The Brashian Parser Evolution System (BPES): A Neuro-Symbolic Framework for Adaptive Parsing and Ontological Self-Revision

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Abstract

The Brashian Parser Evolution System (BPES) unifies symbolic composition, vector-grounded semantics, and evolutionary computation to enable adaptive syntactic-semantic parsing across domains. Inspired by Douglas Brash's stipulative semantics, BPES constructs referentially anchored symbolic frames, refines grammars via genetic algorithms, and evolves its ontological substrate through meta-genomic feedback. It is designed for tasks requiring semantic fidelity and conceptual adaptation, such as mathematical reasoning and legal clause parsing.

1 Introduction

Parsing is traditionally viewed as a syntactic mapping from tokens to structures. The Brashian Parser Evolution System (BPES) redefines parsing as an act of ontological commitment, stipulating referential structures per Douglas Brash's cognitive thesis. BPES integrates evolutionary computation, multimodal grounding, and symbolic mutability to adaptively parse heterogeneous corpora, positioning it as a cornerstone for neuro-symbolic AI.

2 Theoretical Foundations

BPES operationalizes Brash's thesis that cognition emerges from stipulating "things" in perceptual fields. Parsing becomes an evolvable mapping from token sequences to grounded, observer-relative representations, combining symbolic and vectorial semantics.

3 Core Components

3.1 Evolutionary Genome Architecture

Parsers are encoded as genomes with:

- Precedence Genes: Weighted operator hierarchies.
- Attachment Heuristics: Probabilistic phrase attachment policies.
- Penalty Genes: Weights for structural features (e.g., ambiguity).
- Structural Graph Genes: Syntactic connectivity constraints.
- Meta-Genes: Symbol creation and ontology adaptation.

Genomes evolve via mutation and crossover.

3.2 Grounding Alignment Engine

Symbolic nodes are grounded if:

$$\text{cosine}(v(p_i), V_{\text{registry}}(p_i.\text{text})) > \tau$$

where $v(p_i)$ is the node embedding and τ is an adaptive threshold.

3.3 Cognitive Annealing Scheduler

An adaptive mutation rate balances exploration and exploitation based on parser fitness.

4 Symbol Registry

The Symbol Registry maps tokens to embeddings, type signatures, and usage patterns. A meta-genomic layer enables symbol induction, ontological fusion, and pruning.

5 System Dynamics

The evolutionary parsing loop includes:

1. Initialization of parser genomes.
2. Corpus evaluation for grounding and interpretability.
3. Selection, crossover, and mutation of genomes.
4. Meta-genomic symbol registry updates.
5. Deployment of high-fitness parsers.

6 Deployment Architecture

BPES leverages:

- FastAPI Servers: Stateless parser endpoints.
- Evolution Engine: Celery/Redis for cyclic evolution.
- Symbol Registry DB: FAISS-backed vector storage.

7 Conclusion

BPES redefines parsing as a neuro-symbolic, evolvable process, co-evolving grammars and ontologies for domain-specific tasks. Future work includes neuromorphic acceleration and cross-domain mutation transfer.