    - **Data Type:** Categorical String
    - **Allowed Values:**
        - 'text': Prefers written content (e.g., articles, e-books, transcripts).
        - 'image': Prefers visual content (e.g., diagrams, infographics, illustrated guides).
        - 'video': Prefers dynamic visual and auditory content (e.g., lectures, tutorials).
    - **Purpose:** To deliver content in the most engaging and effective format for the learner.

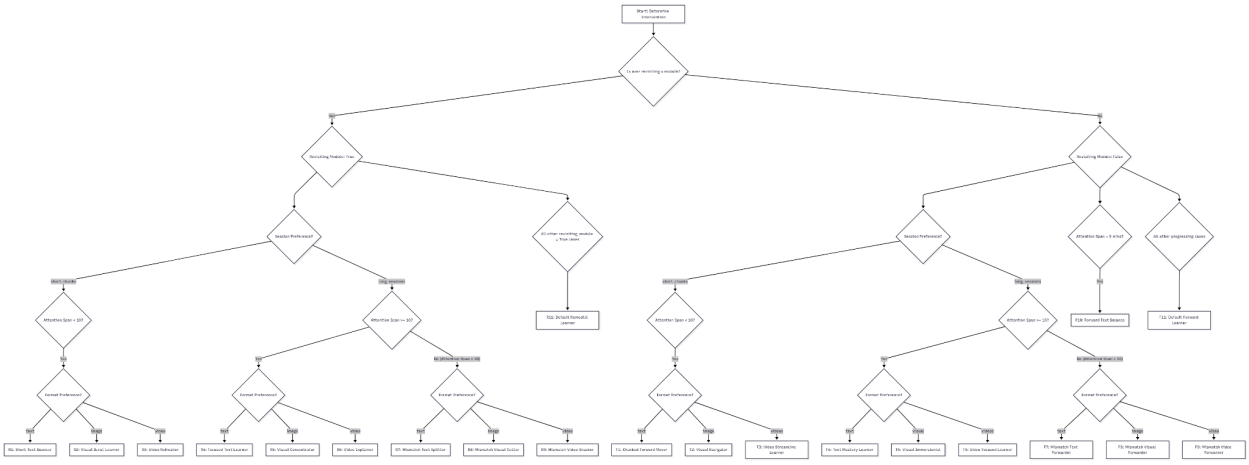
Output Parameters

These parameters define the recommended intervention strategy.

- **1. Strategy Label**
    - **Definition:** A concise, human-readable label summarizing the recommended intervention approach. This is the primary output used for internal system logic and visualization.
    - **Data Type:** Categorical String
    - **Allowed Values:** (Refer to the "Strategy Label" column in the Comprehensive Intervention Strategy Table above)
    - **Purpose:** To provide a clear, high-level classification of the required intervention.
- **2. Intervention (LLM Prompt Summary)**

- **Definition:** A detailed, natural language prompt designed to be fed to a Large Language Model (LLM) or similar content generation system. This prompt guides the LLM to create specific content tailored to the identified strategy.
- **Data Type:** String
- **Allowed Values:** (Refer to the "Intervention: LLM Prompt Summary" column in the Comprehensive Intervention Strategy Table above)
- **Purpose:** To provide actionable instructions for content generation, ensuring the delivered learning material aligns precisely with the learner's needs.

Table for reference



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