

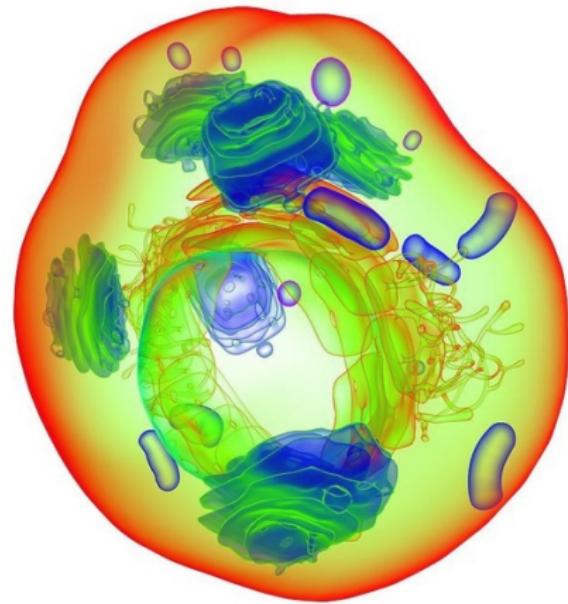
Modelling single-cell dynamics with trajectories and gene regulatory networks

Robrecht Cannoodt

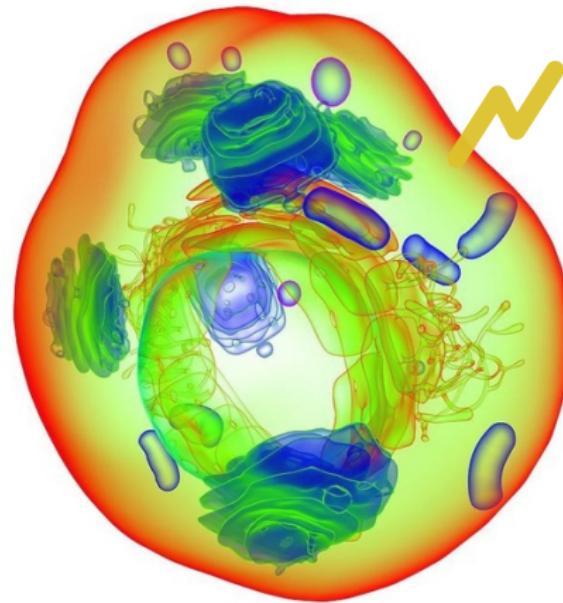
16 december 2019



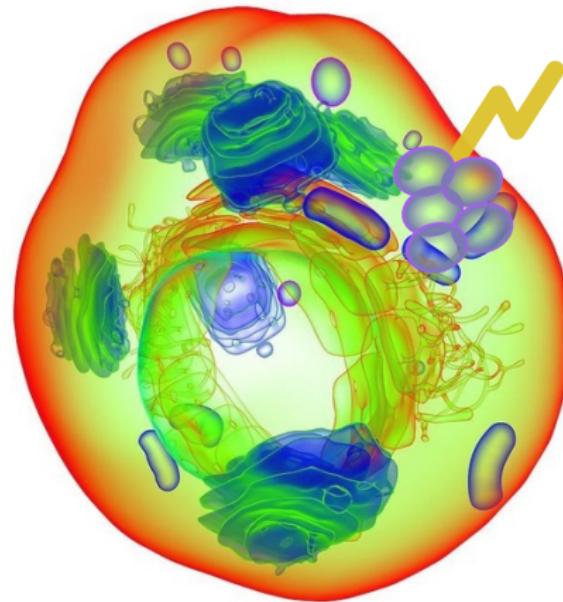
Cellen zijn dynamisch



Cellen zijn dynamisch

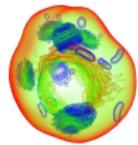


Cellen zijn dynamisch



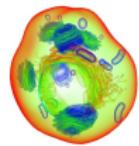
Hoe maken cellen eiwitten aan?

Cel

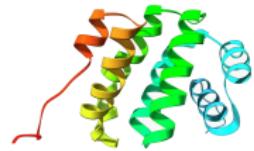


Hoe maken cellen eiwitten aan?

Cel

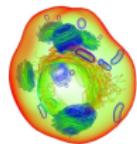


Eiwit

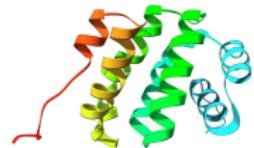


Hoe maken cellen eiwitten aan?

Cel



Eiwit



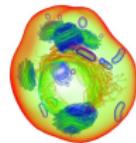
Restaurant



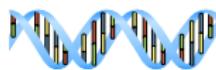
Sushi

Hoe maken cellen eiwitten aan?

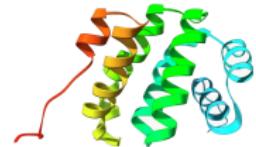
Cel



DNA



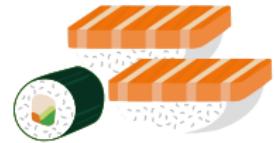
Eiwit



Restaurant



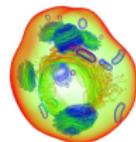
Kookboek



Sushi

Hoe maken cellen eiwitten aan?

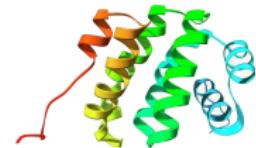
Cel



DNA



Eiwit

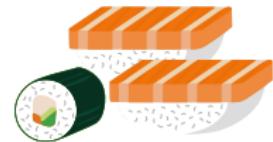


Recept



Restaurant

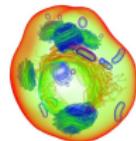
Kookboek



Sushi

Hoe maken cellen eiwitten aan?

