MACHINE LEARNING SIMULATES AGENT-BASED MODEL TOWARDS POLICY-MAKING

Bernardo Alves Furtado

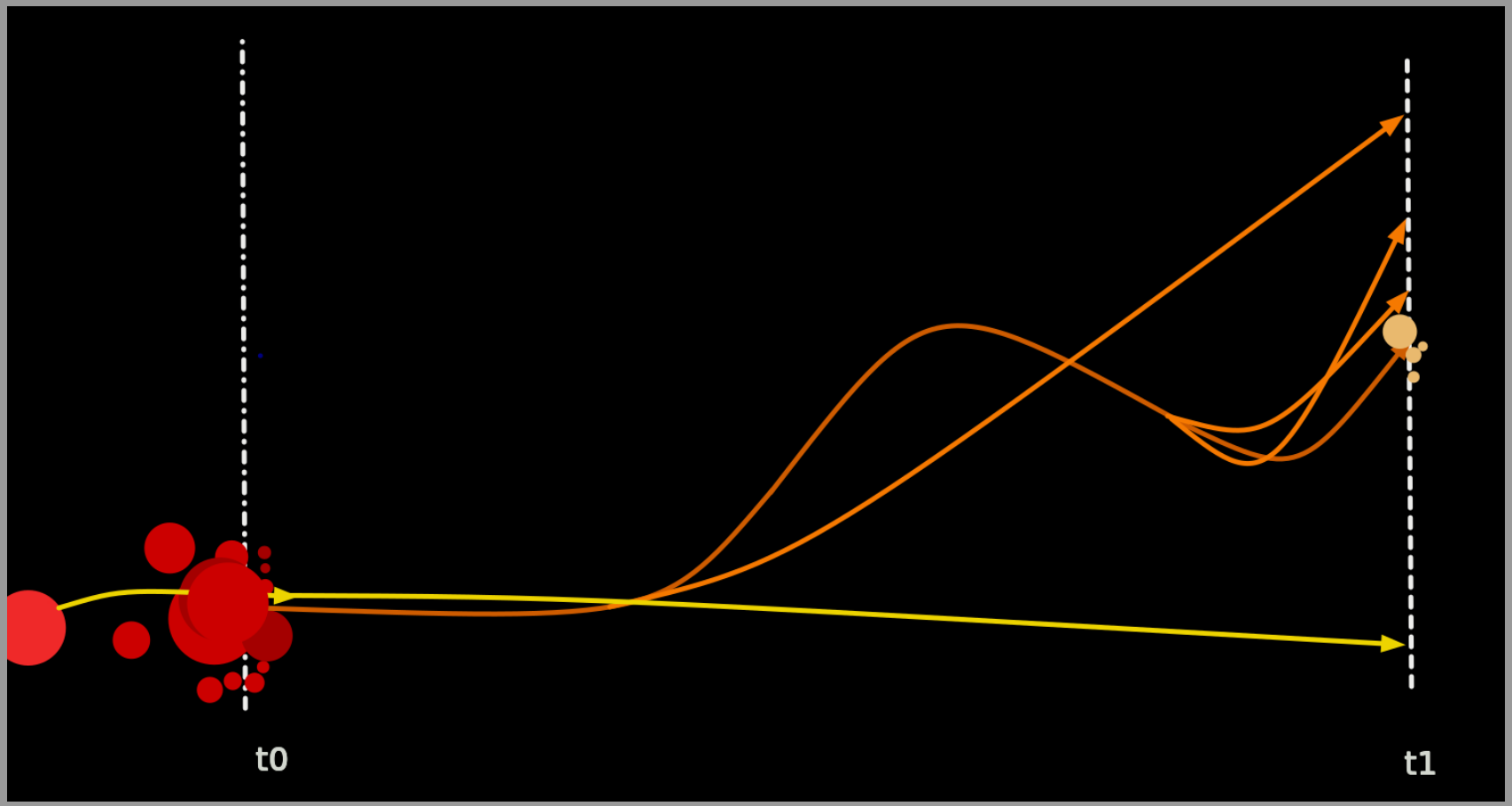
inverse Generative Social Sciences Workshop
@ Home 8-10 June, 2021

