Playing Atari games with an Interpretable Agent

October 27, 2021

Interpretable CGP Architecture

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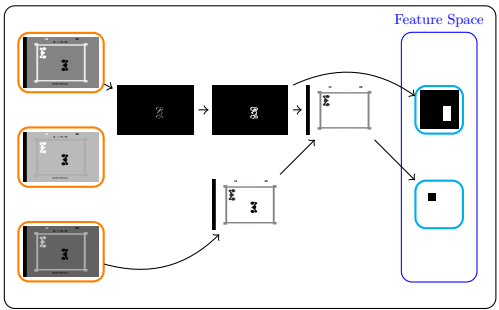
CGP Encoder



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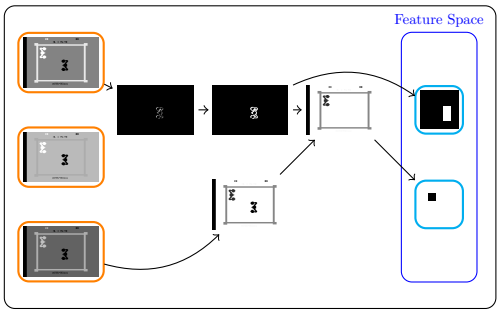

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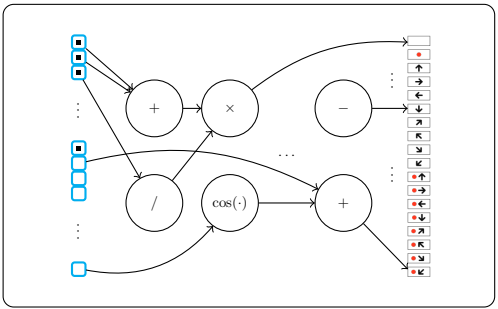

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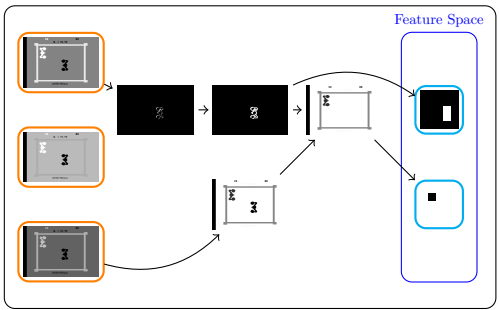

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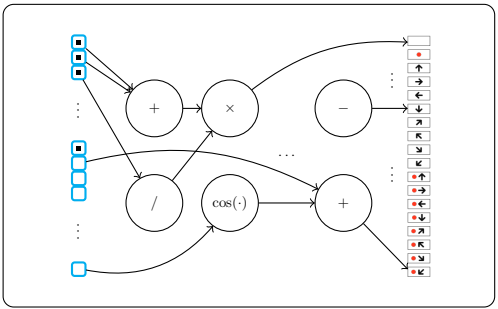

Functions: dilate, erode, subtract, threshold, binary, NOT, AND, OR, XOR, motion-capture

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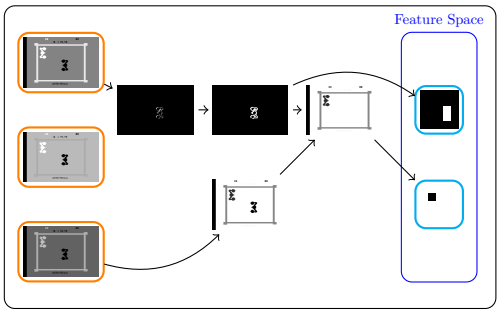

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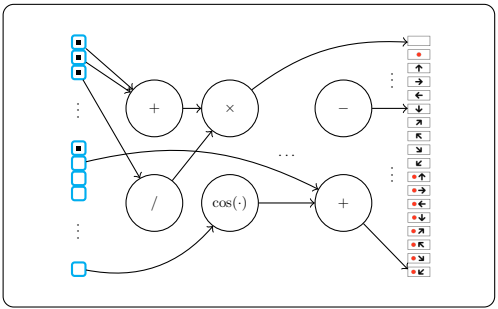

Functions: $+$, $-$, $\times$, $\div$, $|\cdot|$, $\sqrt{\cdot}$, $\leq$, $\geq$, NOT, AND, OR, XOR

Experiment 1: $1 + \lambda$ Co-evolution

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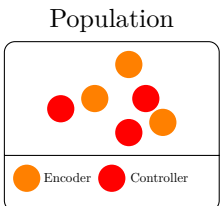

