LLaMEA-Agent

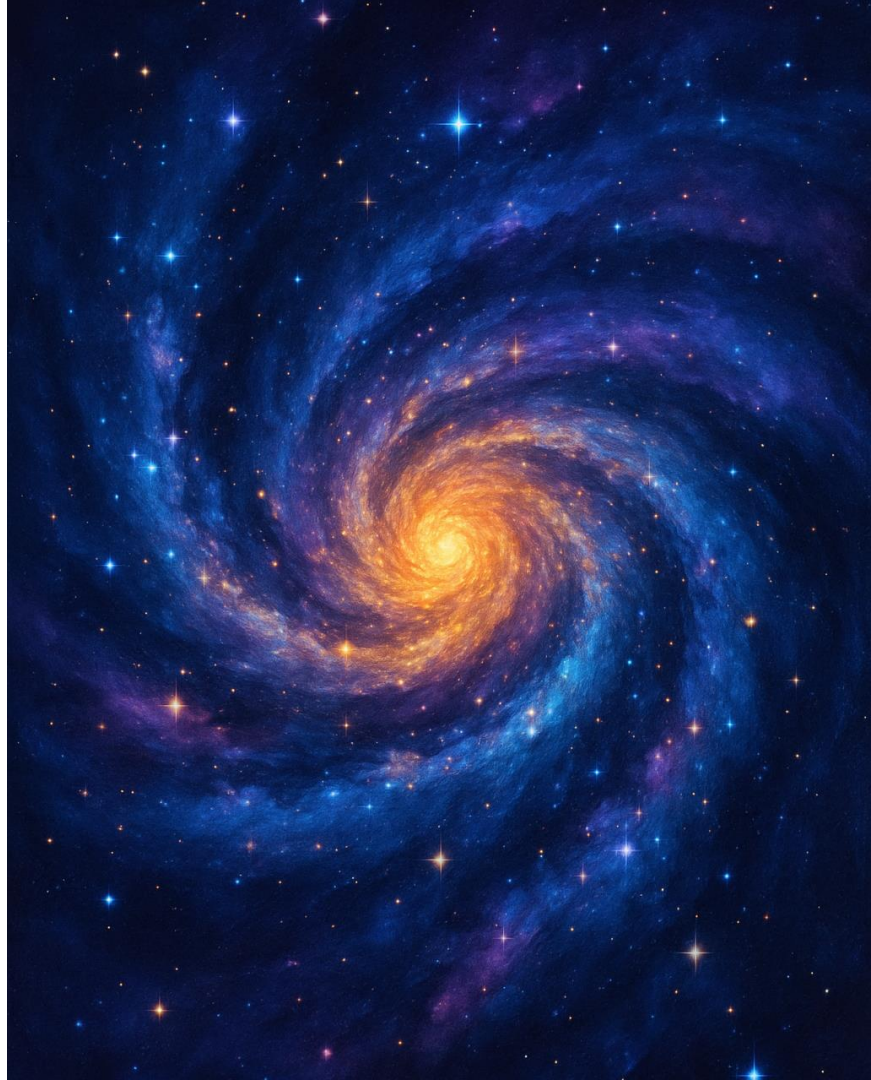## Planet Wars Competition Entry

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Evolving Agents with LLaMEA

- LLM generates candidate agents/heuristics in Python
- LLaMEA stores the agents in Python files and dynamically evaluates a whole population in a Planet Wars tournament using multiple game scenarios.
- The best agents of the population get selected.
- The agents are mutated (refined) by an LLM.
- The process is repeated till the budget is exhausted.
- Result: GalacticArmada

https://github.com/XAI-liacs/LLaMEA
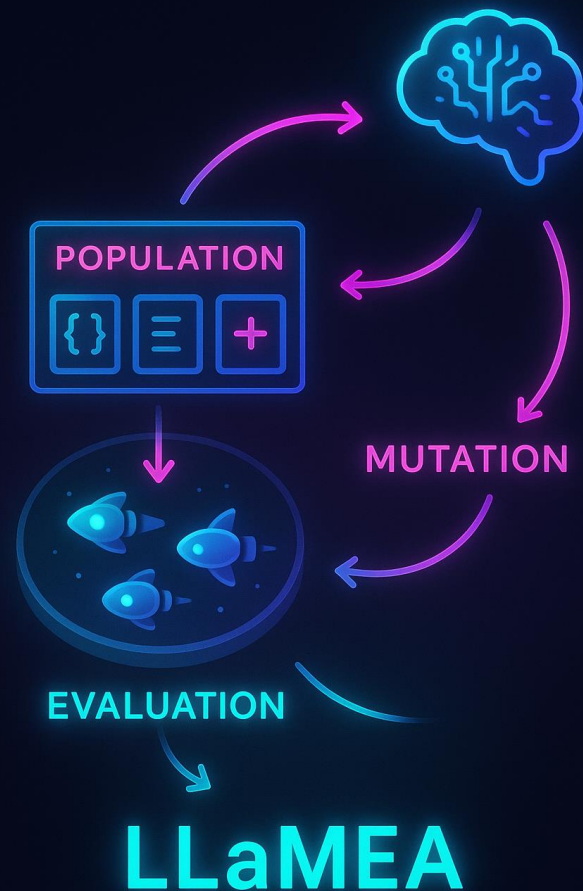
Agent Overview & Evolution

