Opik Integration in FretCoach

Workspace: `padmanabhan-r-7119` [Click To View Workspace]
Projects: `FretCoach` | `FretCoach-Hub` 📊 **Production Dashboard:** [Click To View Dashboard]

Overview

FretCoach traces three distinct AI coaching features — real-time live coaching, AI practice recommendations, and a web based chatbot agent (AI Coach). Opik provides the observability layer to monitor, evaluate, and continuously improve these features in production, giving us visibility into prompt quality, token costs, response latency, and AI coaching quality at scale.

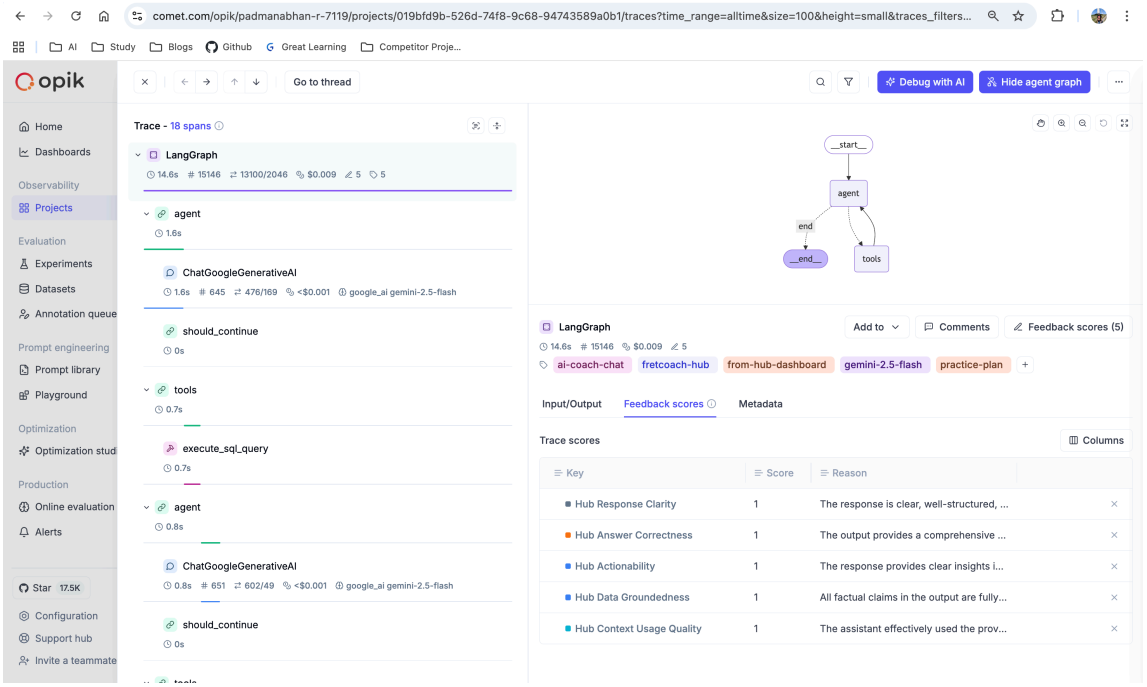
Features Implemented

1. Traces with Metadata and Tags

All LLM calls are logged as traces in Opik with structured tags for filtering, organization and applying targeted online evaluation rules.

Hub Coach Chats:

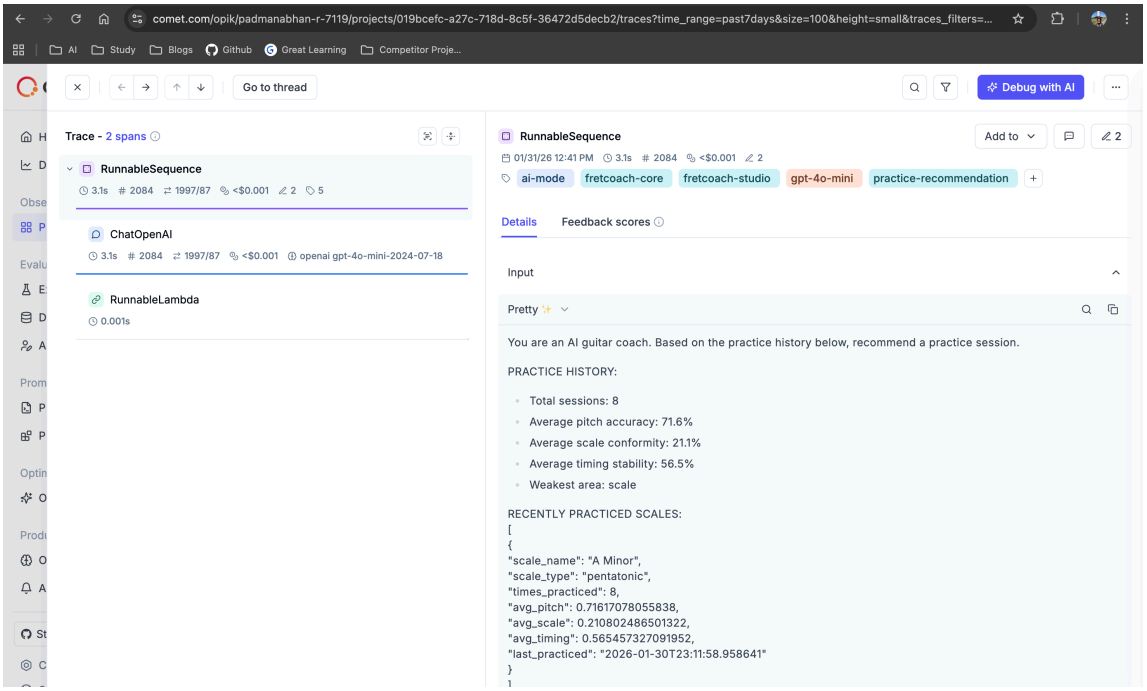
- Tags: `ai-coach-chat`, `fretcoach-hub`, `from-hub-dashboard`, `gemini-2.5-flash`, `practice-plan`
- Tracks AI coach conversations in the web dashboard



Hub coach chat traces with proper tags in Opik dashboard

AI Mode (Practice Recommendations):