Cel



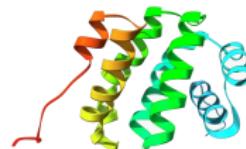
DNA



RNA



Eiwit



Cel



Recept



Restaurant

Kookboek

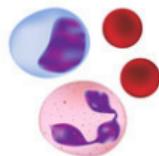
Fotokopie
van recept



Sushi

Restaurant

Het menselijk lichaam bevat >210 soorten cellen



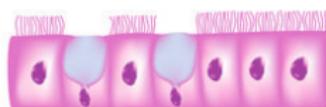
Blood cells



Surface skin cells



Bone cell



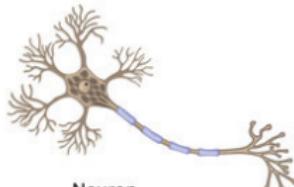
Columnar epithelial and Goblet cells



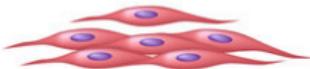
Cardiac muscle cell



Skeletal muscle cells



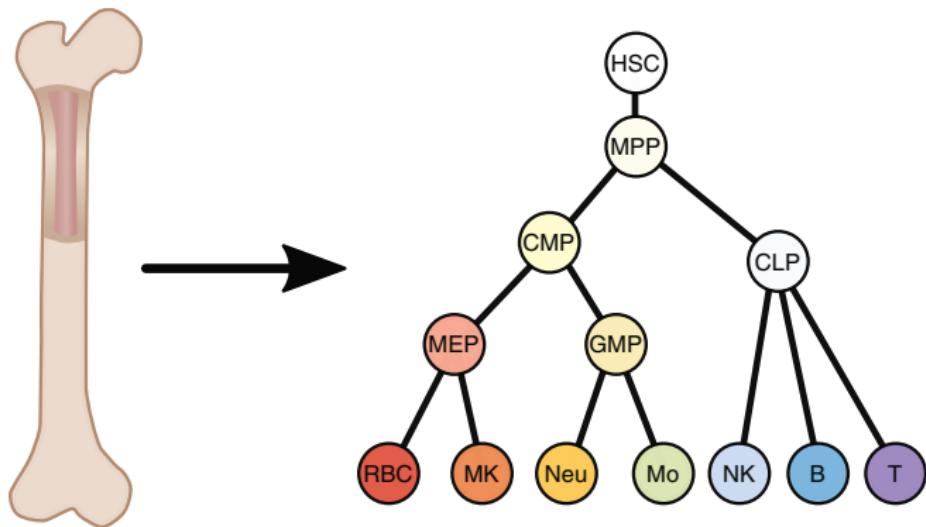
Neuron



Smooth muscle cells

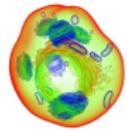
(placeholder figuur)

Cellen kunnen ontwikkelen van één type naar een ander

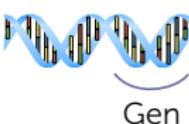


Welke types cellen komen voor in een populatie?

Cel



DNA



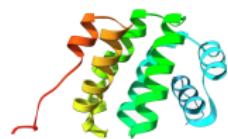
RNA



Aminozuur



Eiwit



Restaurant



Kookboek

Recept



Fotokopie
van recept

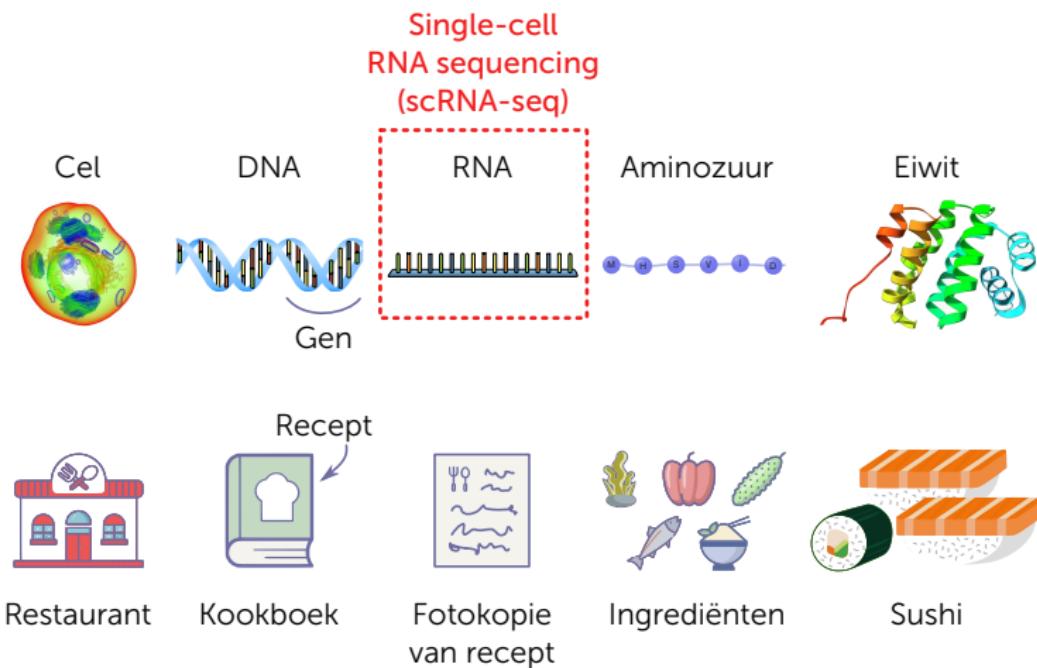


Ingrediënten



Sushi

Welke types cellen komen voor in een populatie?

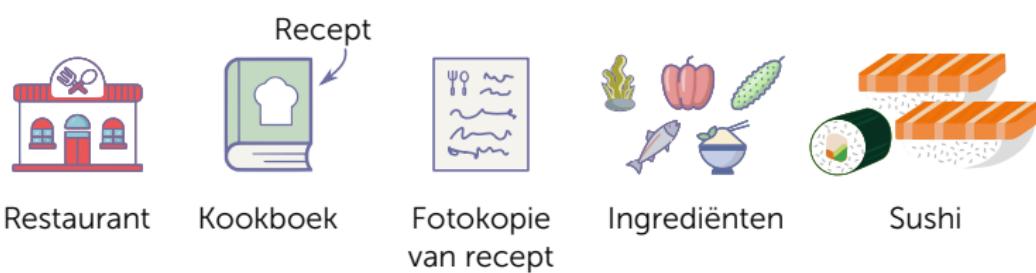
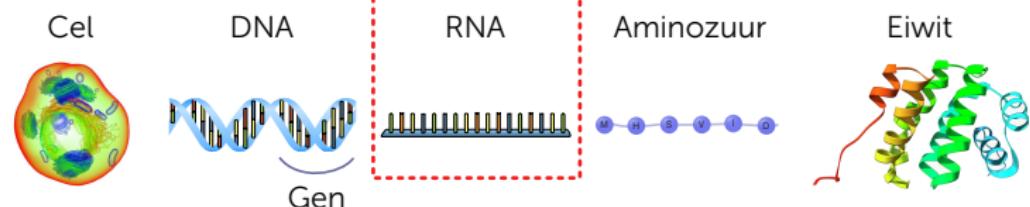


Welke types cellen komen voor in een populatie?

Wat voor een cel is dit?

Wat is zijn functie?

Single-cell
RNA sequencing
(scRNA-seq)



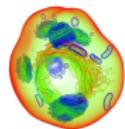
Welke types cellen komen voor in een populatie?

Wat voor een cel is dit?

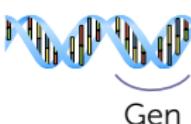
Wat is zijn functie?

