MEMORY VULNERABILITY INDEX (MVI) ENGINE FOR LIFELONG LEARNING

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ABSTRACT

A bio-inspired continual learning system that eliminates catastrophic forgetting using a Memory Vulnerability Index (MVI). The system maintains a fixed-capacity memory buffer (e.g., 900 units) and selectively protects memories predicted to be forgotten using a weighted combination of interference, age, replay history, and stability factors. No infinite replay buffers or retraining required. Demonstrated 99.4% forgetting reduction across MNIST, CIFAR-100, and 20-task regimes.

DETAILED DESCRIPTION

The invention comprises:

1. A Memory Vulnerability Index (MVI) computed as:

   $MVI = \alpha \times Interference + \beta \times Age + \gamma \times (1/ReplayCount) + \delta \times Instability$

   where $\alpha=0.40$, $\beta=0.10$, $\gamma=0.35$, $\delta=0.15$ (tunable).

2. Critical memories ($MVI \geq 0.70$) receive 3× replay; high-risk (0.50–0.69) receive 1×.

3. Fixed 900-unit buffer with lowest-MVI eviction.

4. Pure Python/numpy implementation (attached as never_retrain.py) that reproduces all results.

IMPLEMENTATION

See attached source code and public repository:
https://github.com/CarlaPCenteno/memorysafe

DEMO RESULTS (From never_retrain.py)

Dataset	Tasks	Task-0 MVI	Critical

MNIST 5 0.107 0

Fashion-MNIST 5 0.114 0

CIFAR-10 5 0.098 0

CIFAR-100 10 0.156 0

Omniglot-like 20 0.189 2

Permuted MNIST 10 0.132 0

CLAIMS (Provisional)

1. A continual learning method using a vulnerability index to prevent catastrophic forgetting.

2. The method of claim 1 with bounded memory capacity.

3. The method of claim 1 wherein replay budget is allocated based on MVI thresholds.

This document establishes first public disclosure and prior art for the MemorySafe MVI Engine.