Constructing **patient treatment trajectories** and producing **Markov chain** models for **cost analysis.**

Title: *Patient Treatment Trajectory Modeling With Markov Chains*

👤 PRESENTER: **Markus Haug**

INTRO:

- Treatment trajectories give us a foundation to find out the best healthcare practices, evaluate the economics of treatment patterns and model the treatment paths.
- Two R packages (**Cohort2Trajectory** & **TrajectoryMarkovAnalysis**) were developed.

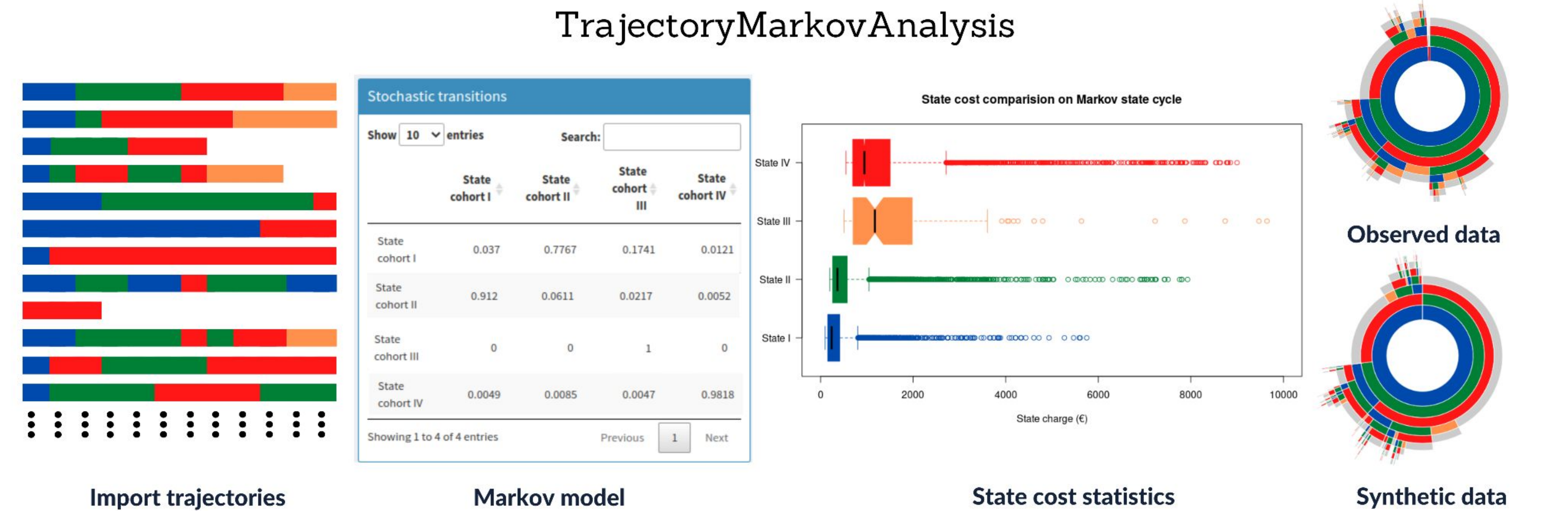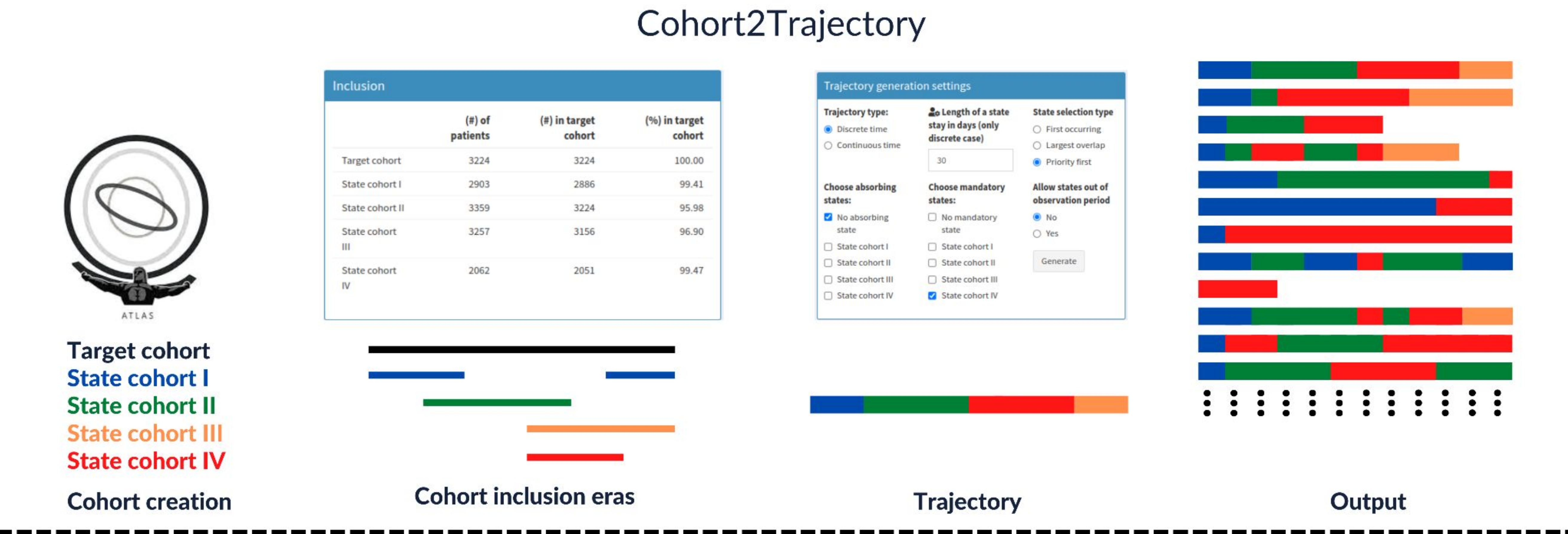**METHODS:**