Single-cell
RNA sequencing
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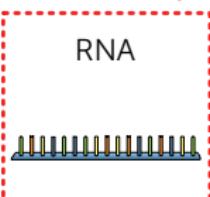
Cel



DNA



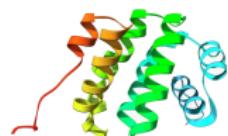
RNA



Aminozuur



Eiwit



Recept



Restaurant



Kookboek



Fotokopie
van recept



Ingrediënten

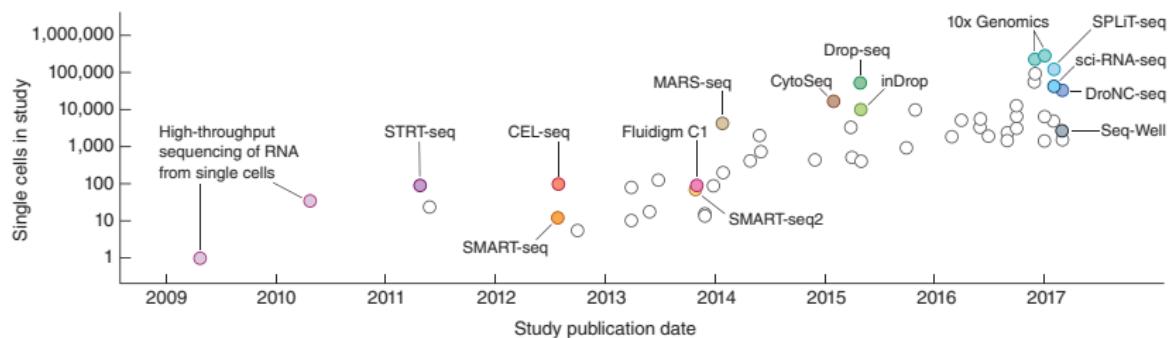
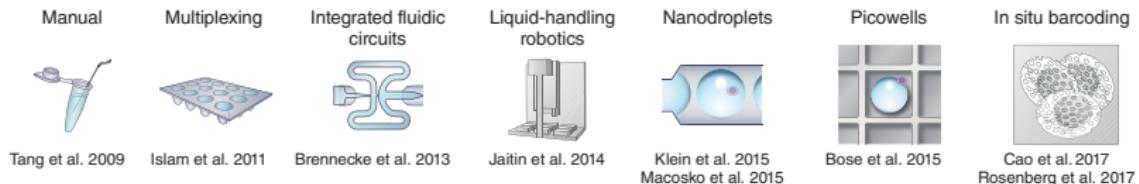


Sushi

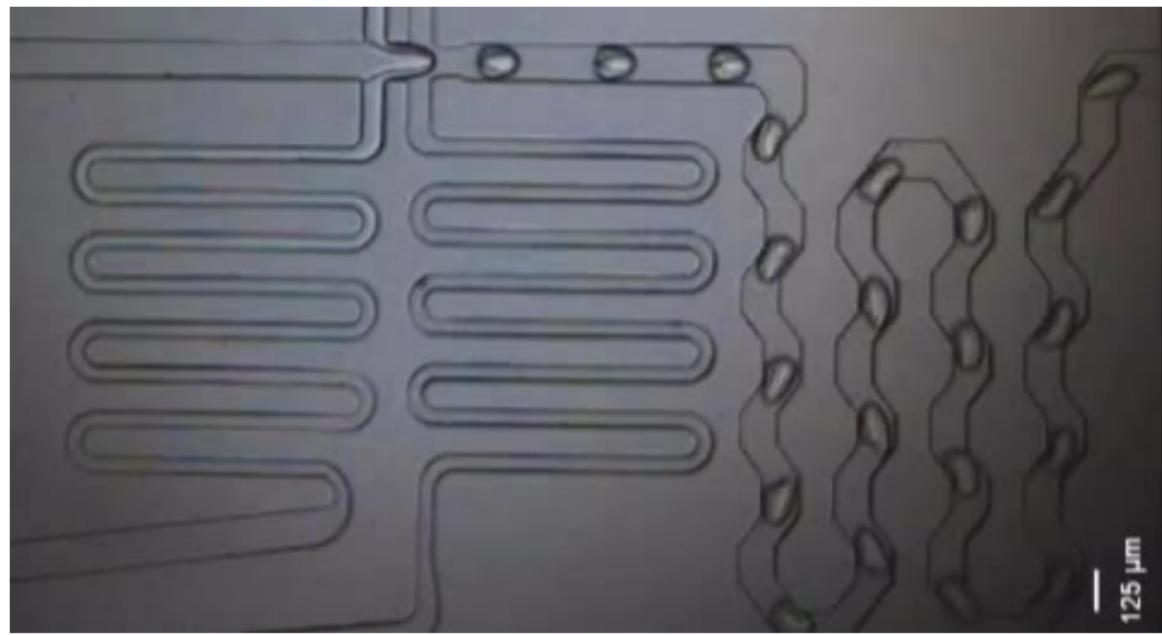
Welk type restaurant is dit?

- Mexikaans, chinees, italiaans, ...
- À la carte, all you can eat, drivethrough
- Hoeveel sterren op yelp?

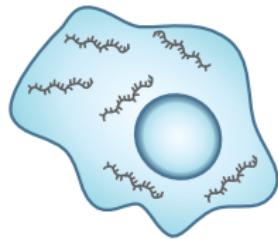
2014: doorbraak in schaalbaarheid van scRNA-seq



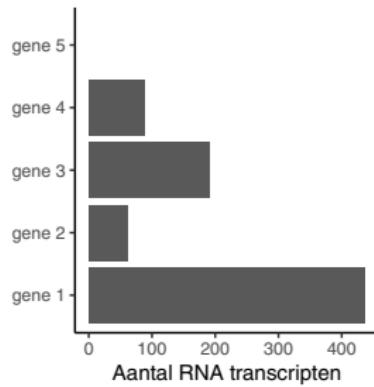
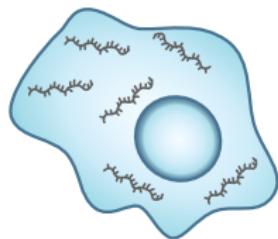
Voorbeeld van een scRNA-seq technologie: Drop-seq



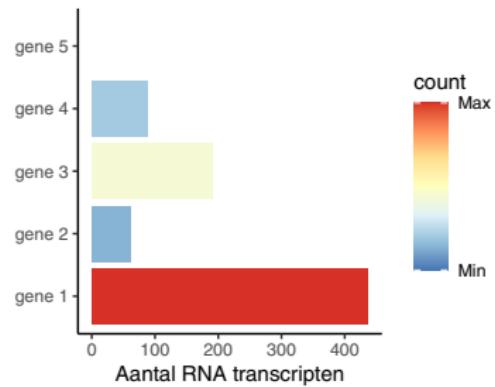
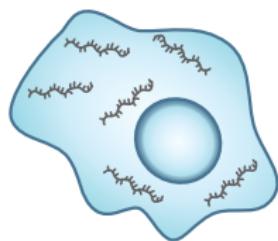
Moleculen tellen met scRNA-seq



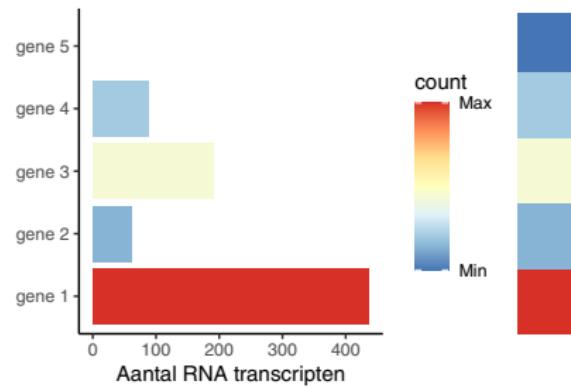
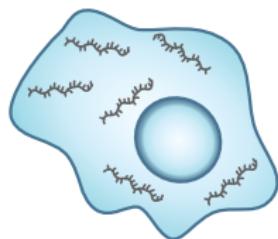
Moleculen tellen met scRNA-seq