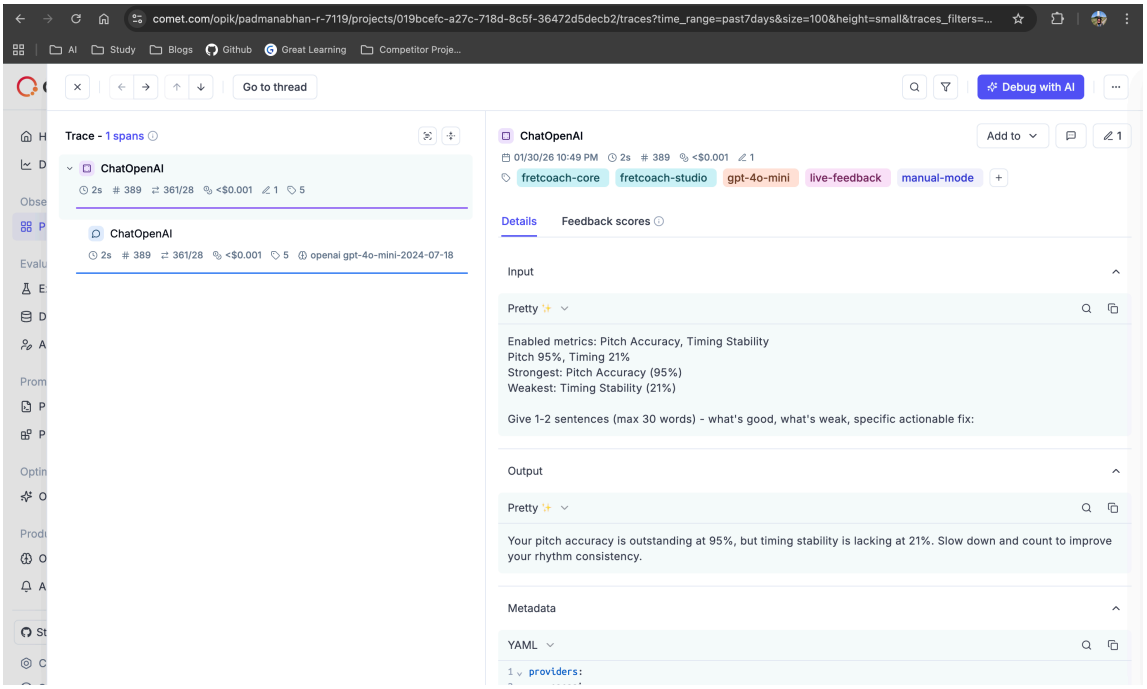
- Tags: `fretcoach-core`, `gpt-4o-mini`, `ai-mode`, `fretcoach-studio`, `practice-recommendation`
- Tracks personalized practice recommendations



AI mode practice recommendation traces

Live AI Feedback in Session:

- Tags: `fretcoach-core`, `gpt-4o-mini`, `ai-mode`, `fretcoach-studio`, `live-feedback`
- Tracks real-time coaching feedback during practice
- TTS audio generation traced separately via `@track` decorator for independent failure tracking and latency monitoring



Live AI feedback traces during practice sessions

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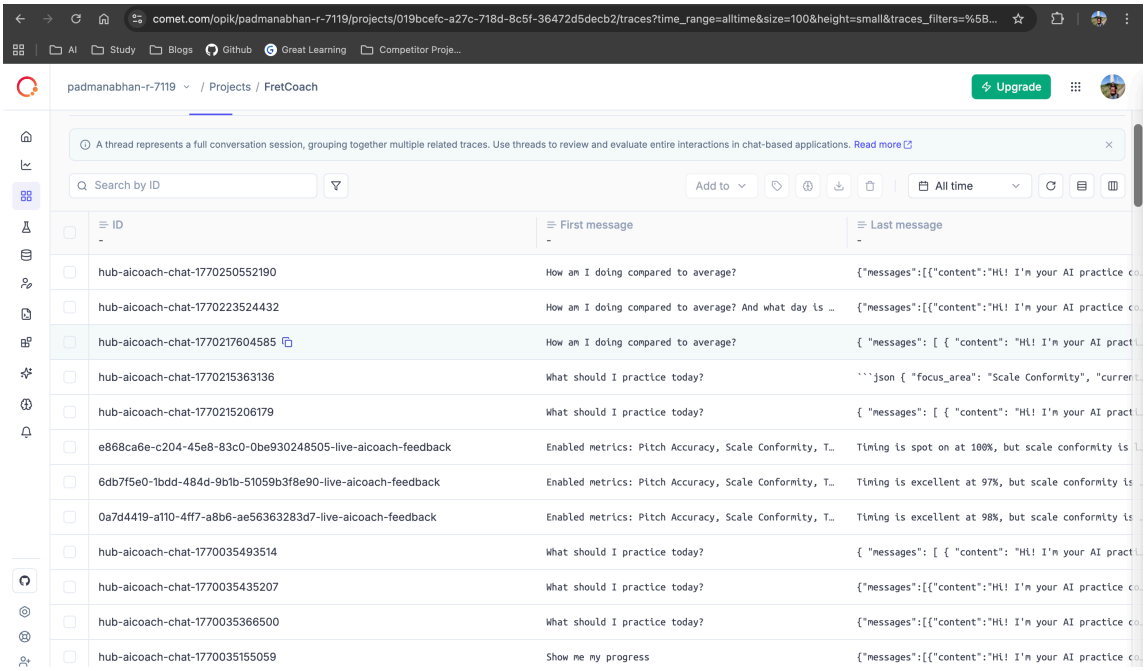
2. Thread Management

Structured `thread_id` to group related LLM calls and maintain conversation context.

Thread Naming Conventions:

- **Hub Coach:** `hub-aicoach-chat-{timestamp}` - Groups all coach chat messages for a user
- **AI Mode:** `{deployment}-ai-mode-{practice_id}` - Maintains thread across recommendations
- **Live Feedback:** `{session_id}-live-aicoach-feedback` - Groups feedback within a practice session



Thread IDs grouping related traces in Opik

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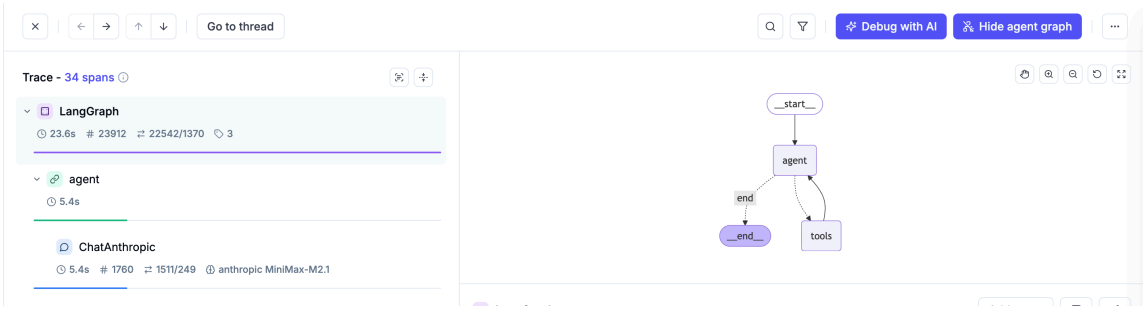
3. Agent Graph Visualization

LangGraph execution flows visualized in Opik using `workflow.get_graph(xray=True)`.

Shows complete agent reasoning path: agent → tool calls (`execute_sql_query`, `get_database_schema`) → decision nodes → response.



