PRES LUNAM
École Doctorale STIM
Sciences et Technologies de
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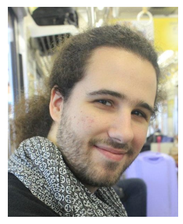

Spécialité: Informatique
Laboratoire: IRCCyN
Équipe: MeForBio

Presentation of the Process Hitting framework and inference of Biological Regulatory Networks with Thomas parameters

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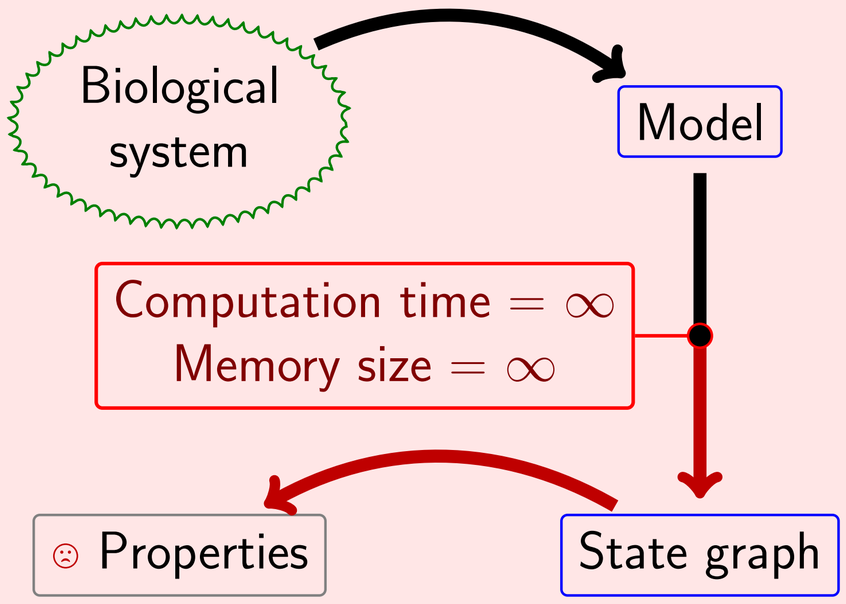
1. Introduction

- **Systems biology** = studying and understanding of interactions inside biological systems
  - A gene produces a protein
  - Many proteins activate/inhibit other genes
- Biological systems are **very complex**, and studying them is time/CPU expensive

2. Studying models

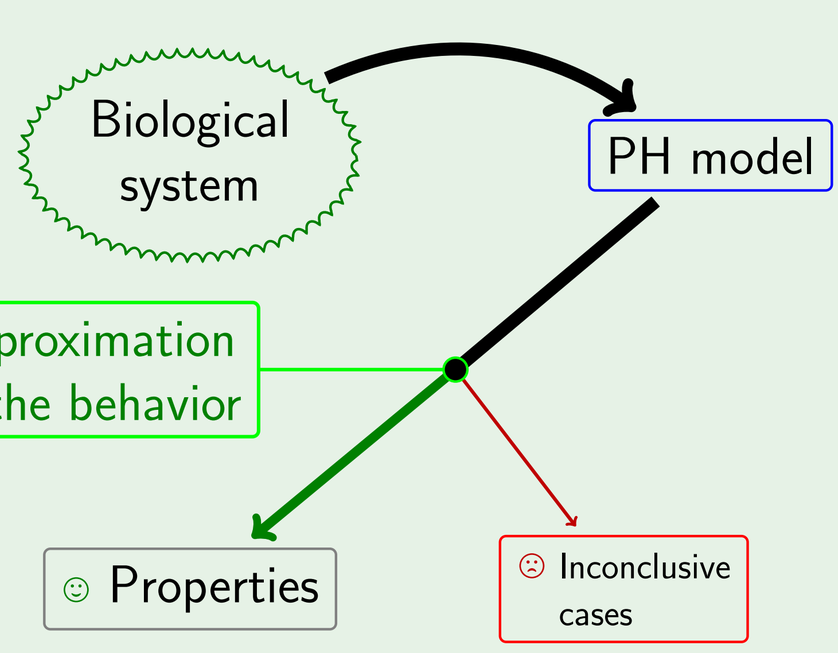
- Models are often **too large to be studied**
- Usual model-checkers have to compute all states