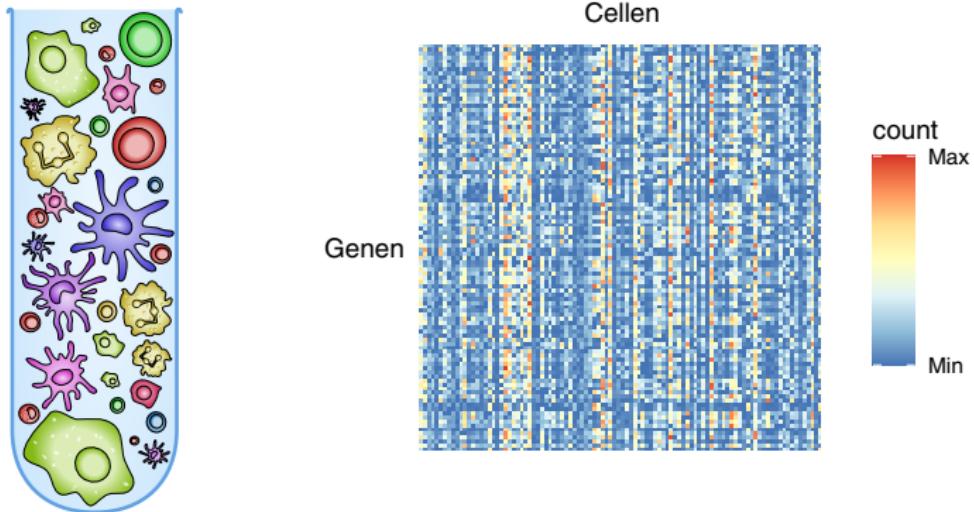
Moleculen tellen met scRNA-seq



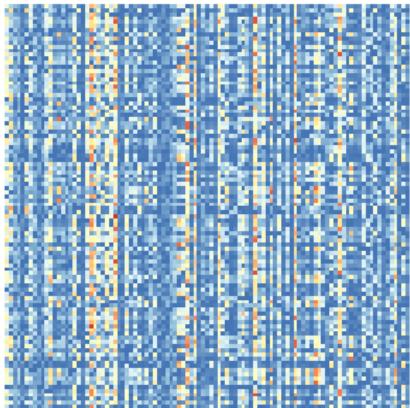
Moleculen tellen met scRNA-seq



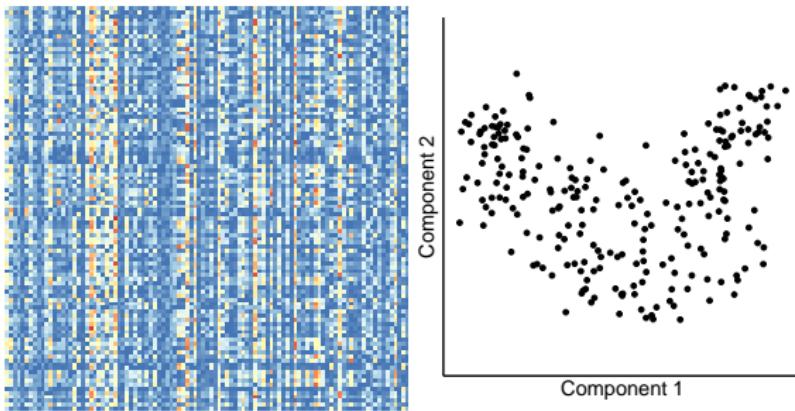
Moleculen tellen met scRNA-seq



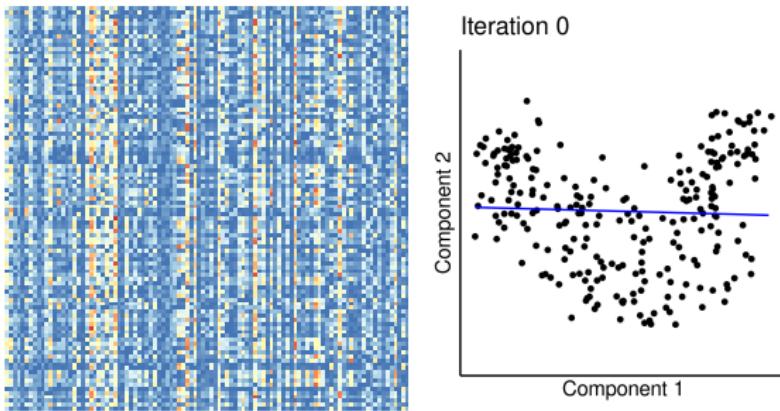
Cellen ordenen met SCORPIUS



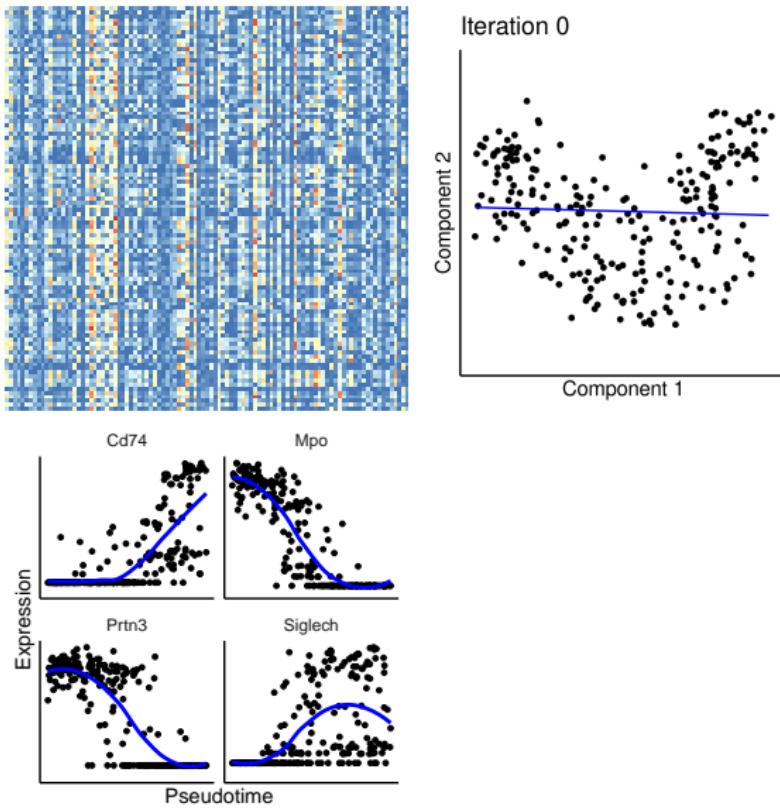