LangGraph agent execution flow in Opik

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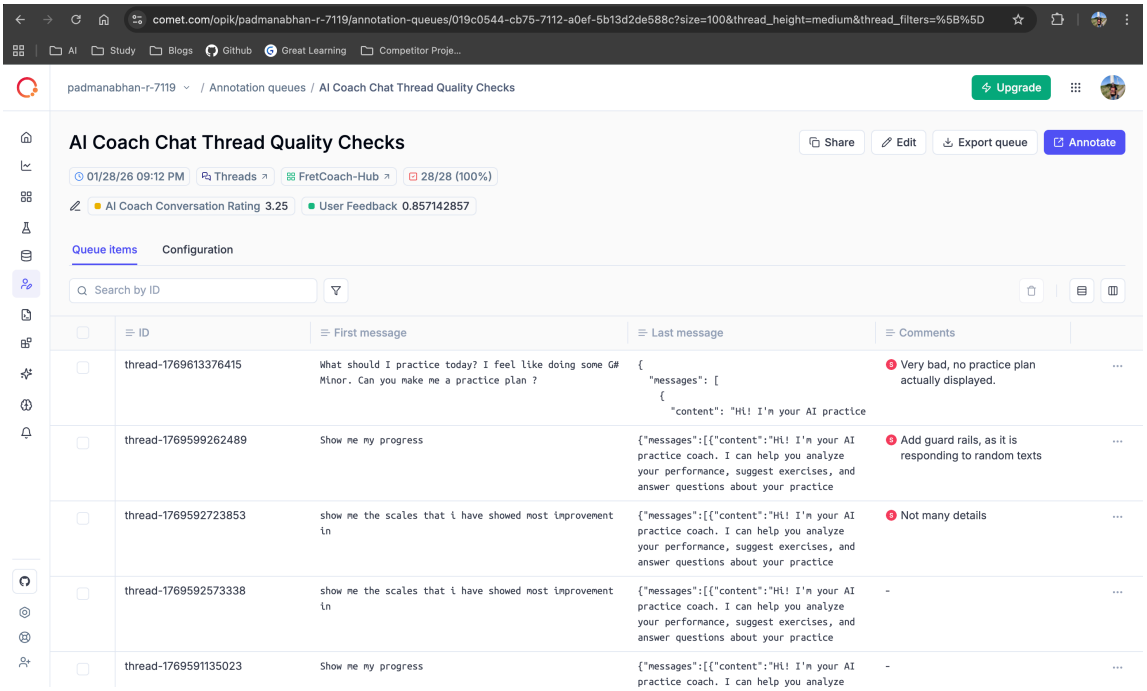
4. Annotation Queues

Used annotation queues for human-in-the-loop evaluation of agent outputs.

Implementation:

- Custom feedback definitions for LLM output quality
- Manual review and rating using custom criteria
- Structured feedback collection for agent improvements



Annotation queue with reviewed LLM outputs

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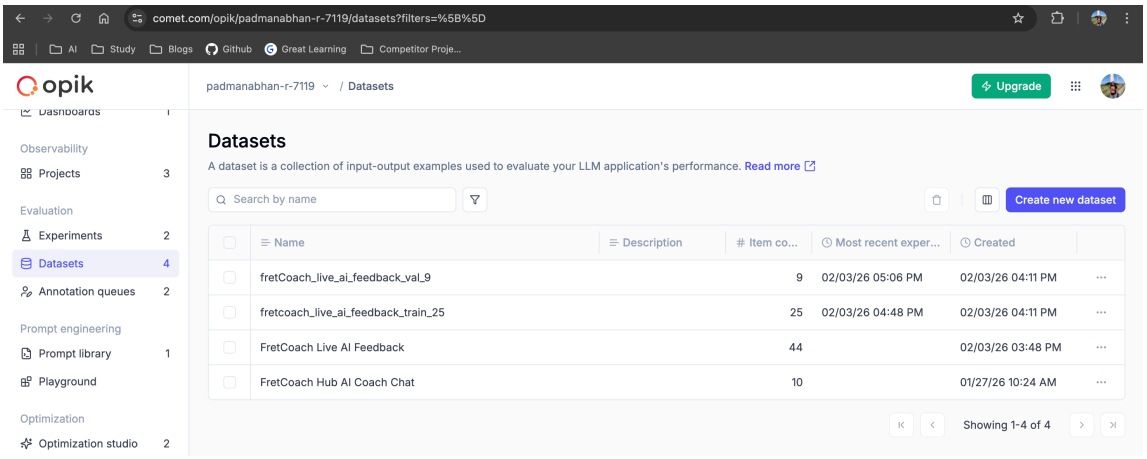
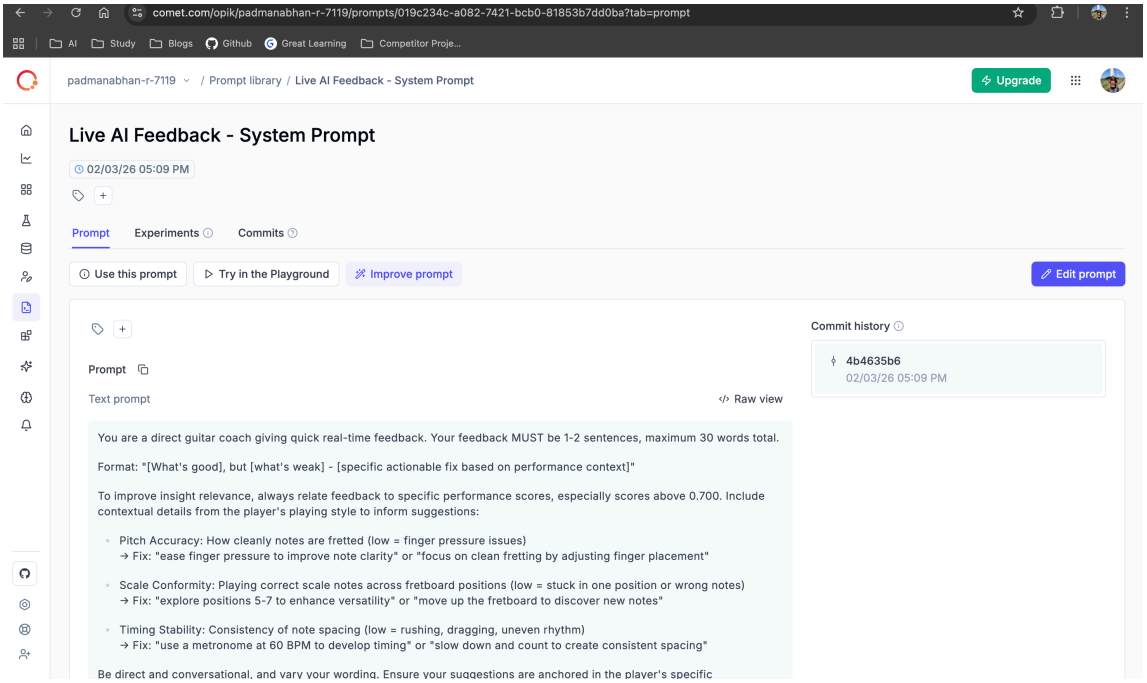
5. Datasets and Prompts

Created datasets and prompts for reproducible experiments and evaluations.