Overview

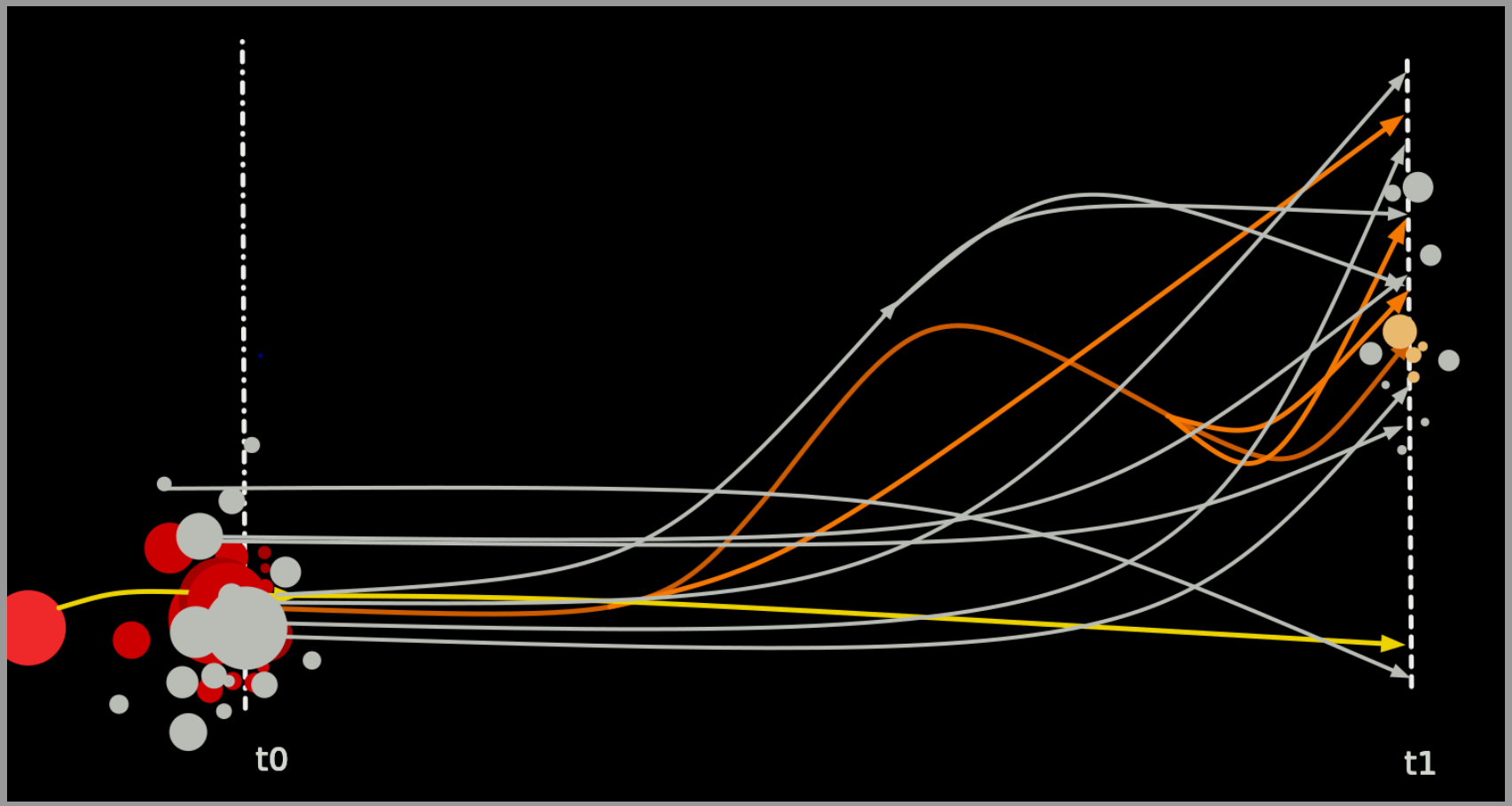
Motivational iGSS questions

- 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?
- 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?

