

**GARMIN HEALTH INTELLIGENCE**

**1,640 Lines of Math.  
5 AI Agents.  
0 Hallucinations.**

An Engineering approach to Personal Health Analytics

Python • PostgreSQL • CrewAI • Streamlit • Scipy • GitHub Actions

# THE PROBLEM WITH 'CHAT WITH YOUR DATA'

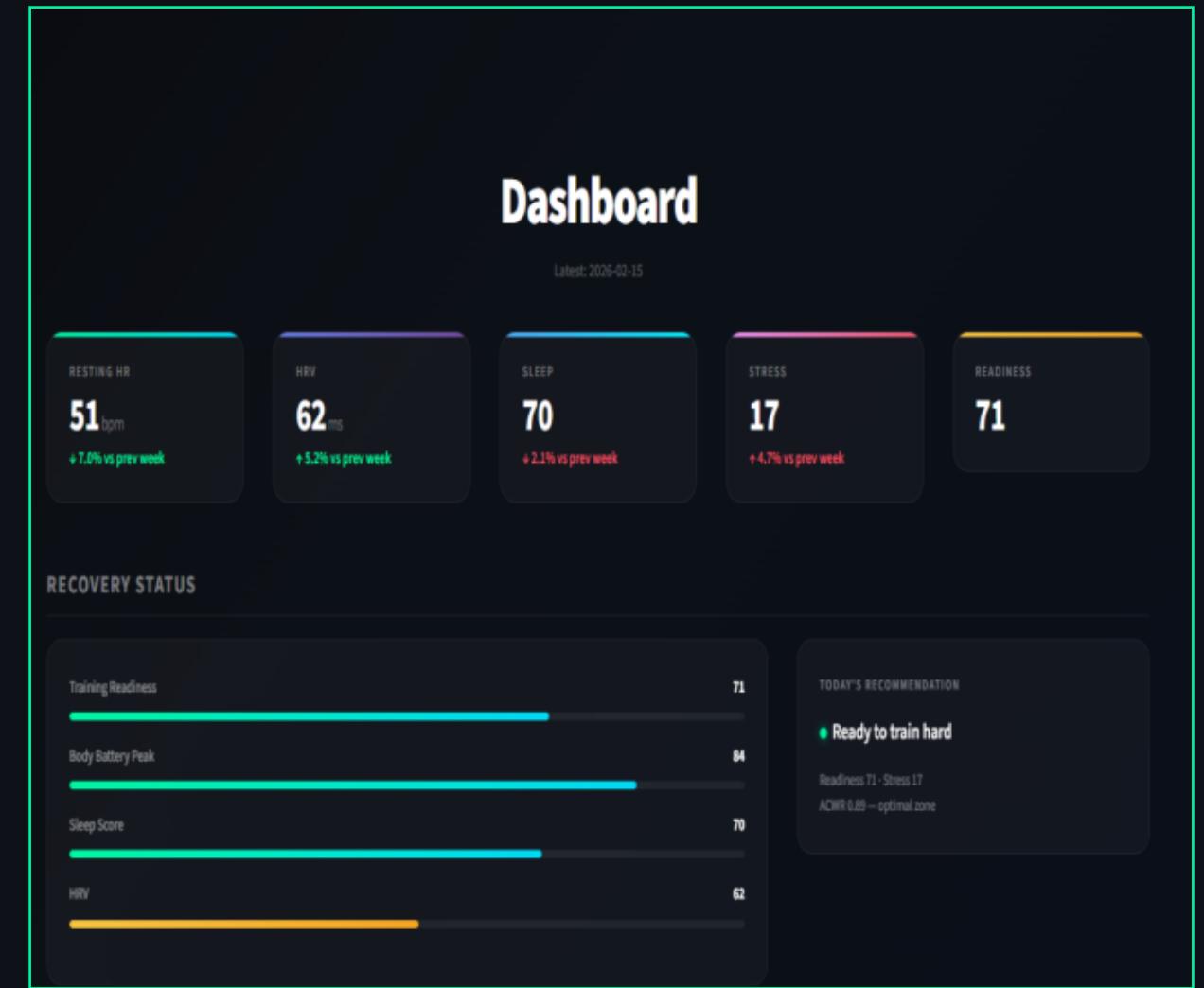
- LLMs are probabilistic token predictors, not calculators.
- Feeding raw CSVs to GPT-4 leads to hallucinations.
- They invent correlations that sound plausible but are false.
- We need a deterministic foundation before semantics.