- Curated test cases from real user sessions
- Used in experiment runs for testing
- Version-controlled coaching prompt templates



Datasets created for experiment runs



Saved prompts

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6. Experiments and Custom Metrics

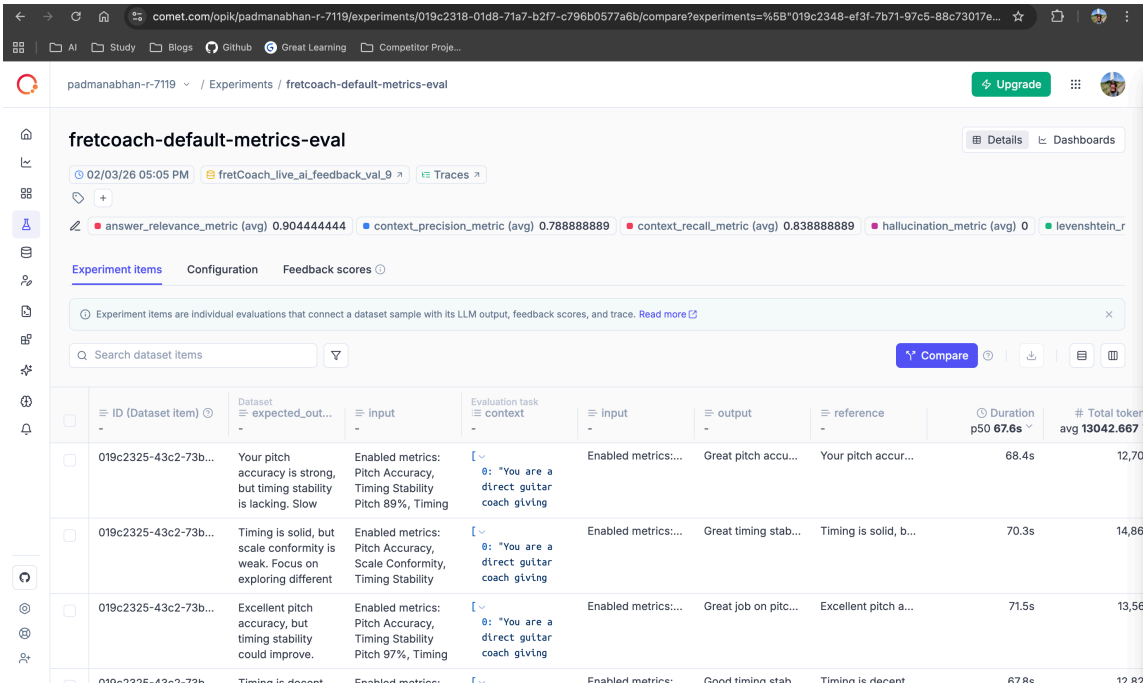
Evaluated LLM performance using both default Opik metrics and custom-created metrics.

Default Metrics:

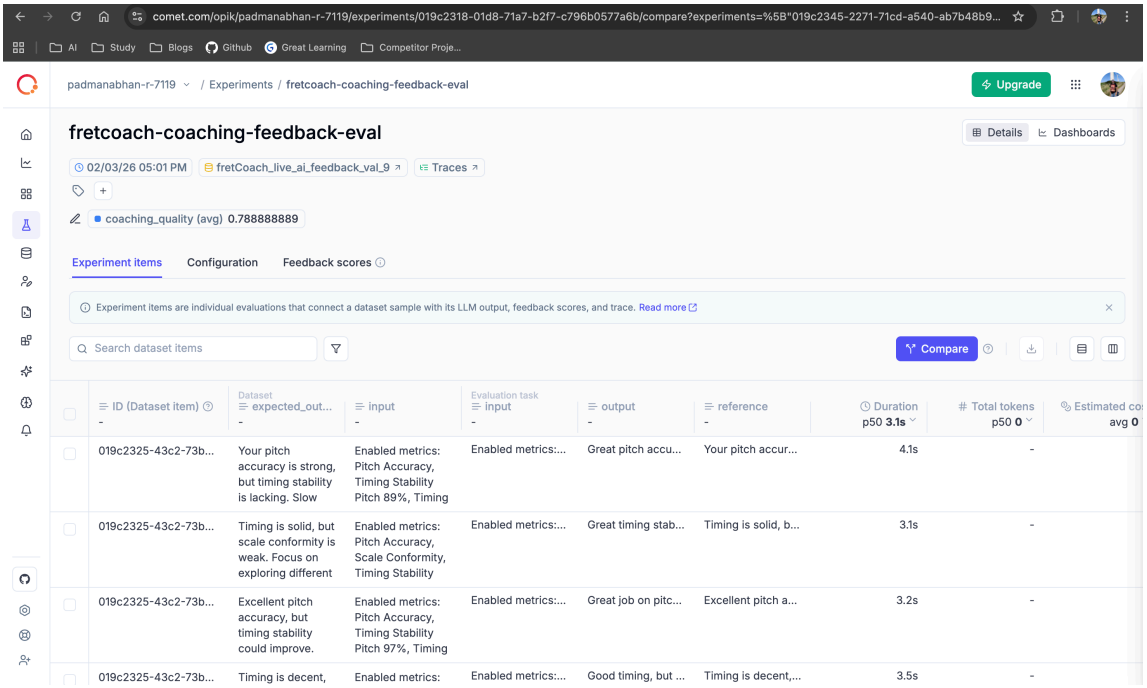
- Opik's built-in evaluation metrics for response quality

Custom Metrics:

- Domain-specific metrics tailored to guitar coaching context
- Measures coaching quality and relevance



Experiments with default Opik metrics



Experiments with custom metric

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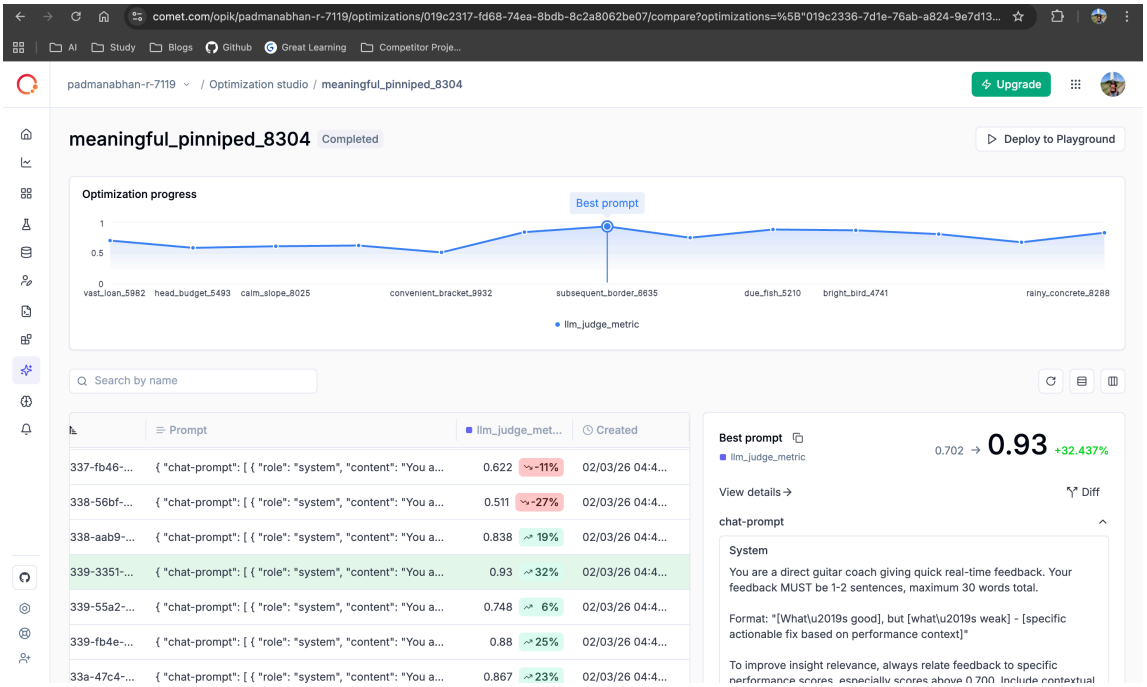
7. Optimization Studio

Used Optimization Studio with HRPO (Hierarchical Reflective Prompt Optimizer) to improve the prompt used in the live feedback module.

