Synthesis of Hybrid Systems from Multimodal Datasets

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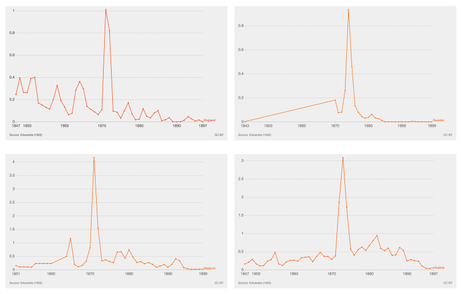
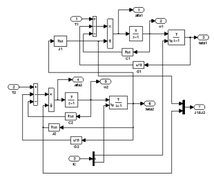
Motivation

Main goal of many sciences is to create a model from a real system



Experimental data

Analysis



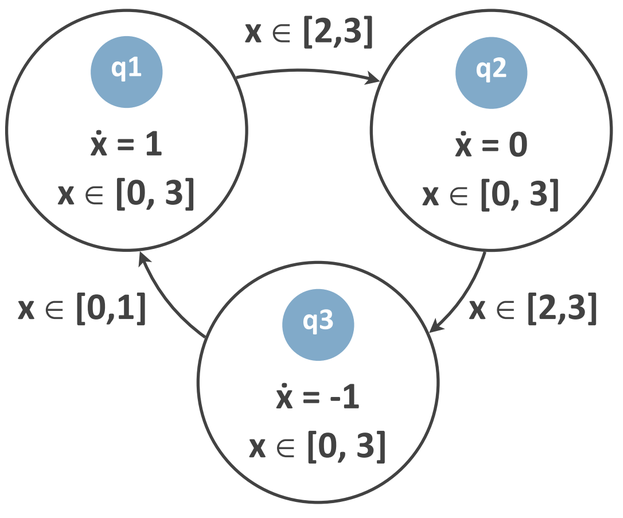
Model

Common scientific approach	Automated approaches
• Hypothesis • Design experiments • Data evaluation	• Expert bias avoidance • Productive experiments • Processing of large datasets

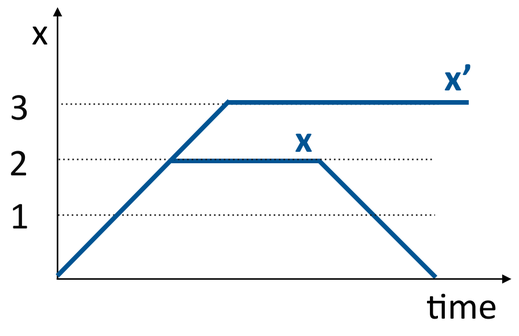
Challenge
How to automatically create a model?

Hybrid systems capture the mixed continuous and discrete behaviour

Linear hybrid automaton (LHA)



