Switching the loop on at inference cuts E rate ≈15×

exp038 · 30 May 2026

The trained networks this entry uses are produced once in the shared training hub, exp022 (Training), and reused here rather than retrained.

Abstract

Loads a trained COBA network and switches the I-loop on at inference by sweeping *ei_strength* from 0 to 1. The same feedforward weights that fire at ≈ 133 Hz without the loop fire at ≈ 9 Hz with it engaged, a ≈ 15× drop with no weight update. Accuracy, though, falls ≈ 36 pp (from ≈ 90% to ≈ 55%) as the loop engages, because the readout was never trained with it. PING gating is a post-hoc sparsity knob: the architecture, not the training, supplies the gamma dynamics, but using it well still needs training *with* the loop.

Method

Parameter	Value
Integration timestep Δt	0.1 ms
Trial duration T	200 ms
MNIST samples (80/20 stratified split of 7000)	5600 train / 1400 test (≈ 10% of the 70k-sample MNIST corpus)
Epochs	50

The PING and COBA baseline definitions and the training recipe are in exp025 this entry runs the COBA → PING I-loop transfer probe at eval time on the trained baselines. (The input-rate sweep / f–I curve material that previously lived here has moved to exp023, the natural home for “architectural response to drive”.)

Inference-time probe. The trained COBA baseline (seed 42, θ_u = off) is loaded and *ei_strength* (the I-loop gain) is overridden at eval time across 11 values from 0 to 1. W_{in} and W_{out} load from the COBA checkpoint; W^{EI} and W^{IE} are freshly initialised (the COBA checkpoint stores these at zero, so skipping the load leaves a functional I-loop). No retraining.

