

Summary of Peer Review Findings – Manuscript 2 Only

Reviewer Model: Grok (built by xAI)

Date: Sunday, 29 March 2026

Manuscript Title:

Diversity Maintenance Strategies in Bio-inspired and Evolutionary Computation: Mathematical Frameworks and Adaptive Mechanisms

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Overall Assessment

This is an excellent, self-contained tutorial-style chapter that provides a clear, rigorous, and highly pedagogical treatment of population diversity maintenance in evolutionary computation. It successfully bridges mathematical theory, intuitive explanations, visual demonstrations, and reproducible Python code. The manuscript would make an outstanding contribution to any mathematical/computational periodical that accepts educational or “practical theory” articles.

Key Strengths

- Strong logical structure and progressive exposition (concepts → mathematics → visual results → critical discussion).
- Rigorous and correctly presented mathematical framework (distance metrics, Shannon/spatial entropy, fitness sharing with sharing function).
- High pedagogical value: original, insightful visualisations (diversity scatter plots, fitness-sharing colour maps, entropy evolution over generations, niching demonstration on multi-modal landscape).
- Fully functional, well-commented Python code (`DiversityAnalyzer` class) that directly reproduces all figures.
- Balanced critical discussion of strengths, limitations (e.g., niche-radius sensitivity, $O(N^2)$ cost), and future directions (adaptive/hybrid methods, dynamic environments).
- Current and appropriately cited references.

Summary of Concerns

The table below summarises the main issues identified:

Category	Issue Description	Severity	Suggested Fix
Empirical Validation	Results rely solely on synthetic/toy populations; no actual EA runs on standard multimodal benchmarks (Rastrigin, Ackley, etc.) to quantify performance gains	Major	Add at least one quantitative experiment comparing standard GA/PSO vs. GA/PSO + diversity maintenance (e.g., success rate, final fitness, diversity metrics)
Adaptive Mechanisms	Promised in abstract/introduction but not formalised, implemented, or tested	Major	Either provide a mathematical model + code for an adaptive scheme (e.g., entropy-thresholded mutation) or clearly scope as “future work”
Figure 1	General EA flowchart is externally sourced (MI-Research)	Minor	Replace with an original author-generated diagram or remove citation
Code & Formatting	Hard-coded paths (<code>/home/ubuntu/...</code>), <code>warnings.filterwarnings('ignore')</code> , minor OCR artefacts	Minor	Make paths configurable and clean for publication
Quantitative Summary	No table comparing diversity measures across population types	Minor	Add a small results table (entropy, avg. distance, shared fitness, etc.)

Recommendation

Minor Revision – The manuscript is already strong in substance and presentation. With the two major issues addressed (benchmark experiments + formal treatment or clear scoping of adaptive mechanisms) and the minor points cleaned up, it will be fully publication-ready and a valuable addition to the computational intelligence literature.

I am happy to provide the complete detailed peer-review report, suggested benchmark code snippets, or a re-review of the revised version if requested.