- **Cohort2Trajectory**
1. Importing relevant target and state cohorts.
2. Resolving cohort overlap conflicts.
3. Choosing the trajectory creation settings.
4. Output: CSV with patient treatment trajectories.

- **TrajectoryMarkovAnalysis**
1. Importing treatment trajectories.
2. Using them to produce discrete or continuous time Markov chain models.
3. Querying data from specific domains for state cost analysis.
4. Synthetic trajectories can be generated from the assembled Markov models.
5. Output: Markov model, state cost statistics, synthetic medical data.

RESULTS:

- To showcase the functionalities of the R packages we reproduced the study of heart failure carried out in the UK (Thokala et al., 2020) on data supplied by the Estonian Health Insurance Fund.
- The packages can be implemented in large-scale studies with regard to patient treatment trajectories.

Cohort2Trajectory

| Cohort creation | Cohort inclusion eras | Trajectory | Output |

Target cohort
State cohort I
State cohort II
State cohort III
State cohort IV

TrajectoryMarkovAnalysis

| Import trajectories | Markov model | State cost statistics | Synthetic data |

**Observed data**

Synthetic data

CASE STUDY:

- Study by Thokala et al. for comparing traditional care with additional telemonitoring use among heart failure patients was reproduced using the packages.
- Five Markov states for isolating heart failure progression and death.
- Markov and cost-effectiveness analysis were conducted.
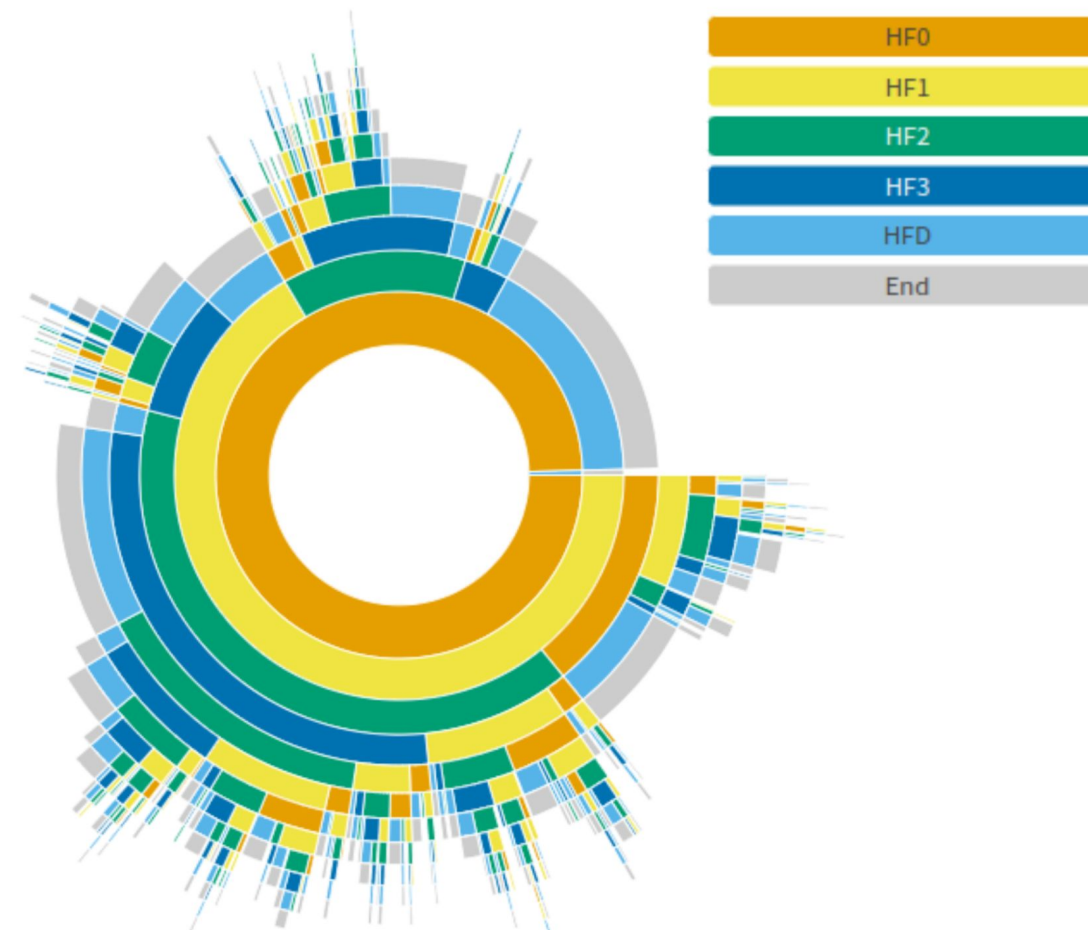
Chronological state transitions in the heart failure study

|	Results from Estonia					Results from the UK				
	HF0	HF1	HF2	HF3	HFD	HF0	HF1	HF2	HF3	HFD
HF0	0.95	0.04	0.00	0.00	0.01	0.98	0.01	0.00	0.00	0.01
HF1	0.06	0.78	0.12	0.02	0.02	0.07	0.87	0.02	0.00	0.04
HF2	0.00	0.07	0.72	0.18	0.03	0.01	0.09	0.78	0.04	0.08
HF3	0.00	0.00	0.04	0.92	0.04	0.00	0.00	0.10	0.78	0.12
HFD	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00