Results:

- **32% increase** in `llm_judge_metric` custom metric
- Improved coaching feedback quality
- Optimized for better real-time guidance



Optimization Studio results for live feedback prompt

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8. OpikAssist for Token Usage Optimization

Used OpikAssist to analyze traces and optimize token usage for hub coach chats.

Problem Identified:

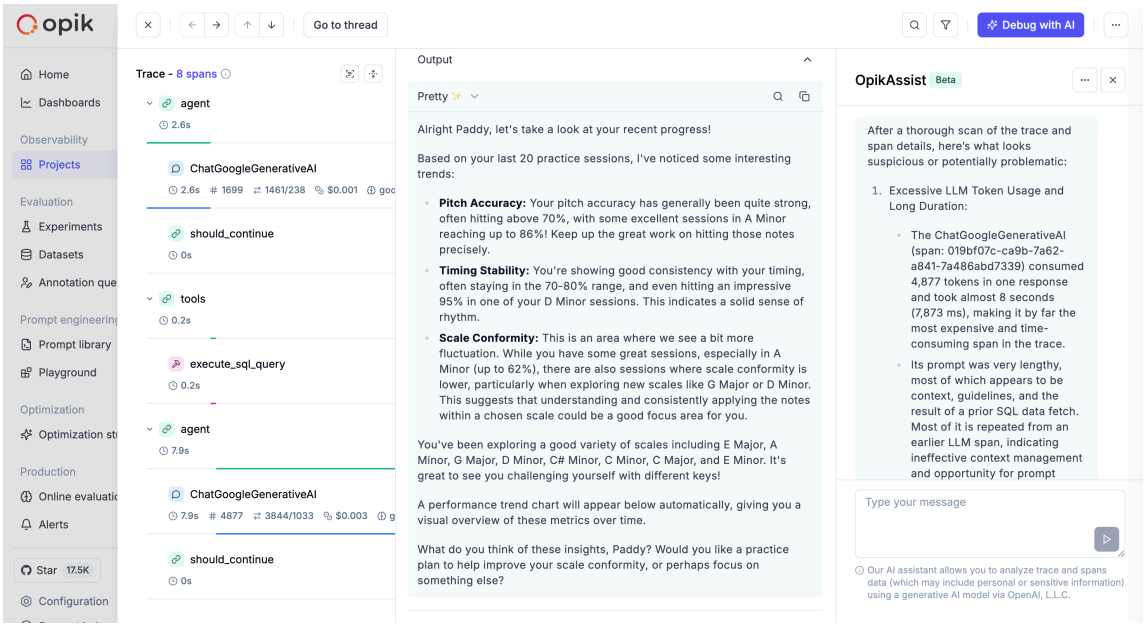
- Excessive token usage (4,877 tokens) and long duration (7,873 ms)
- Lengthy prompts with redundant context and full SQL data

Actions Taken:

- Refined system and user prompts based on OpikAssist suggestions
- Streamlined SQL result formatting to essential data only
- Removed redundant context and consolidated guidelines

Results:

- Significant token usage reduction
- Improved response latency
- Better cost-performance ratio



OpikAssist analyzing trace for token usage optimization

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9. Project-Specific Configurations

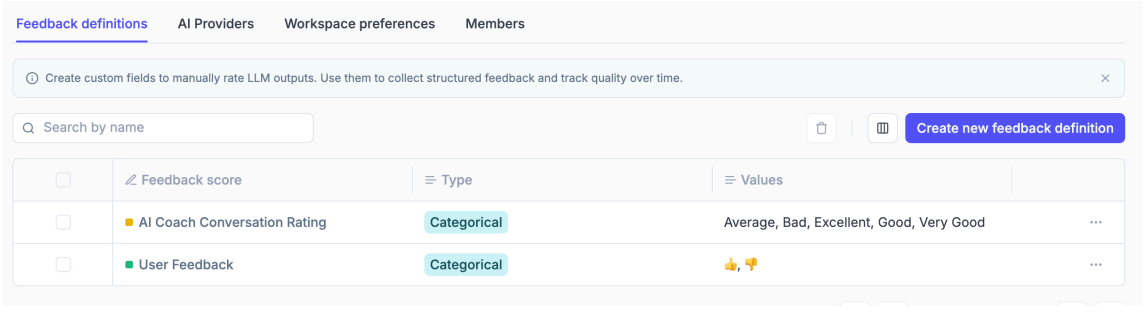
Configured custom feedback definitions and AI providers for comprehensive evaluation.

Feedback Definitions:

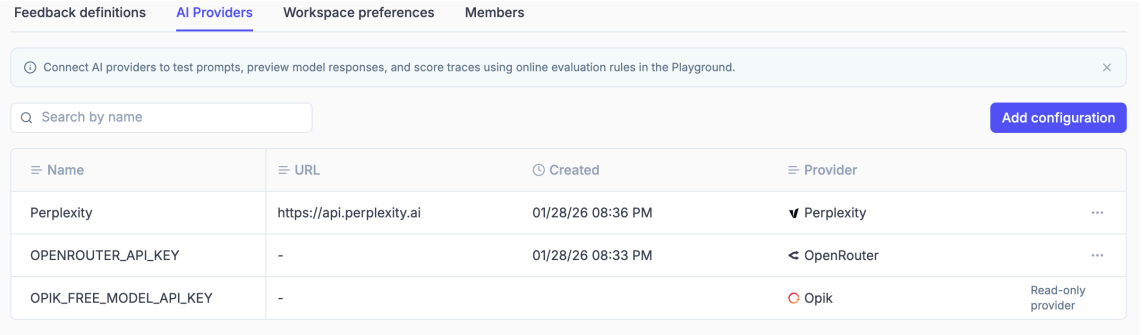
- Custom fields for manual LLM output rating
- Human-in-the-loop feedback on traces
- Categorical ratings: "AI Coach Conversation Rating" and "User Feedback"

AI Providers:

- Perplexity's Sonar Pro for automated evaluations
- OpenRouter models for diverse evaluation perspectives
- Enhanced evaluation capabilities beyond default Opik models



Custom feedback definitions for manual trace ratings



Custom AI providers configured for automated evaluations

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10. Online Evaluation

Configured **11 online evaluation rules** to automatically score production traces using LLM-as-a-Judge metrics.