Generation & Evolution

- **LLaMEA** automatically evolves agent heuristics
- Evaluate offspring vs parents via tournament per iteration
- Continuous adaptation perfects strategies over generations

GalacticArmada

- Identify strongest and weakest planets
- Transfer 20% of ships from nearby planets to reinforce the strongest
- Limit transfers to avoid over-commitment

Defence

- Monitor threats using weighted enemy proximity
- Estimate defence: ships + growth × arrival time
- Coordinate multiple planets to defend the weakest

System Architecture (GalacticArmada)

Planet Analysis
Categorise planets by owner and compute strongest/weakest

Consolidation
Reinforce the strongest planet with nearby ships

Target Evaluation
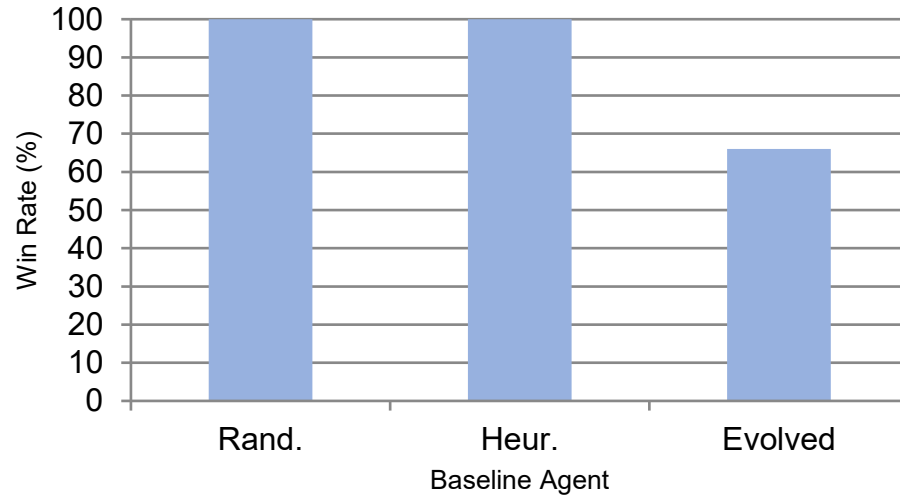Score candidates using ships, distance, growth & randomness

Ship Allocation
Send min(available, required, 70% available) ships

Defence Module
Assess threats & coordinate multi-planet defence

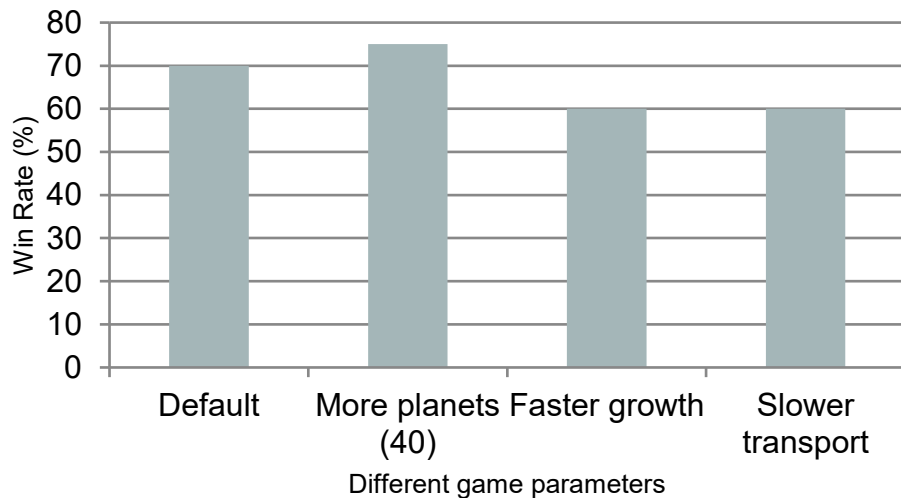# Results & Performance (Galactic Armada)

Baseline	Games	Wins	Win Rate
Random Bot	1000	1000	100%
Heuristic Bot	1000	1000	100%
Evolved Agents	1000	662	66%

- Perfect win rates vs random and heuristic baselines
- Strong 66% win rate against other evolved agents
- Tournament evaluation ensures continuous improvement

Analysis & Insights

Failure Modes

- Over-consolidation slows expansion
- Distance weighting underestimates far threats sometimes

Future Work & Improvements

Dynamic Tuning

Use evolutionary & reinforcement learning to tune heuristics on the fly

Deeper Search

Integrate Monte Carlo & tree search to look ahead beyond one decision

Explainability

Harness explainable AI to visualise decision rationale and build trust

Beyond heuristics, we plan to incorporate search and learning algorithms.
Our XAI expertise will provide clear explanations for every move.