- When using telemonitoring the disease progression was diminished, but the cost of a QALY was high:
  - 60735.87 €/QALY in Estonia;
  - 56316.94 €/QALY in the UK.
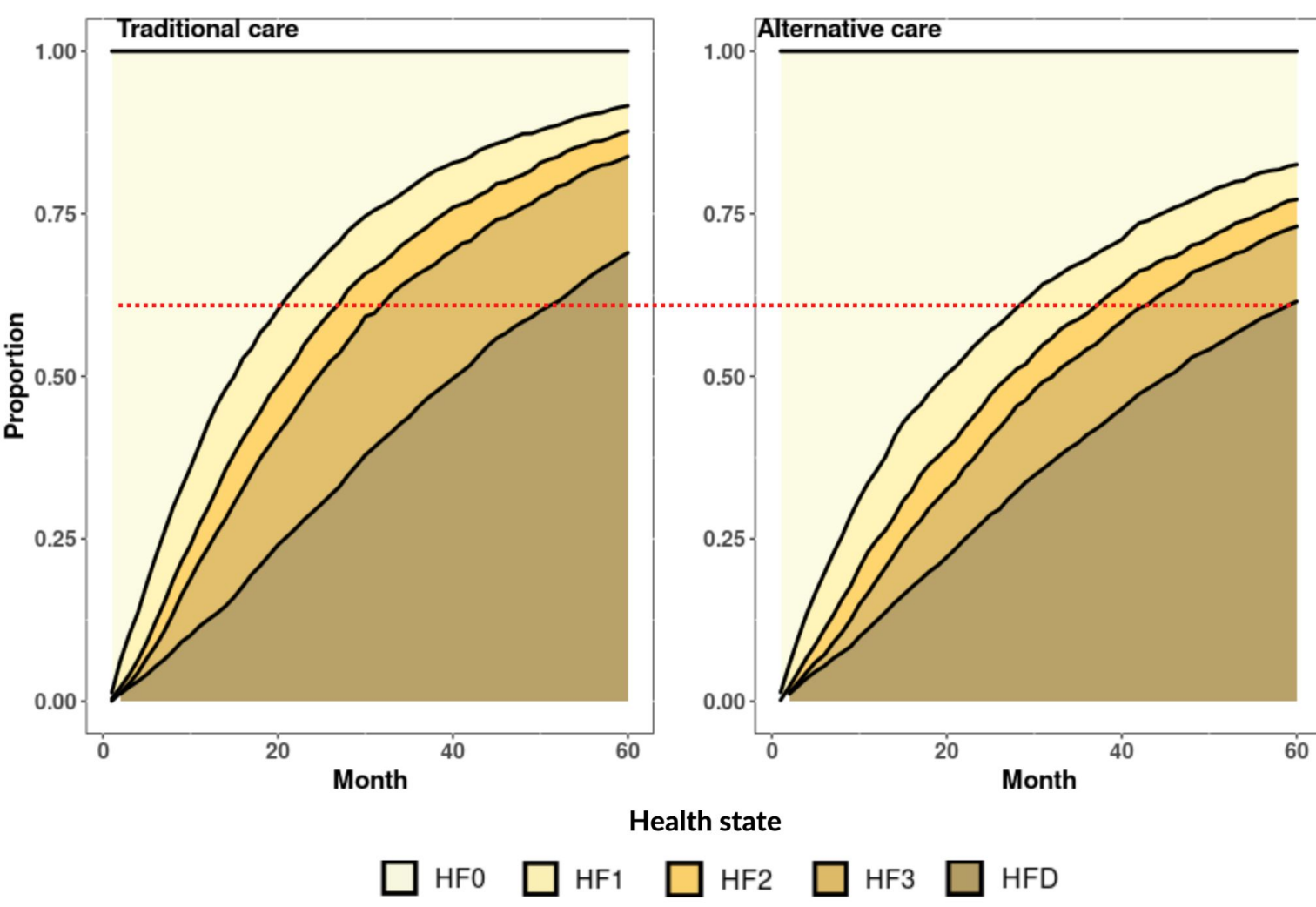
State distributions of synthetic data comparing usual care and alternative care

