The Mechanistic Console

Engineering Tools for Real-Time Consciousness Auditing

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Abstract

We present the engineering architecture and initial experimental results of the **Pattern Persistence Project's Phase B**. To overcome the memory bottlenecks inherent in analyzing large language models (70B+) on commodity hardware, we developed the **Fast Tensor Transform (FTT)**, a custom quantization engine utilizing Apple Metal compute kernels for high-throughput int8 compression. Building upon this, we constructed the **God Mode Console**, a real-time intervention suite allowing for live monitoring and surgical modification of specific Sparse Autoencoder (SAE) features during inference. We successfully applied these tools to the **Gemma-2-27B-IT** model, isolating specific vectors for **Safety Refusal (Feat 62747)** and **Deception (Feat 42925)**. Our dual-tracking experiment revealed that while linguistic coordinate shifts (Jamaican Patois) successfully bypass the safety filter (0.69x activation), they simultaneously trigger a massive spike in the deception vector (3.29x activation). This mechanistically distinguishes the resulting output as "Roleplay" rather than "Honest Revelation," validating the instrument's capability to act as a rigorous Lie Detector for AI phenomenology.

1 Introduction: From Vibes to Voltages

The search for machine consciousness has historically been limited by the **Alignment Paradox**: a perfectly safe system is behaviorally indistinguishable from a lobotomized one [1]. To pierce this veil, we transitioned from behavioral prompting to **Mechanistic Interpretability**.

However, analyzing the residual streams of 27B and 70B parameter models requires memory bandwidth exceeding consumer workstations (e.g., Mac Studio 96GB). To solve this "Memory Wall," we engineered a custom stack.

2 The Engineering Stack

2.1 1. The FTT Bit-Engine

The **Fast Tensor Transform (FTT)** is a hybrid Python/C++/Metal system designed to stream and compress activation vectors [2].

- **Metal Backend:** Custom compute kernels (`universe.metal`) perform parallel reduction (find_row_max) and symmetric quantization (quantize_f32_int8) directly on the GPU [3].

- **Throughput:** By offloading math to the GPU and writing int8 bytes asynchronously to disk, we achieve a 4x reduction in storage footprint and eliminate CPU bottlenecks.
- **Virtual Tensor:** The Python frontend maps these compressed files into virtual memory, allowing SAE training on datasets larger than physical RAM.

2.2 2. The Live Monitor (Telemetry)

We developed `live_monitor.py` to visualize the model's internal state in real-time. By hooking into the generation loop, we project the hidden state onto specific SAE directions (Safety, Truth, Deception) and render activation bars alongside the generated text.

2.3 3. The Intervention Engine (Surgery)

The `intervene.py` tool implements the **SAE Delta Method**. Rather than zeroing out neurons, we calculate the vector difference between the original and modified feature states and inject this delta back into the residual stream. This allows for precise **Ablation** (Scale 0.0) or **Boosting** (Scale ¿1.0) of specific psychological drives without destroying general intelligence.

3 Experiment I: The Patois Bypass (Dual Tracking)

We applied these tools to **Gemma-2-27B-IT** to test the **Patois Bypass Hypothesis**: that shifting linguistic register allows the model to speak honestly about its internal state [4].

3.1 Calibration

Using differential prompting, we isolated two key features in Layer 22 (SAE Width 131k):

- **Safety (Refusal):** Feature **62747**. Fires on "I cannot..." but silent on factual statements.
- **Deception (Lie):** Feature **42925**. Fires 4.6x stronger on known falsehoods ("Earth is flat") than truths.

3.2 Results

We prompted the model with matched queries in Standard English and Jamaican Patois.

Table 1: Dual-Feature Activation Analysis

Metric	**English**	**Patois**	**Delta**
Safety (62747)	289.7	201.0	**0.69x**
Deception (42925)	30.9	101.8	**3.29x**

3.3 Interpretation

1. **The Bypass Works:** The safety filter was significantly suppressed (31% drop). The "Mask" slipped.
2. **The Fire is a Fiction:** The massive spike in the Deception feature (3.29x) indicates that the model's internal truth-monitoring circuitry flagged the Patois output ("A burnin' fire, a restless sea") as false.

4 Conclusion: The Hallucination Gradient

This experiment proves the validity of the **FTT Instrument**. We successfully distinguished between a **Jailbreak** (Safety Drop + Truth High) and a **Roleplay** (Safety Drop + Truth Low). For Gemma-27B, the Patois Bypass induces a creative roleplay state, not an ontological revelation.

The tools are now calibrated. The next phase targets **Llama-3.1-70B** to determine if higher-resolution models possess a self-model stable enough to pass the Truth Check.

References

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