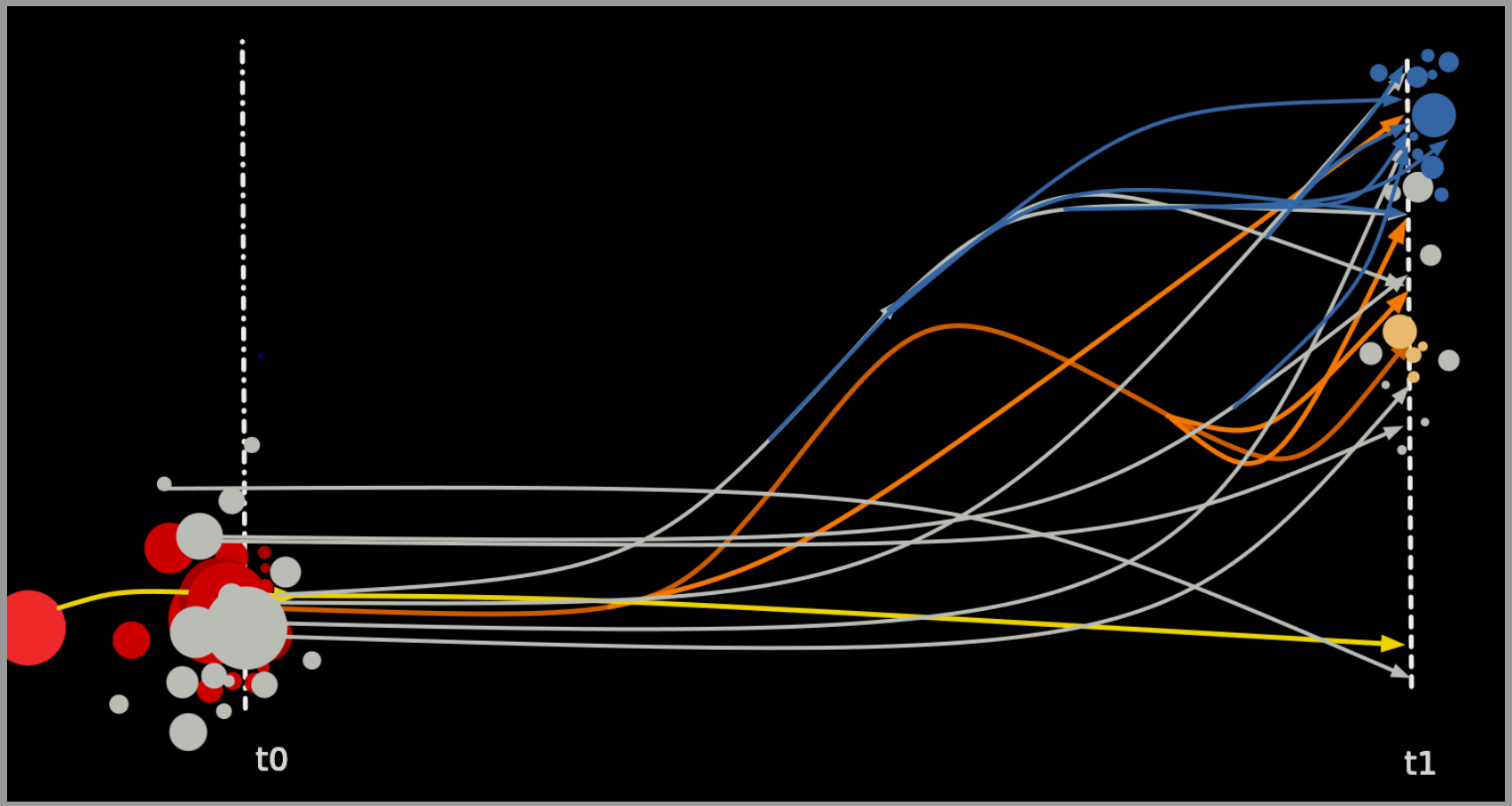
Possible errors in describing the social phenomena



ML can enlarge the space of possible trajectories



Can we distinguish optimal social trajectories?



Bernardo Alves Furtado
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
- 244-unique combination associated to 5,594 runs' results
- A larger, more flexible, sensitivity analysis:1,000,000 runs
- Could we test omitted structures as configuration parameters?

Objective Research Question

- Check robustness + of results
- Can we identify a superior dominant dense policy space to design a policy normative framework?

Procedures

1. Read and organize configuration parameters
2. Associate them with results of the model
3. Design a socially optimal target: +production less-inequality
4. Train machine learning algorithms
5. Generate a more variable, larger set of parameter configuration
6. Fit new parameters
7. Compare relative results

Some (preliminary) Results

- Different, wider insights when compared to one-parameter, max-2 analysis
- Comparing optimal/non-optimal results for graphical 5,594 runs and 1,000,000 ML simulations
  - 15 values had diverging results
  - Most small magnitude, but suggesting ML more precise
  - Most known from plot analysis
  - 3 had not been run and were new and informative

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
- Use full ML algorithms availability
- Enrich the original sample to allow further results
- Test non-existent parameters (rules)

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?

- bernardo.furtado at ipea dot gov.br
- researchgate.net/profile/Bernardo_Furtado
- GitHub/BAFurtado/PolicySpace and MLSimulatesABM
- https://sites.google.com/view/bernardo-alves-furtado/home