Cellen ordenen met SCORPIUS



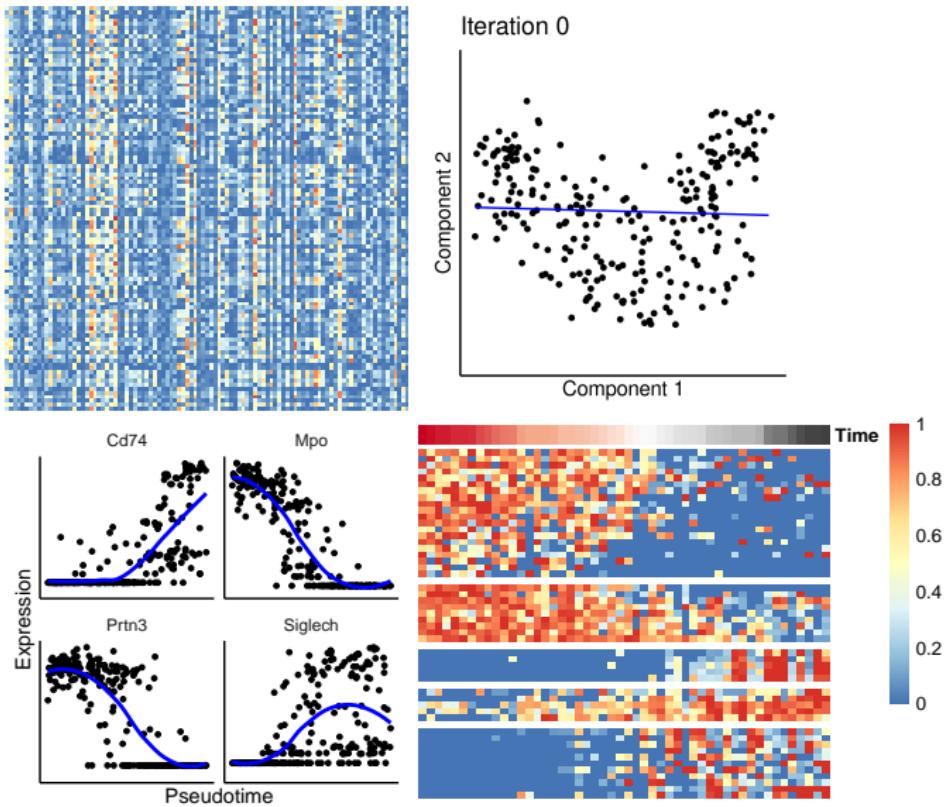
Cellen ordenen met SCORPIUS



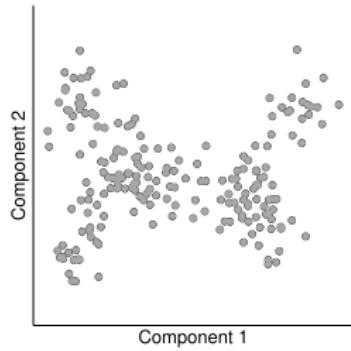
Cellen ordenen met SCORPIUS



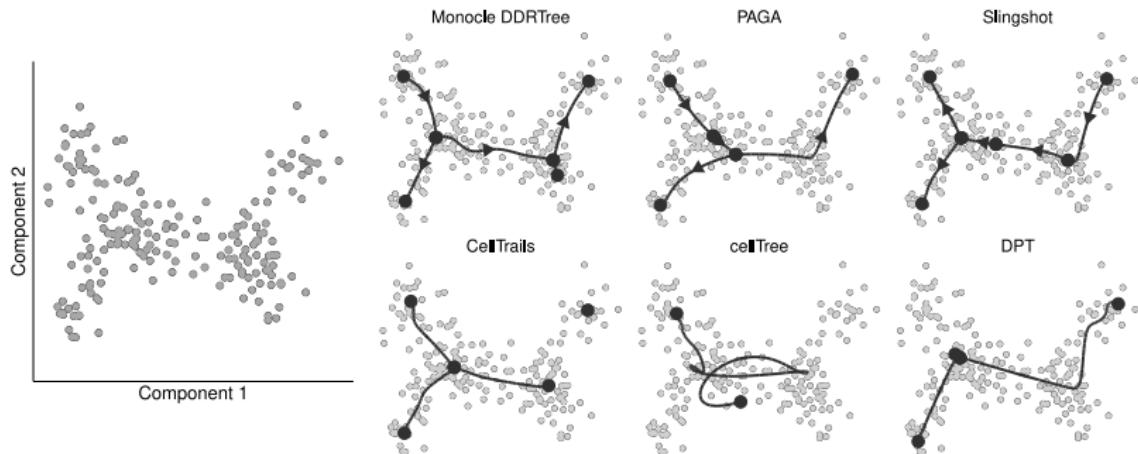
Cellen ordenen met SCORPIUS



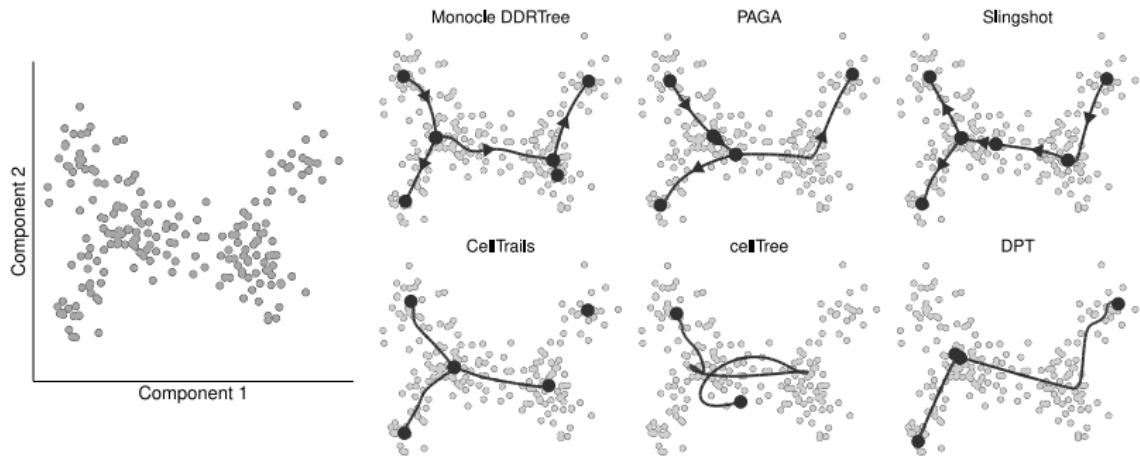
Niet alle datasets zijn even gemakkelijk