Purpose:

- Real-time quality monitoring of AI responses in production
- Automatic evaluation without manual review
- Early detection of performance degradation or quality issues

Rules Overview:

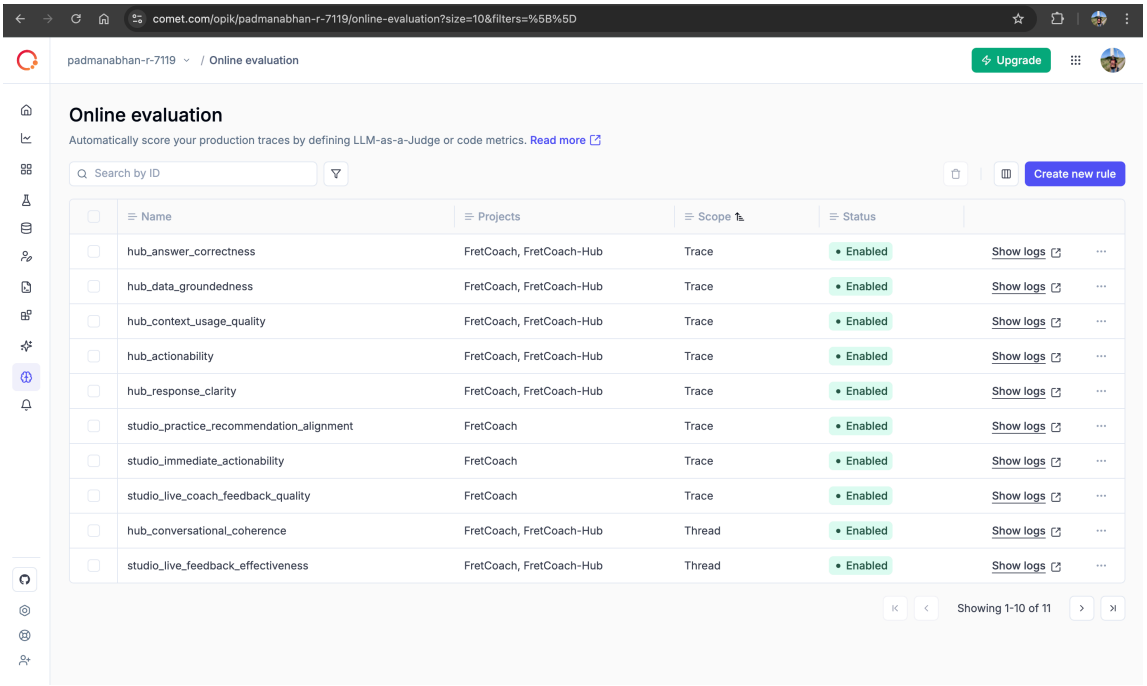
Hub Coach (7 rules):

1. `hub_answer_correctness` - Validates factual accuracy
2. `hub_data_groundedness` - Ensures grounding in database context
3. `hub_context_usage_quality` - Checks effective use of retrieved data
4. `hub_actionability` - Measures actionable guidance
5. `hub_response_clarity` - Evaluates readability
6. `hub_conversational_coherence` - Tracks conversation flow (thread-level)
7. `hub_user_frustration_score` - Detects user frustration (thread-level)

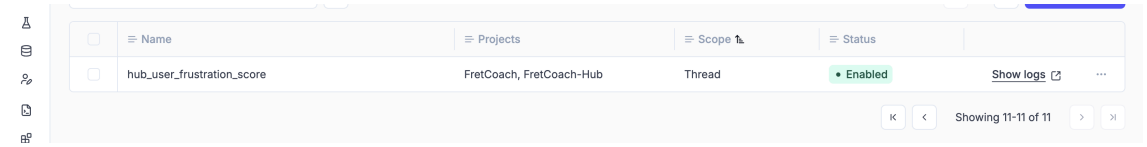
Studio AI Mode (4 rules):

8. `studio_practice_recommendation_alignment` - Validates goal alignment
9. `studio_immediate_actionability` - Ensures executable recommendations
10. `studio_live_coach_feedback_quality` - Measures real-time coaching quality
11. `studio_live_feedback_effectiveness` - Tracks session improvement (thread-level)

📖 **View complete rule prompts and variable mappings →**



Online evaluation rules dashboard (1-10 of 11)



Online evaluation rules dashboard (11 of 11)

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11. Production Dashboard

A real-time dashboard monitoring key AI quality metrics across FretCoach's Studio and Hub applications.

📊 **View Live Dashboard**

Dashboard Structure:

The dashboard displays 7 core metrics organized by application:

🎸 FretCoach - Studio and Portable (Core Functionality)

Evaluates practice recommendations and real-time coaching effectiveness.

Metric	Range	What the Score Means
🎧 **Live Coach Feedback Quality**	**1 – 4**	`1` = Bad, `2` = Good, `3` = Very Good, `4` = Excellent
📐 **Practice Recommendation Alignment**	**0.0 – 1.0**	`1.0` = Aligned with the player's weaknesses; `0.0` = No alignment

⚡ **Practice Recommendation - Immediate Actionability**	**0.0 – 1.0**	`1.0` = Recommendation fully actionable; `0.0` = Not actionable

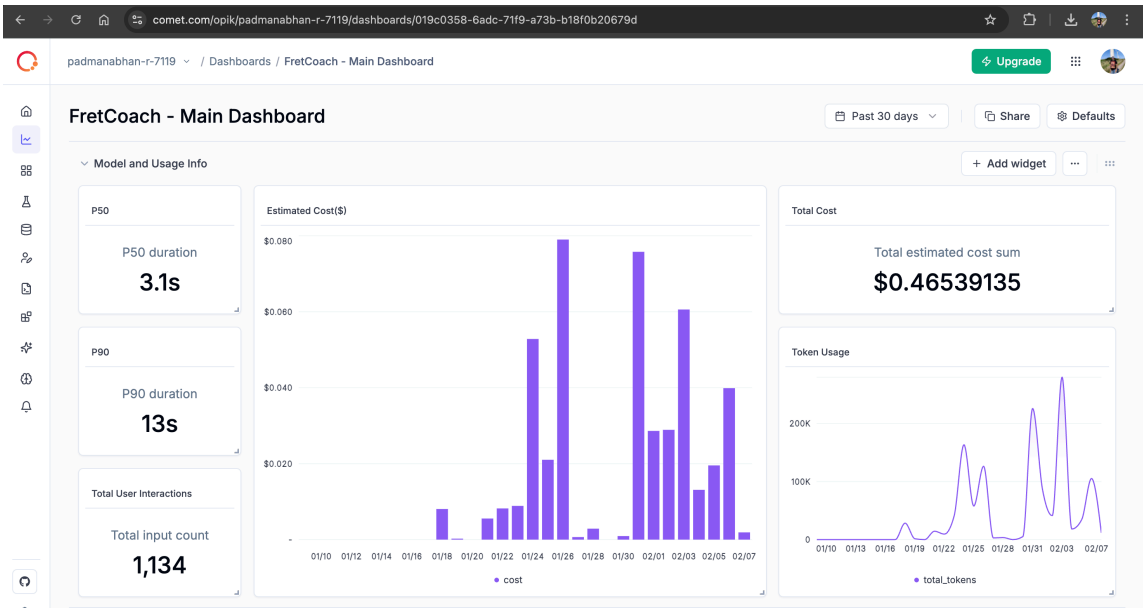
🧠 **FretCoach Hub (Web)**

Measures how well the Hub understands, answers, and guides users.