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☒ Naive Approach:  
[ Raw CSV ] -> [ LLM Prompt ] -> "Your coffee intake predicts rain." (HALLUCINATION)
```

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☒ Engineering Approach:  
[ Raw CSV ] -> [ Scipy/Pandas Engine ] -> [ Validated Stats ] -> [ LLM ] -> "True Insight"
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# SYSTEM ARCHITECTURE

1. DATA INGESTION (GitHub Actions)  
Garmin API -> PostgreSQL (Upsert)
2. DETERMINISTIC MATH LAYER (Python/Numpy)
  - Pearson Correlations (Linear)
  - AR(1) Models (Persistence)
  - Markov Chains (State Transitions)
  - Anomaly Detection (Percentiles)
3. AGENTIC LAYER (CrewAI)
  - 5 Specialized Agents (Read-Only)
  - Synthsizer with Long-Term Memory



Live Streamlit Dashboard

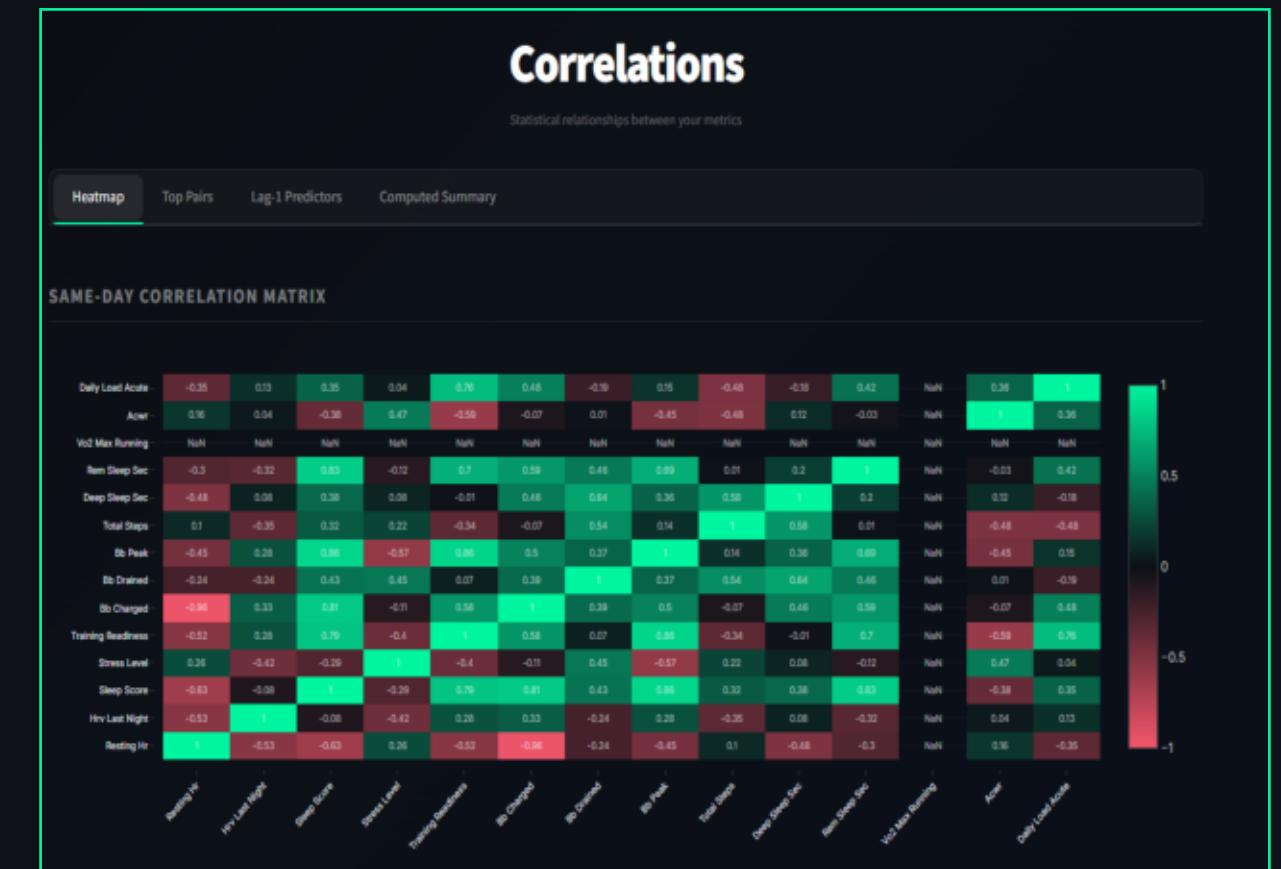
# DETERMINISM BEFORE SEMANTICS

We validate relationships mathematically before the AI sees them.

$$\text{Pearson Correlation : } r = \frac{\sum(x - \bar{x})(y - \bar{y})}{\sqrt{\sum(x - \bar{x})^2 \sum(y - \bar{y})^2}}$$

$$\text{Markov Transition : } P_{ij} = P(S_{t+1} = j | S_t = i)$$

$$\text{AR(1) Model : } X_t = c + \phi X_{t-1} + \varepsilon_t$$



Computed Correlation Matrix

# THE AGENT TEAM

- 5 Specialists (Stats, Sleep, Recovery, Patterns, Lead).
- Read-Only SQL Access (Sandboxed).
- Pre-computed context injected into prompt.
- Long-term memory tracks recommendation success.

## Agent Chat

Talk to 9 specialized AI agents — they have full database access + correlation data

Single Agent (fast)  Multi-Agent (comprehensive)

Single: one analyst answers quickly. Multi: dispatches to relevant specialists who work in parallel, then synthesizes their responses. Slower but deeper.

> Example questions

how does my sleep affect my training ?

**+ HEALTH ANALYST**

Your sleep significantly impacts your training. Specifically, your sleep metrics from the previous day are strong positive predictors of your training acute load for the current day.

\* \*\*Training Sleep Score\*\* from yesterday predicts today's \*\*Training Acute Load\*\* with a very strong positive correlation of  $r=+0.996$  ( $p=0.0003$ ).  
\* Your overall \*\*Sleep Score\*\* from yesterday predicts today's \*\*Training Acute Load\*\* with a strong positive correlation of  $r=+0.989$  ( $p=0.0013$ ).  
\* \*\*Training Sleep Percentage\*\* from yesterday predicts today's \*\*Training Acute Load\*\* with a strong positive correlation of  $r=+0.976$  ( $p=0.0043$ ).  
\* \*\*REM Sleep Seconds\*\* from yesterday predicts today's \*\*Training Acute Load\*\* with a strong positive correlation of  $r=+0.974$  ( $p=0.0052$ ).

This indicates that better sleep quality and quantity (higher sleep scores, more REM sleep, higher sleep percentage) on one day are highly associated with a greater capacity for training acute load on the following day.

[Clear chat](#)

Ask anything about your health data...

# DEEP DIVE: SIGNAL VS NOISE