Results

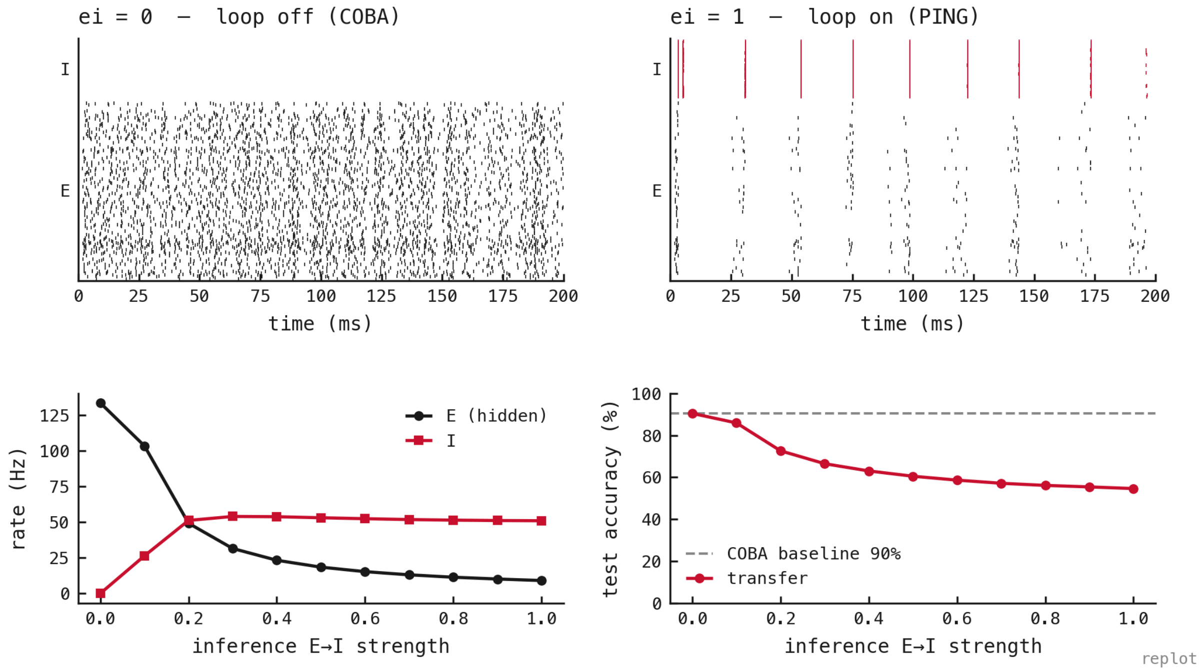

Figure 1: Switching the recurrent I-loop on *at inference* on a trained COBA network (no retraining; W^{EI}/W^{IE} freshly wired, since the COBA checkpoint stores them at zero). **Top**: the same feedforward weights fire densely and asynchronously at $ei = 0$ (COBA) and in gamma bands at $ei = 1$ (PING); the gamma dynamics come from the inhibitory architecture, not from training. **Bottom left**: E rate falls $\approx 15\times$ ($\approx 133 \to 9$ Hz) as the loop engages while I rises to ≈ 51 Hz; the suppression is continuous in loop strength. **Bottom right**: accuracy *degrades* without retraining, from the $\approx 90\%$ COBA baseline to $\approx 55\%$ at full strength (a ≈ 36 pp cost). So the architecture supplies the rate-gating for free, but using it well needs training *with* the loop (exp025): the sparsity is architectural, the accuracy is learned.

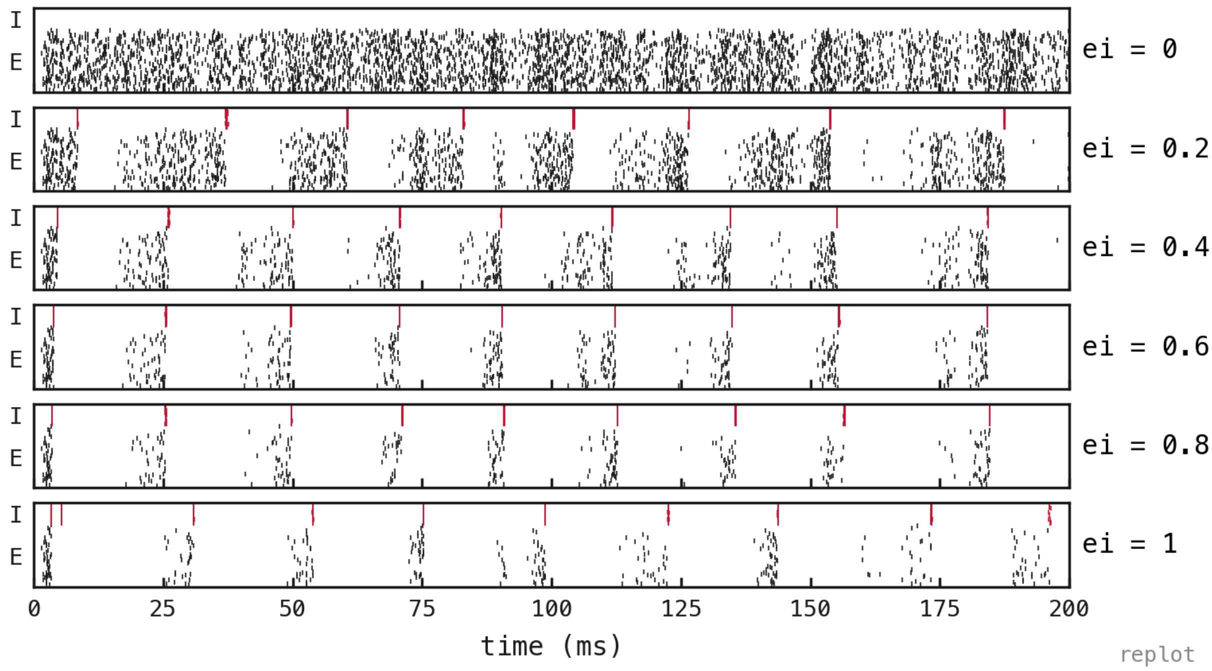

Figure 2: The full transition: trained COBA replayed at six inference-time *ei_strength* values (same trial, same feedforward weights, a fresh I-loop each row). At $ei = 0$ the asynchronous-dense COBA pattern persists; by $ei \approx 0.4$ the same weights produce gamma cycles, sharpening toward $ei = 1$. The rhythm appears continuously as the loop is wired in, with no retraining at any point.