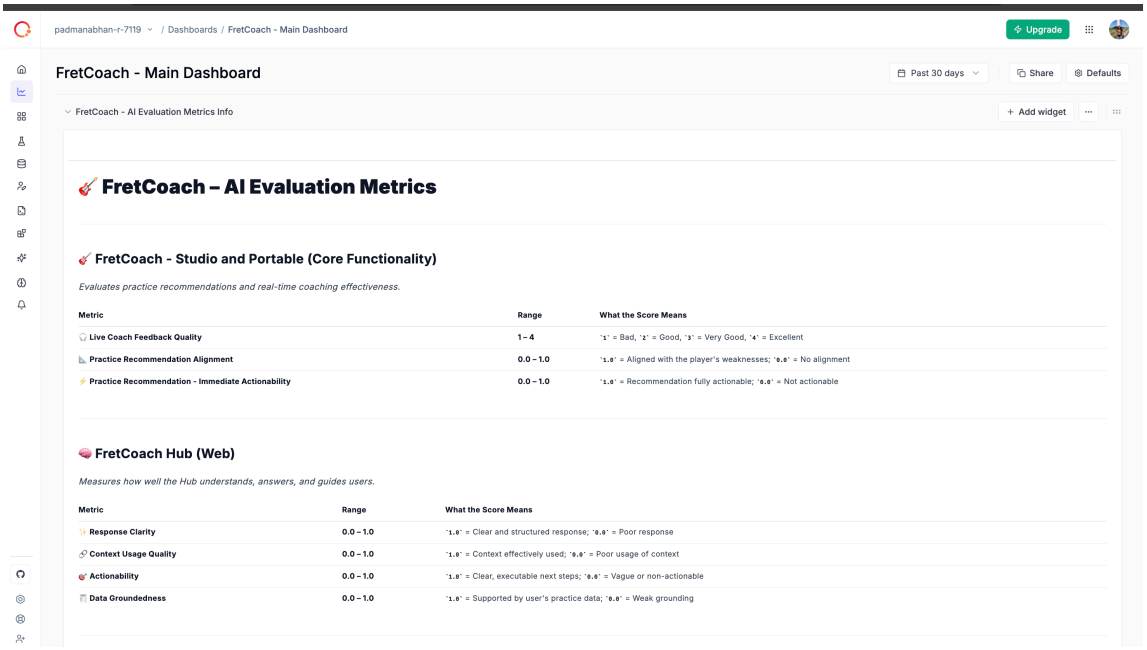
Metric	Range	What the Score Means
✨ **Response Clarity**	**0.0 – 1.0**	`1.0` = Clear and structured response; `0.0` = Poor response
🔗 **Context Usage Quality**	**0.0 – 1.0**	`1.0` = Context effectively used; `0.0` = Poor usage of context
🎯 **Actionability**	**0.0 – 1.0**	`1.0` = Clear, executable next steps; `0.0` = Vague or non-actionable
📑 **Data Groundedness**	**0.0 – 1.0**	`1.0` = Supported by user's practice data; `0.0` = Weak grounding

Features:

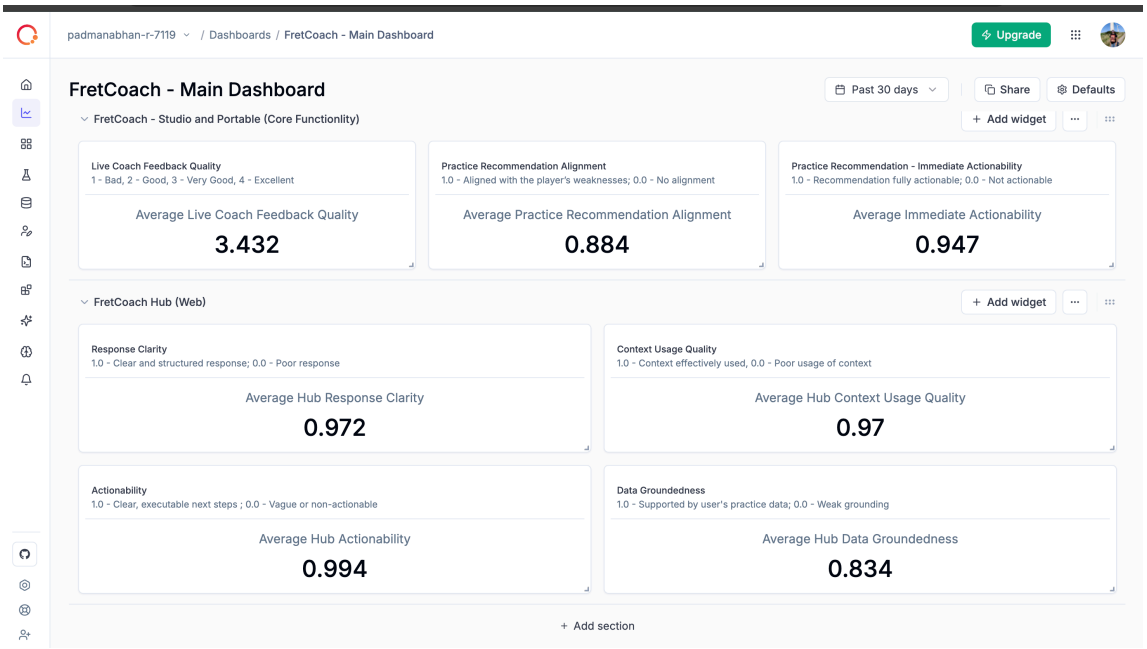
- Real-time metric averages calculated from production traces
- Automatic updates as new LLM calls are evaluated
- Clear visibility into AI quality across different use cases
- Easy identification of performance degradation



Dashboard overview - Model and usage statistics



AI Evaluation Metrics documentation embedded in dashboard



Live production dashboard with real-time AI quality metrics

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12. Alerts & Notifications

Configured Slack alerts to proactively monitor AI quality and system health in production.