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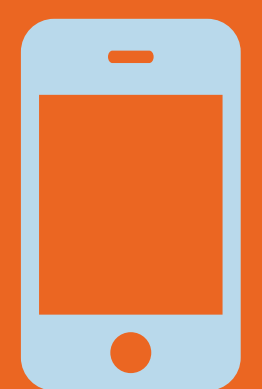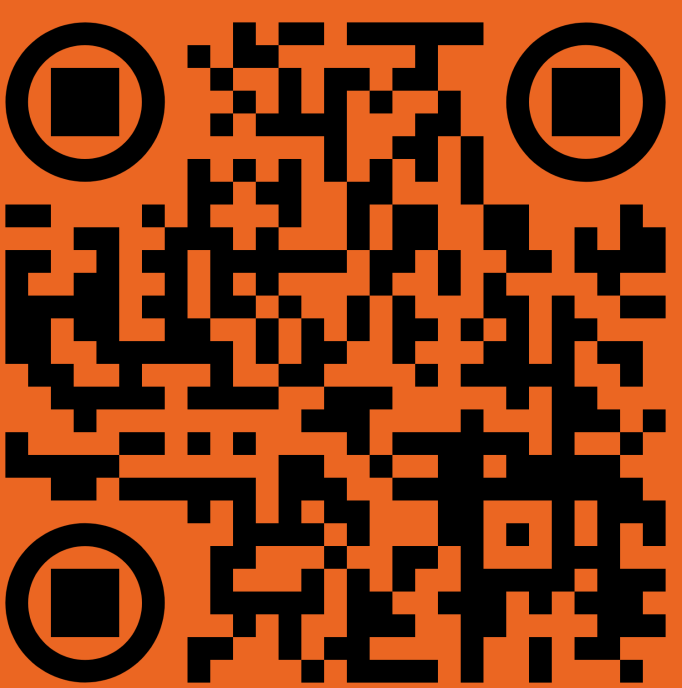
Cohort2Trajectory

TrajectoryMarkovAnalysis

Scan QR for link to **github repository..**

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