Niet alle datasets zijn even gemakkelijk

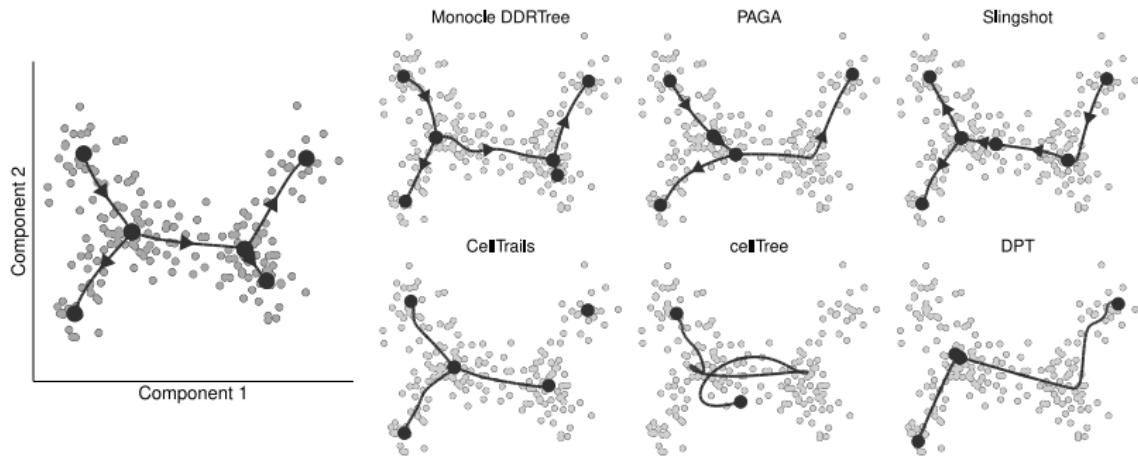


Niet alle datasets zijn even gemakkelijk



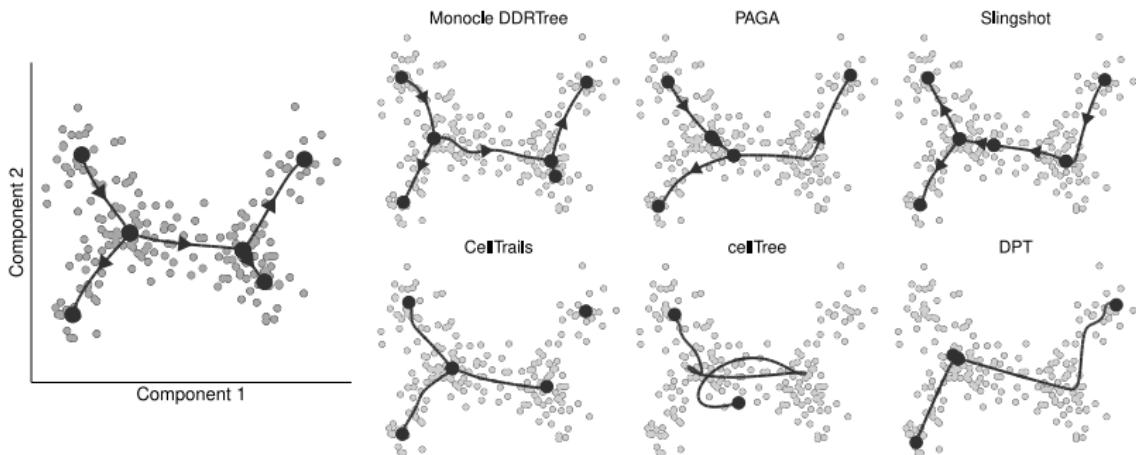
Trajectory inference; >70 methoden

Niet alle datasets zijn even gemakkelijk



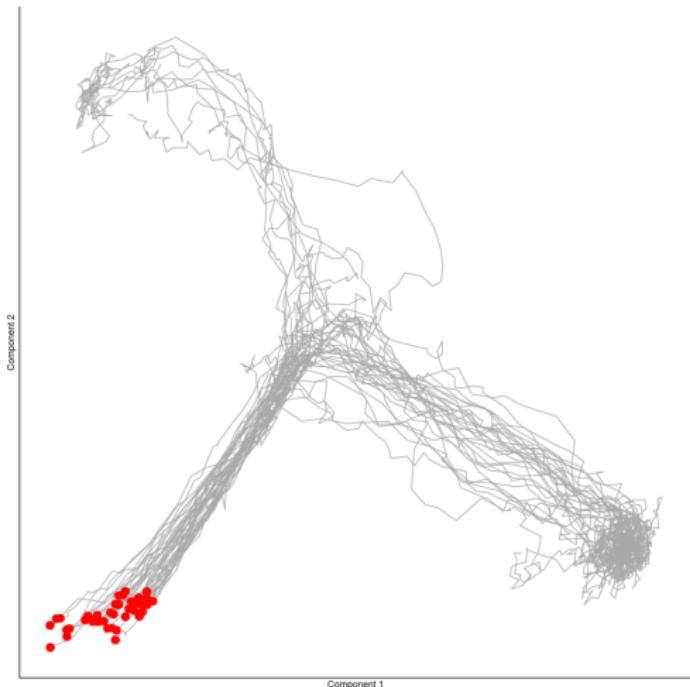
Trajectory inference; >70 methoden

Niet alle datasets zijn even gemakkelijk

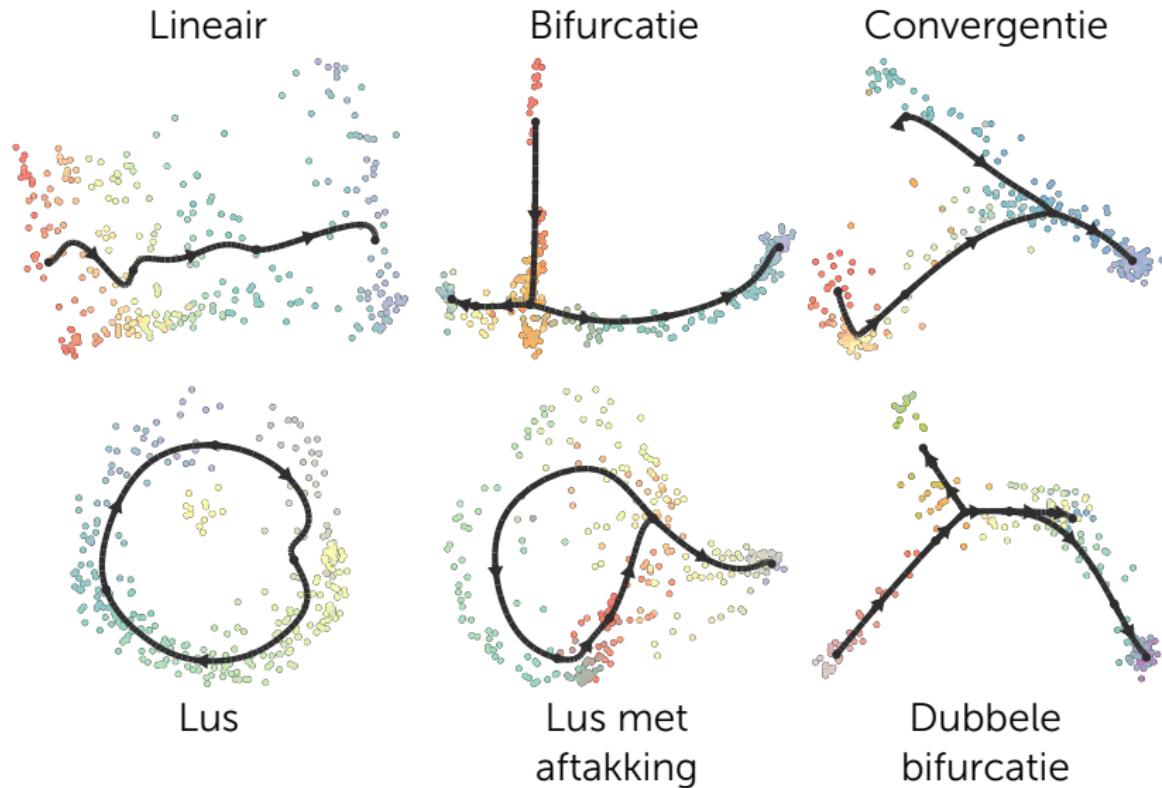


Trajectory inference; >70 methoden
Nood aan een vergelijking van methoden

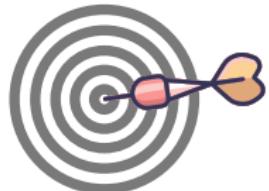
Simulatie van virtuele cellen



Simulatie van virtuele cellen

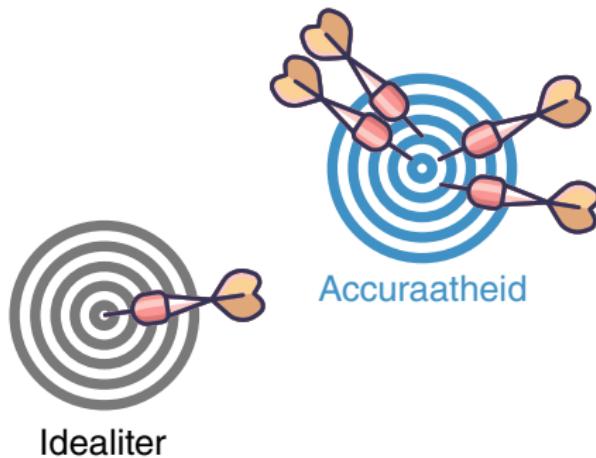


Grootschalige evaluatie van trajectory inference methoden

