MACHINE LEARNING SIMULATES AGENT-BASED MODEL TOWARDS POLICY-MAKING

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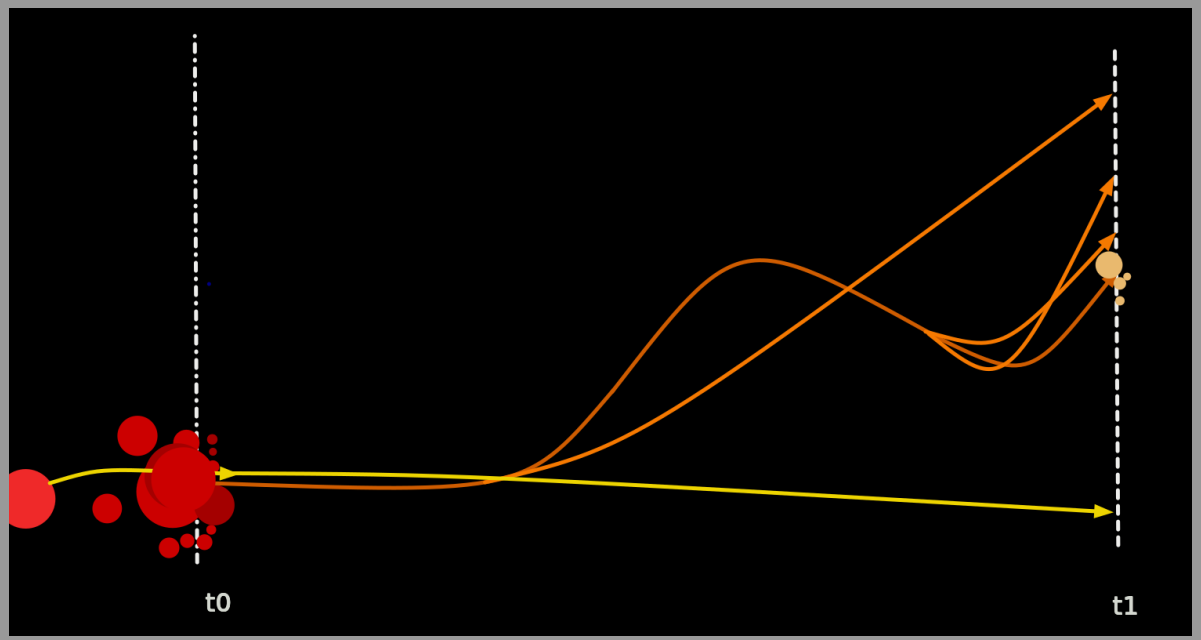
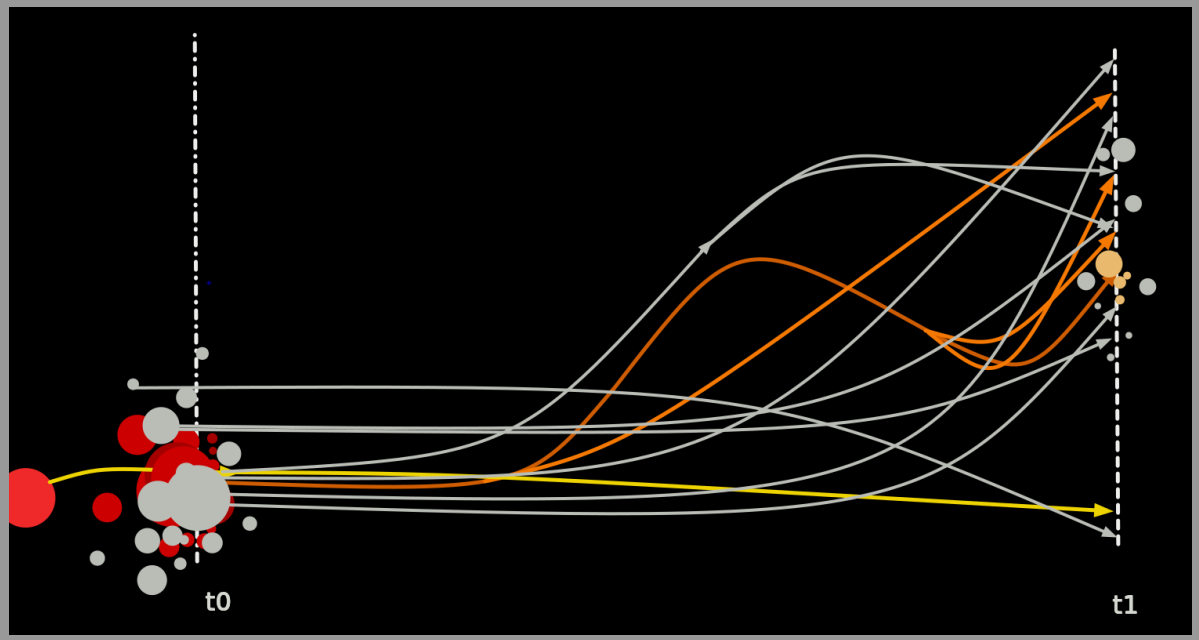
Overview

Possible errors in describing the social phenomena

- Given a social phenomena, can we sufficiently describe an initial and target point?
- Given an observed trajectory, can we guarantee that a slightly different starting point would not lead to a different pathway and end-target?