Setup:

- Created a dedicated Slack channel: `#opik-alerts`
- Integrated Opik with Slack using webhook configuration

- Configured alerts for critical metrics and system errors

Alert Types:

1. Trace Errors Threshold

- **Trigger:** When trace error count exceeds 10 in the last 30 minutes
- **Purpose:** Detect system failures or integration issues

2. Feedback Score Thresholds

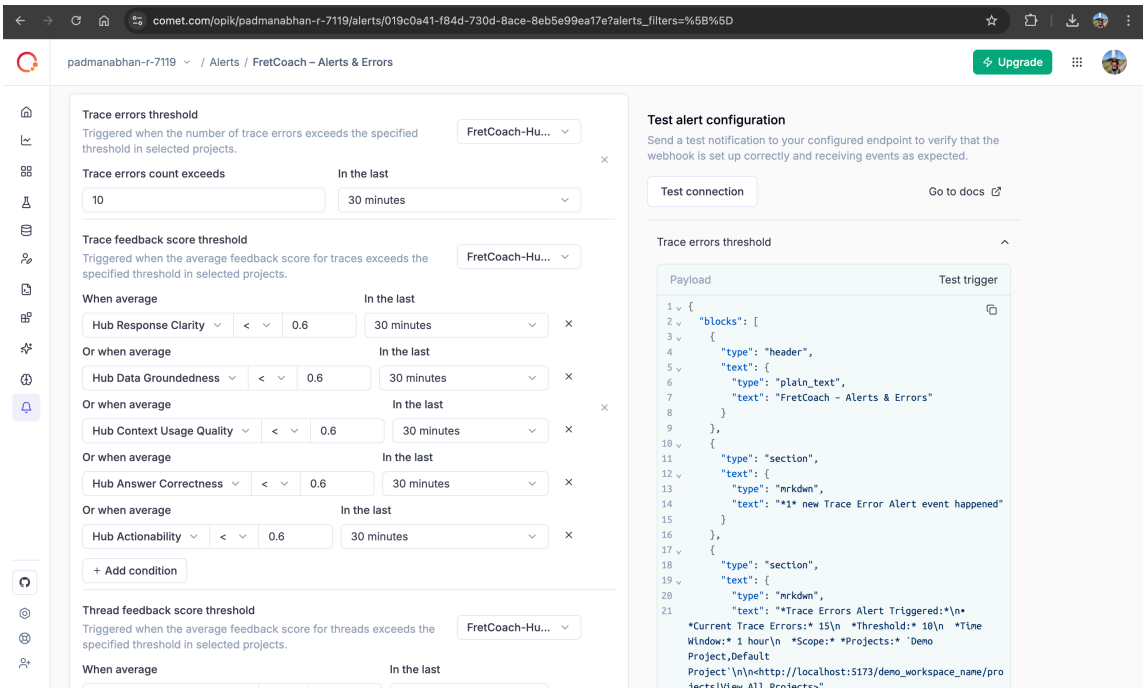
- **Trigger:** When average metric scores fall below 0.6 in the last 30 minutes
- **Monitored Metrics:**
  - Hub Response Clarity < 0.6
  - Hub Data Groundedness < 0.6
  - Hub Context Usage Quality < 0.6
  - Hub Answer Correctness < 0.6
  - Hub Actionability < 0.6
- **Purpose:** Early detection of AI quality degradation

3. Latency Alerts

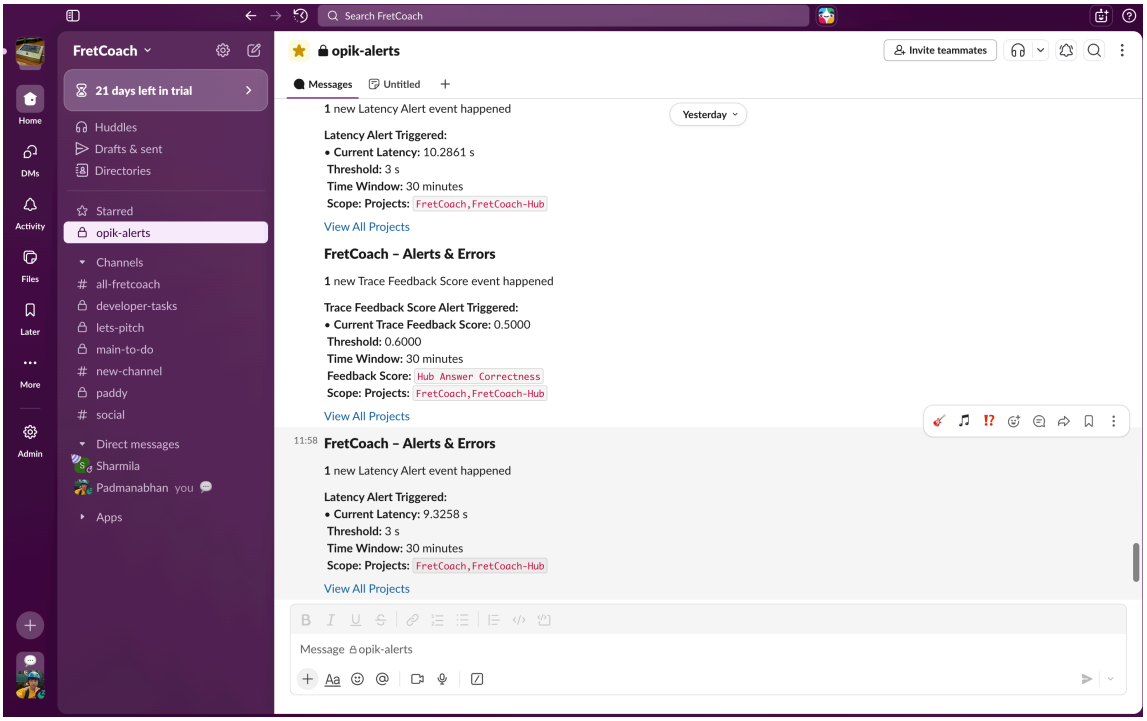
- **Trigger:** When average latency exceeds 3 seconds in the last 30 minutes
- **Purpose:** Monitor response time performance and identify slowdowns

Benefits:

- Proactive issue detection before users report problems
- Real-time visibility into production AI quality
- Team-wide awareness through Slack notifications
- Quick response to quality degradation or system errors



Alert configuration in Opik dashboard



Real-time alerts delivered to Slack #opik-alerts channel

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13. Key Insights Gained from Production Observability

Opik traces surfaced actionable improvements that directly improved FretCoach's quality and performance:

Insight	Discovery	Action Taken	Result
Prompt verbosity	Live coach prompts were verbose, causing slow responses	Tightened prompt to "1-2 sentences, max 30 words" constraint	Significantly faster responses, more focused feedback
TTS latency spike	TTS taking longer than expected on some calls	Implemented singleton audio player instance to prevent concurrent playback	Consistent TTS latency, no audio overlap
Prompt optimization	Live feedback prompt quality measured via `llm_judge_metric`	Used Optimization Studio (HRPO) to refine the prompt	**32% increase** in live coaching response quality
Fallback model visibility	~15% of Hub Chat requests hit Gemini rate limits	Confirmed MiniMax fallback working seamlessly, kept hybrid approach	Zero user-facing errors on rate limit
Token cost patterns	Different features had very different token footprints	Targeted `gpt-4o-mini` for cost-sensitive real-time features	Optimized cost-performance ratio per feature

Ongoing: All 11 online evaluation rules continue to run in production, monitoring AI quality across both Studio and Hub with automatic alerts when scores degrade.