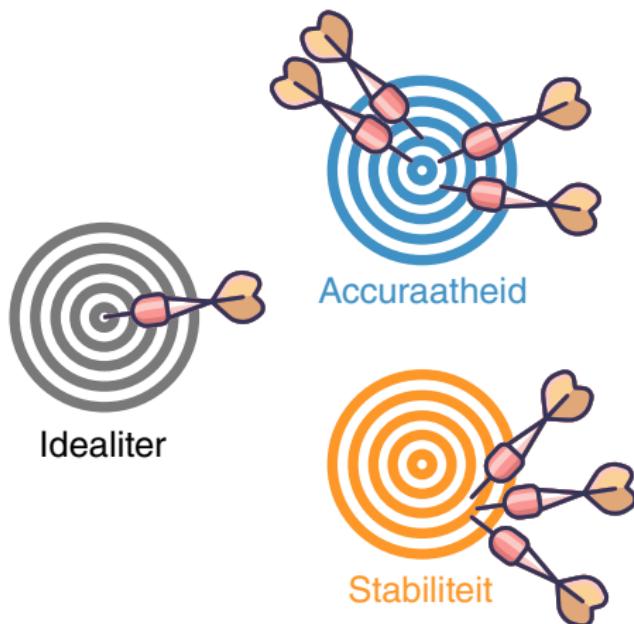


Idealiter

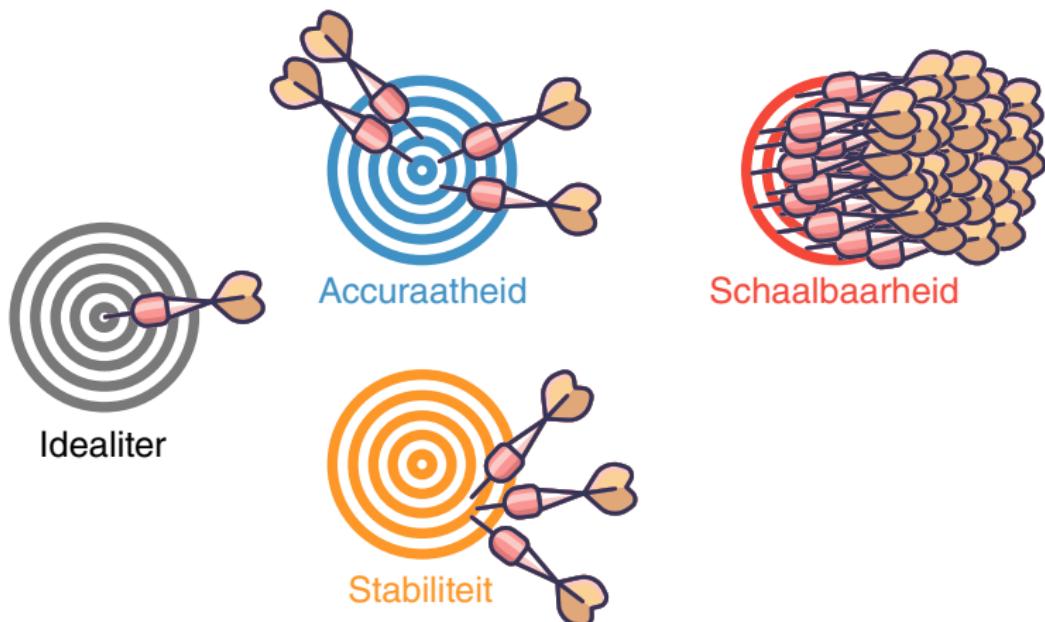
Grootschalige evaluatie van trajectory inference methoden



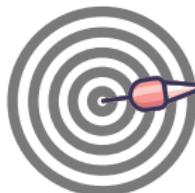
Grootschalige evaluatie van trajectory inference methoden



Grootschalige evaluatie van trajectory inference methoden



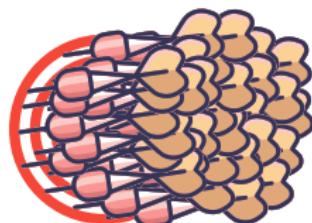
Grootschalige evaluatie van trajectory inference methoden



Idealiter



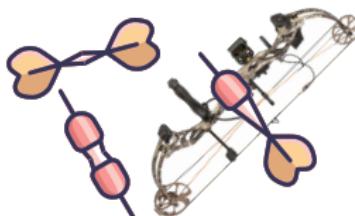
Accuraatheid



Schaalbaarheid

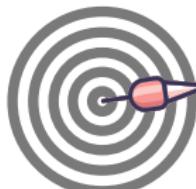


Stabiliteit

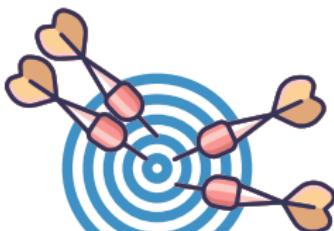


Bruikbaarheid

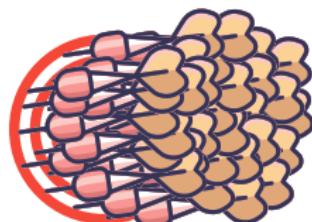
Grootschalige evaluatie van trajectory inference methoden