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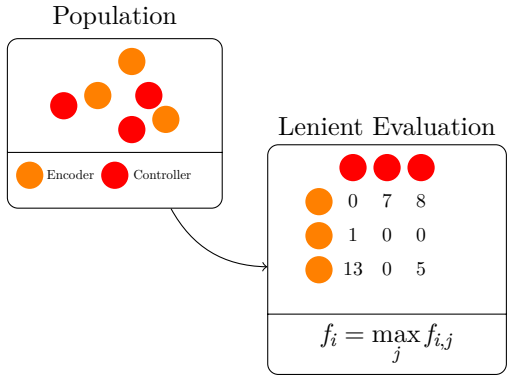

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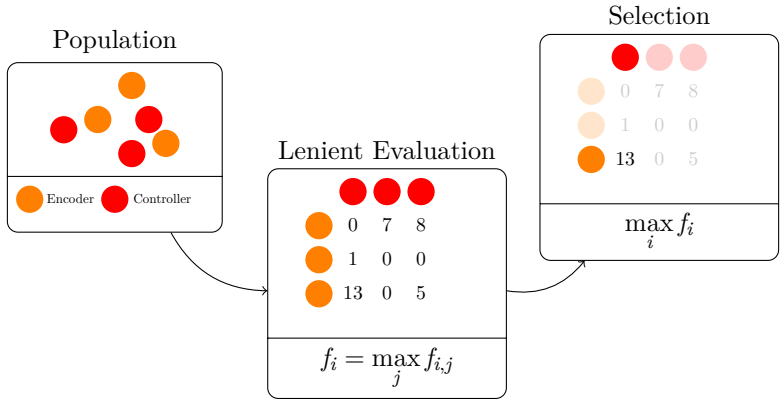

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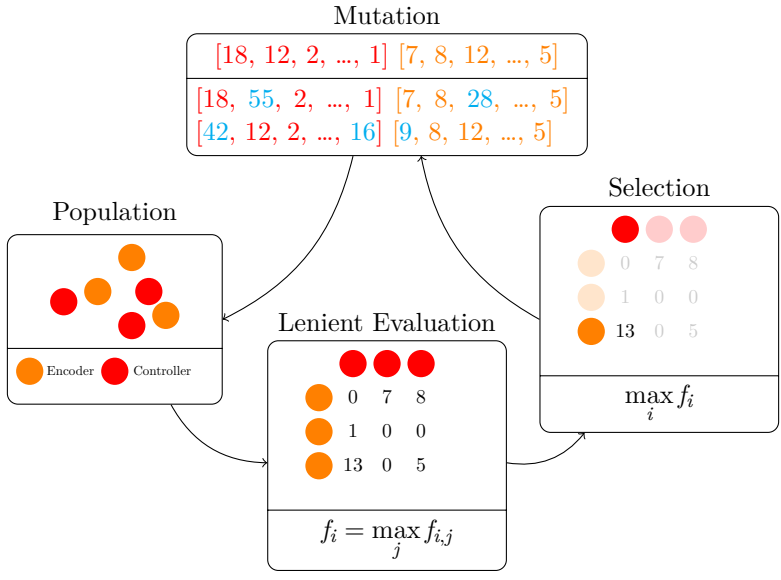

Experiment 1: $1 + \lambda$ Results

https://github.com/erwanlecarpentier/ICGP-results

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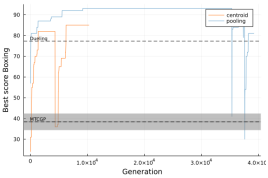
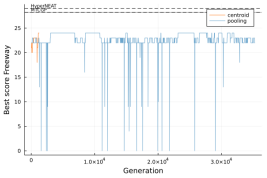
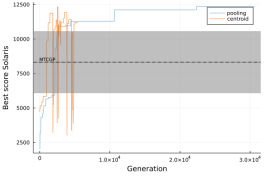
Boxing



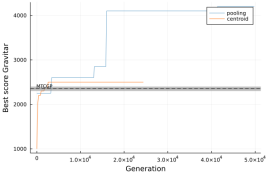
Freeway



Solaris



Gravitar



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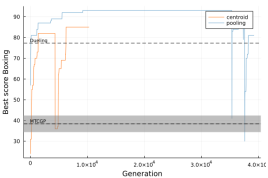

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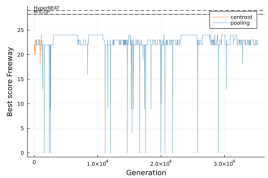