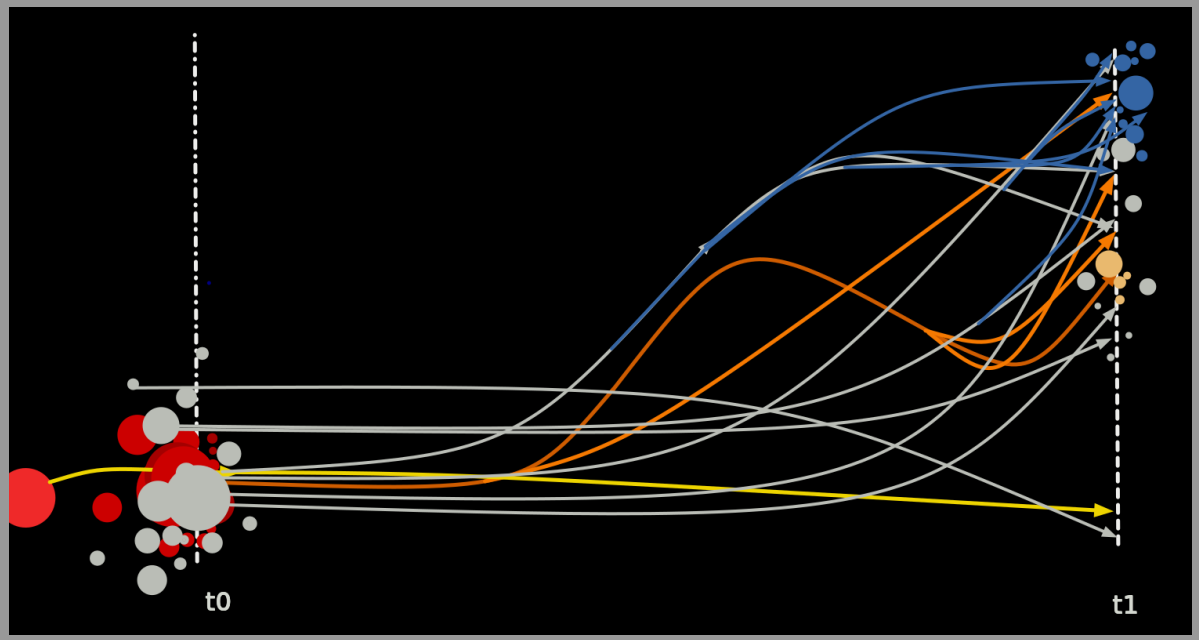
ML can expand the space of possible trajectories



Motivational iGSS questions

- Question: Independent of the observed, real or possible trajectories, is there a space of parameters/policy alternatives that are socially optimal? Or consistently superior, despite the imperfections and incompleteness of both description and trajectories?

Can we distinguish optimal social trajectories?



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ML Simulates ABM towards Policy-Making - Institute for Applied Economic Research/CNPq

What? An Ongoing Project

- Freshly out-of-the-oven complex spatial-economic-empirical ABM: PolicySpace2 [1]
- 7 parameter-based rules and 27 actual parameters
- Configuration JSON parameters associated to 5,573 runs' results
- A larger, more flexible, sensitivity analysis:1,000,000 runs

Objective Research Question

- Check robustness + of results
- Can we identify a superior dominant dense policy space to design a policy normative framework?
- Could we test omitted structures as configuration parameters?

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3. Design a socially optimal target: +production, less-inequality

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5. Train machine learning algorithms
6. Generate a more variable $\sigma = 3$, larger set of parameters configuration (X). Truncated
7. Fit new parameters
8. Compare relative results

Some preliminary results

- More precise when compared to one-parameter sensitivity, max 2-2, analysis
  - Most differences small magnitude, but suggesting ML more precise
  - Most results were known from plot analysis
  - Nuances of some results had not been identified. New and informative
  - For example: Policy Quantile. Policy Days.

Random Forest Classifier

- Score: 0.9842
- Confusion Matrix: $\begin{bmatrix} 1148 & 3 \\ 19 & 224 \end{bmatrix}$

Policy Test. Confirm, reinforce previous analysis

Policies	Sample size	Non-optimal	Optimal
Housing	0.2500	0.4403	0.0257
No Policy	0.2500	0.3664	0.1129
Rental vouchers	0.2498	0.1126	0.4115
Monetary Aid	0.2501	0.0807	0.4498

Insights into Metropolitan Regions comparisons

Metropolitan Areas	Sample size	Non-optimal	Optimal
Belo Horizonte	0.0346	0.0019	0.0732
Fortaleza	0.0342	0.0190	0.0522
Porto Alegre	0.0345	0.0256	0.0449
Campinas	0.0347	0.0309	0.0393
Brasília	0.0345	0.0442	0.0230

Future work

- Use full set of results. 66 indicators
- Vary distributions configuration parameters
- Use full ML algorithms availability
- Enrich original sample (cities) for comprehensive results
- Test non-existent parameters aka omitted rules using historic data: validation

References

[1] B. A. Furtado, "Policyspace2: modeling markets and endogenous housing policies." Submitted. Preprint available on https://arxiv.org/abs/2102.11929, 2021.

Thank you! Questions? Collaborations?

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- github.com/BAFurtado/MLsimulatesABMtowardsPolicy
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