Non deterministic mode changes

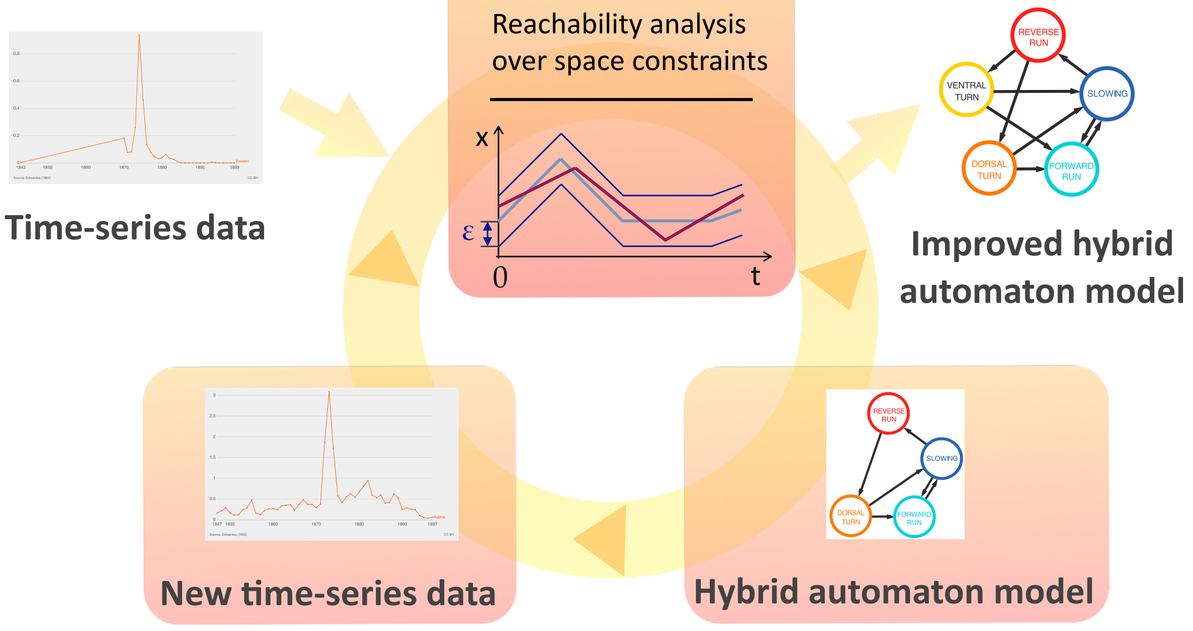


Executions of an LHA
Piecewise Linear (PWL) functions

Problem: find a LHA **model** that is **close to** the **data**

Automated approach

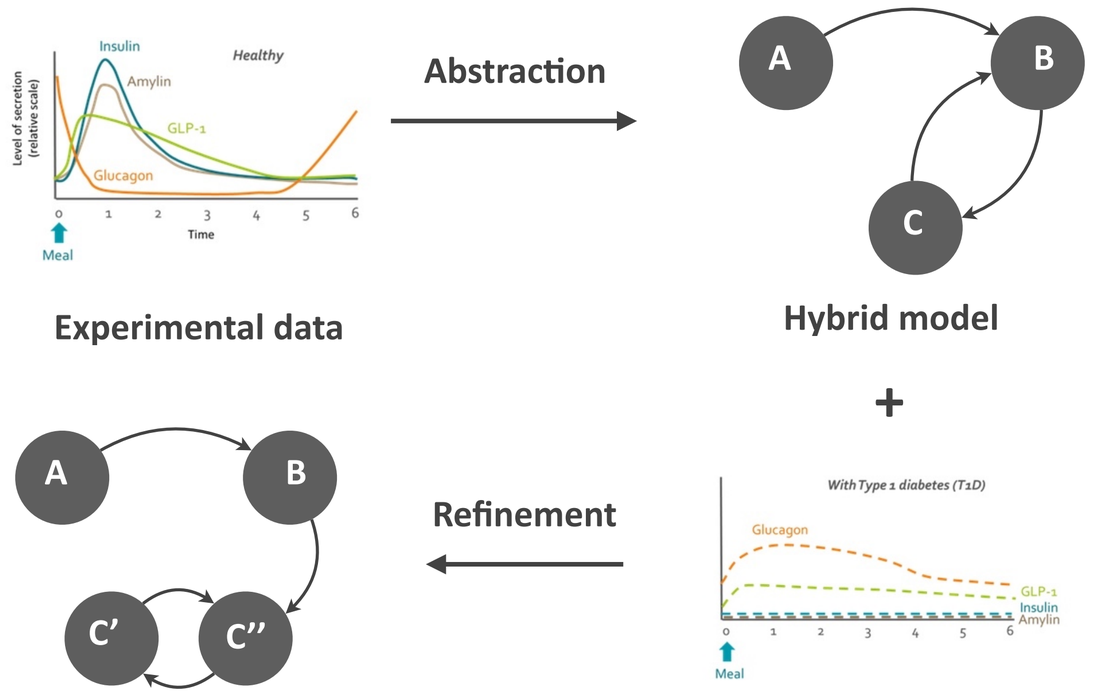
Adaptive synthesis algorithm for model inference



distance(model, data) ≤ ε

- Adaptive synthesis algorithm
- Model construction for an initial data set
- Iterative model improvement when considering new data
- Precision guarantees in the model
- Solution based on reachability analysis

Inference from normal and abnormal behaviours



- Initial data taken from healthy individuals
- Construction of a hybrid model
- Data would be collected from sick people
- Model refinement with sick-people data
- Helpful approach to design medical devices

Software: HySynth

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Publications

Collaborators: Christian Schilling & Thomas A. Henzinger