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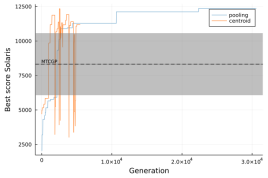

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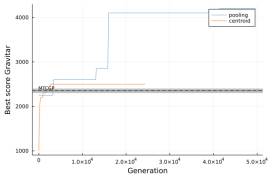

Conclusions:

- "Rote Learning" of deterministic game is efficient in this setting
- Interpretability (Boxing video) (Solaris video)
- Introducing stochasticity is catastrophic

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Experiment 1: $1 + \lambda$ Results

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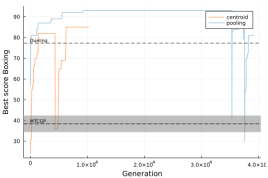

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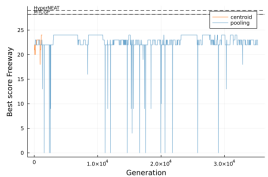

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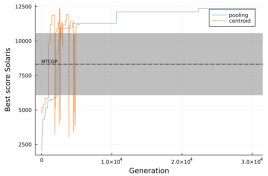

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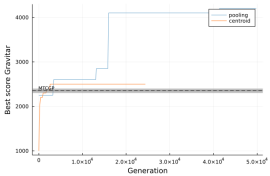

Conclusions:

- "Rote Learning" of deterministic game is efficient in this setting
- Interpretability (Boxing video) (Solaris video)
- Introducing stochasticity is catastrophic

→ Tackle the stochastic problem
→ What optimizer in this setting?

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Experiment 2: GA Co-evolution

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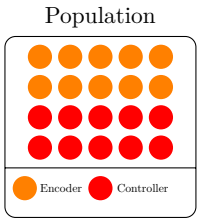

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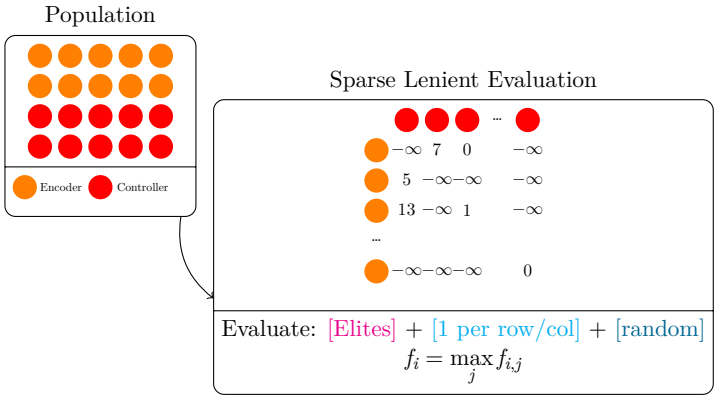

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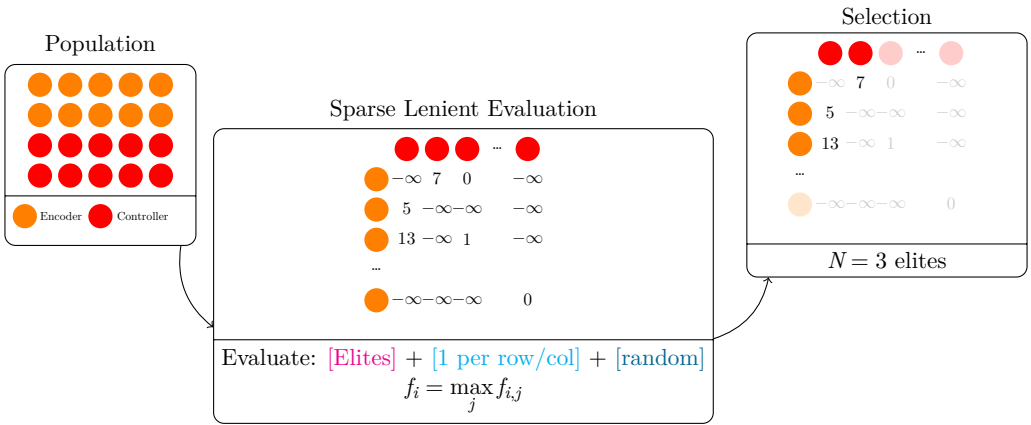