Idealiter



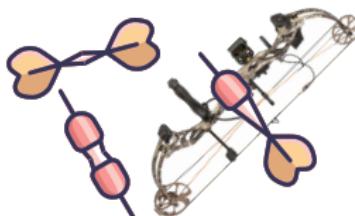
Accuraatheid



Schaalbaarheid

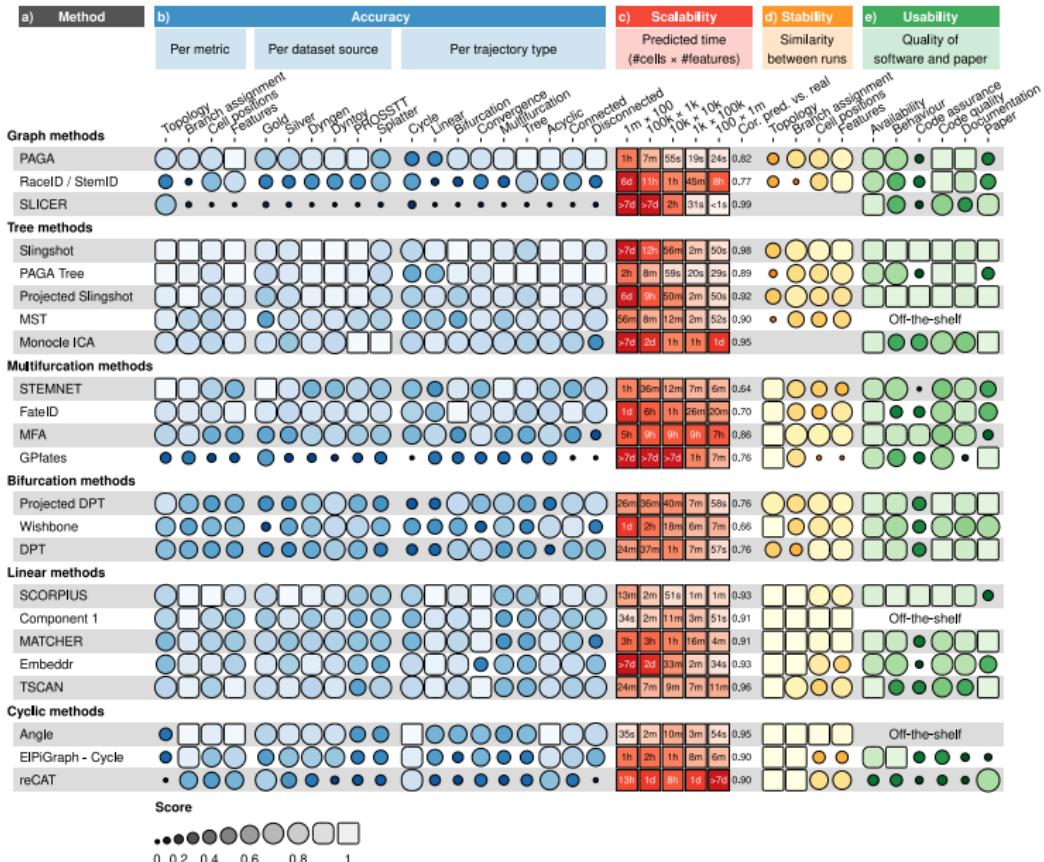


Stabiliteit



Bruikbaarheid

Resultaten van evaluatie



Set van richtlijnen voor gebruikers

dynguidelines

Tutorial 7 Citation 13

Topology
Do you expect multiple disconnected trajectories in the data?
Yes I don't know No

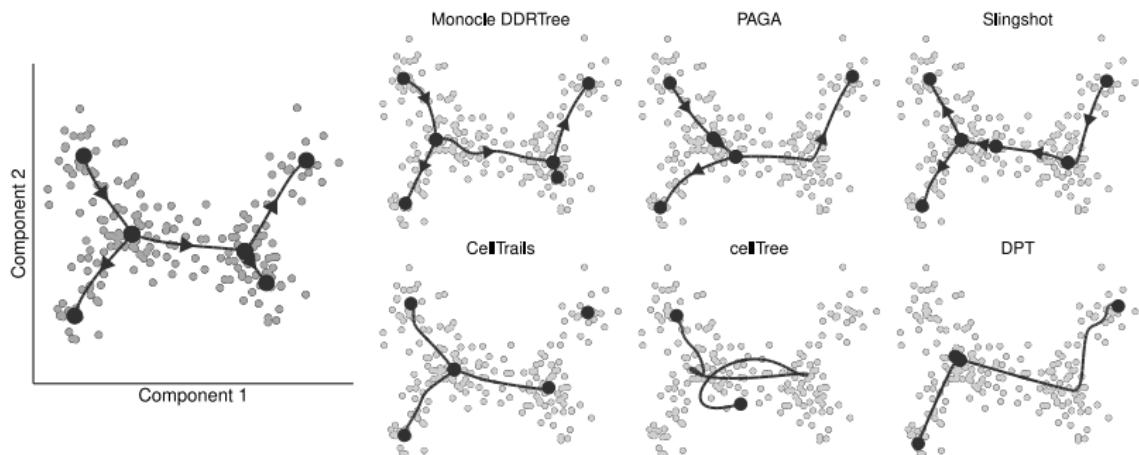
Scalability COMPUTED
Number of cells
1000
Number of features (genes)
1000
Time limit
10s 1h
Memory limit
10MB 10GB

Show code </> Show/hide columns Options
Lenses Default Summary (Fig. 2) Method Scalability Stability Usability Accuracy Overall Everything
Method Accuracy Scalability Stability

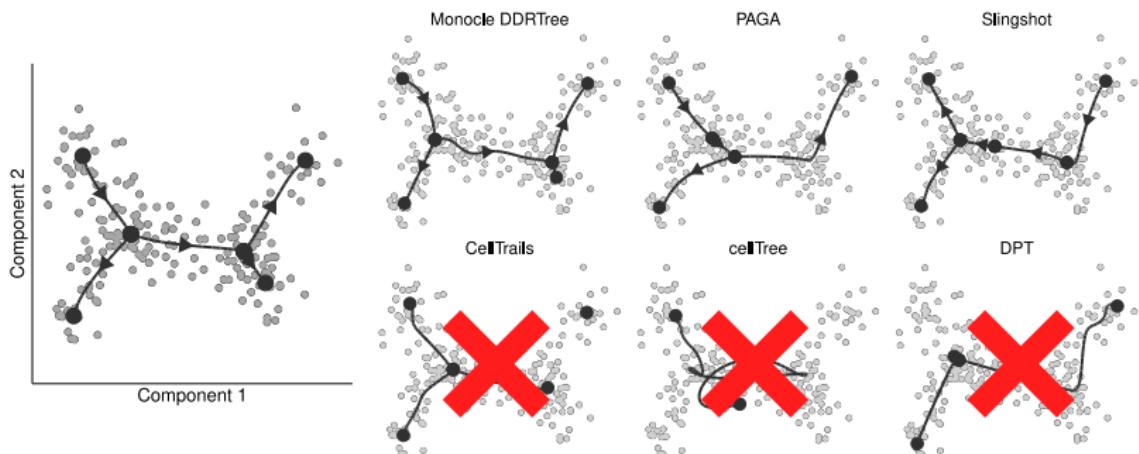
Method	Accuracy	Scalability	Stability
Singshot	100	8s	942MB
SCORPIUS	96	3s	507MB
Angle	92	1s	308MB
PAGA	59	15s	559MB
Embeddr	89	5s	581MB
MST	69	4s	572MB
Waterfall	69	5s	369MB
TSCAN	68	5s	476MB
Component 1	67	1s	516MB
SLICE	63	16s	713MB
Monocle DDRTree	62	41s	647MB
EPIGraph Linear	81	1m	573MB

Benchmark study Evaluating methods with dynbenchmark Part of dynguidelines

Gevolgen benchmark paper



Gevolgen benchmark paper



Toekomstvisie

- Werk Helena rond GNG (toon filmpje)
- Trajectory alignment
- Combinatie met spatial omics
- Human Cell Atlas (vergelijk met de human genome project)