3. The Process Hitting framework

Process Hitting (PH)

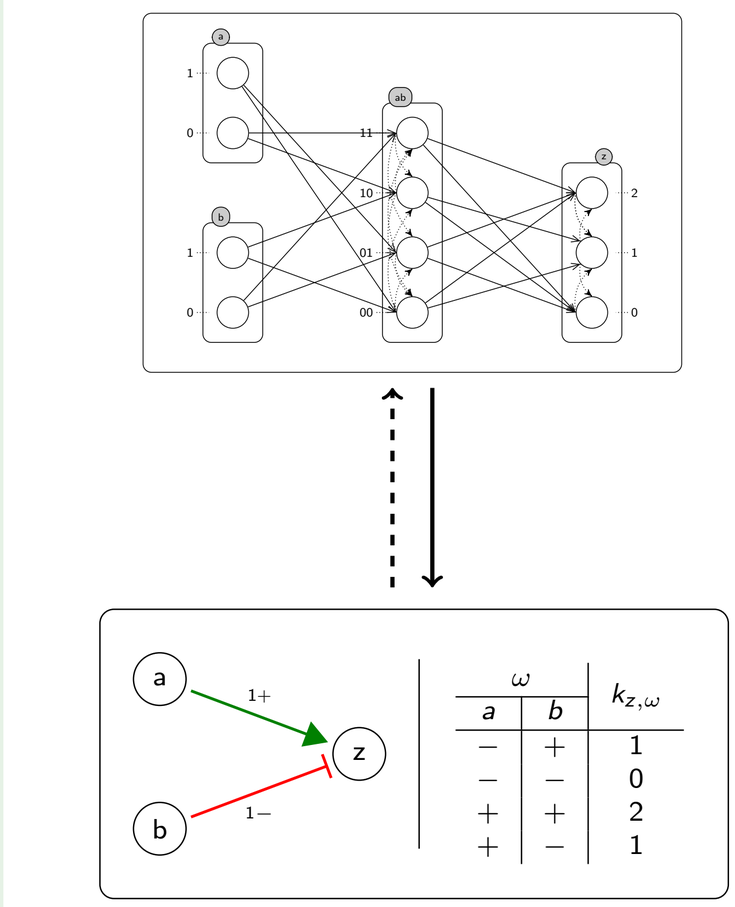
- Recent framework well adapted to large-scale models
- Atomistic representation of actions
- Very efficient **reachability approximations** [1]
- Handles models with hundreds of components in < 1s



4. Translating PH models to BRN

Biological Regulatory Network (BRN)

- **Widespread** representation for biological models [2]
  - Interaction Graph (IG) = interactions between genes
  - Parameters = evolution of each gene
- Method: **exhaustive search** of interactions [3]



5. Work in progress

PH are not **strictly equivalent** to BRN yet

- Add priorities between actions into PH
- Find a class of models equivalent to BRNs
- Adapt the **reachability approximations**

6. Conclusion

- Formal translation PH $\rightarrow$ BRN
- Implemented into the Pint library
- Efficient results on big models (up to 40 genes)

Model specifications			IG inference		Parameters inference	
System	Genes	Actions	Δt	Edges	Δt	Parameters
egfr	**20**	399	**1s**	50	**1s**	191
tcrsig	**40**	301	**1s**	54	**1s**	143
tcrsig	**94**	1124	**13s**	169	∞	$0/2.10^9$
egfr	**104**	2356	**4min**	241	**1min 30s**	$1.10^6/2.10^6$

[1] Paulevé, Magnin, Roux in MSCS, 2012
[2] Bernot, Cassez, Comet, Delaplace, Müller, Roux in ENTCS, 2007
[3] Folschette, Paulevé, Inoue, Magnin, Roux in CMSB, 2012