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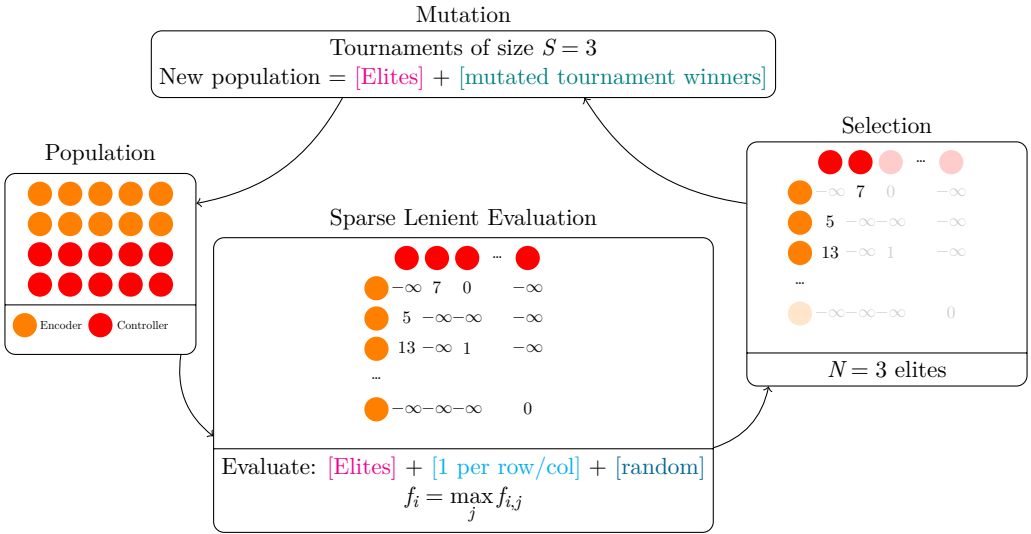

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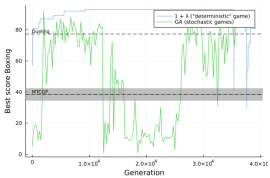

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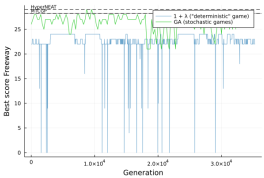

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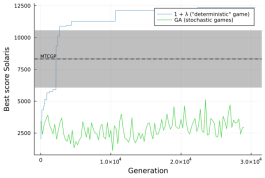
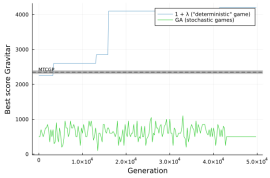


Gravitar



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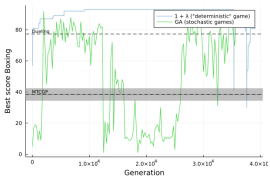

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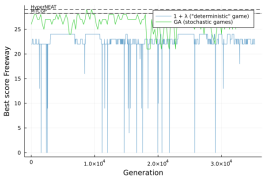

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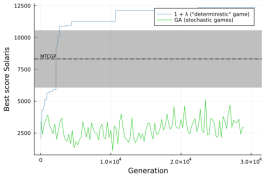

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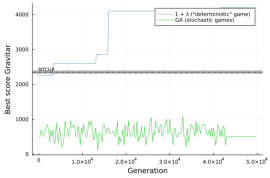

Remarks:

- Boxing: collapse
- Freeway Solaris Gravitar: no learning progress

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Experiment 2: GA Results

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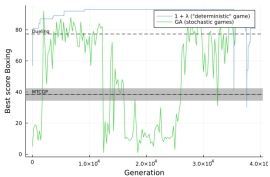

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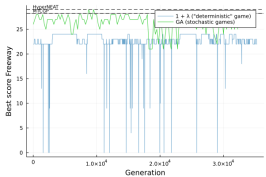

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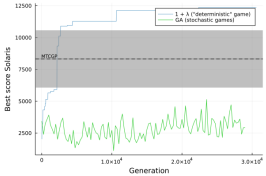
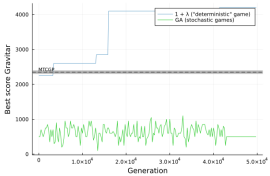


Gravitar



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→ Remove “cross-over” to avoid elites loss and focus on E/C pairs

→ Encourage diversity to avoid local minima

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Overall conclusion

Experimental results:

	Performance	Interpretability
Atari deterministic	OK	OK
Atari stochastic	NOT OK	OK

→ Need for a better optimizer in stochastic Atari games:

- Experiment 3: E/C pairs only
- We are unsure about ways to measure behavior diversity in Atari