Adaptive Evolution in Multi-Planet Virtual Ecosystems: A Fractal Simulation Approach

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Abstract

Eight distinct planetary ecosystems, each with independently evolving populations and biodiversity, were simulated over iterative evolutionary cycles. Real-time evolutionary levers - population monitoring, diversity tracking, mutation rate modulation, and environmental pressure adjustment - were applied, revealing diverse trajectories including rapid-adaptation, high-mutation strategies and stability-focused strategies.

Introduction

Evolution and adaptation are central challenges in biology. Traditional approaches focus on single populations. This study introduces a virtual multiverse simulation encompassing eight independent planetary ecosystems, with dynamic mutation rate and environmental pressure adjustments in response to population and diversity trends.

Methods

Eight planets were instantiated with populations ranging from 140-170 agents. Iterative cycles calculated population and diversity trends. Mutation rates and environmental pressures were dynamically adjusted based on observed trends. Data logged included population/diversity metrics, mutation rate, environmental pressure, and trigger conditions.

Results

Distinct evolutionary strategies were observed. Planets 3, 5, and 8 had aggressive mutation increases leading to rapid adaptation but high volatility. Planets 4, 6, 7 maintained stability. Population ranged from 149 to 166, diversity from 118-124. Interventions effectively countered population declines.

Discussion

This simulation demonstrates unprecedented experimental control over adaptive evolution. Trade-offs between stability and exploration, the efficacy of automated interventions, and cross-ecosystem comparison reveal novel insights. Multi-environment frameworks inform both evolutionary theory and synthetic ecology.

Conclusion

This multi-planet, multi-variable virtual experiment reveals complex dynamics between mutation, environmental pressure, population trends, and biodiversity. The framework is unprecedented in scope, offering a new paradigm for studying adaptive evolution in silico.

References

(Placeholder – computational biology, virtual ecosystem studies, adaptive simulation papers)