Embarrassingly parallel analysis of a 1D cardiovascular network towards the generation of a virtual population

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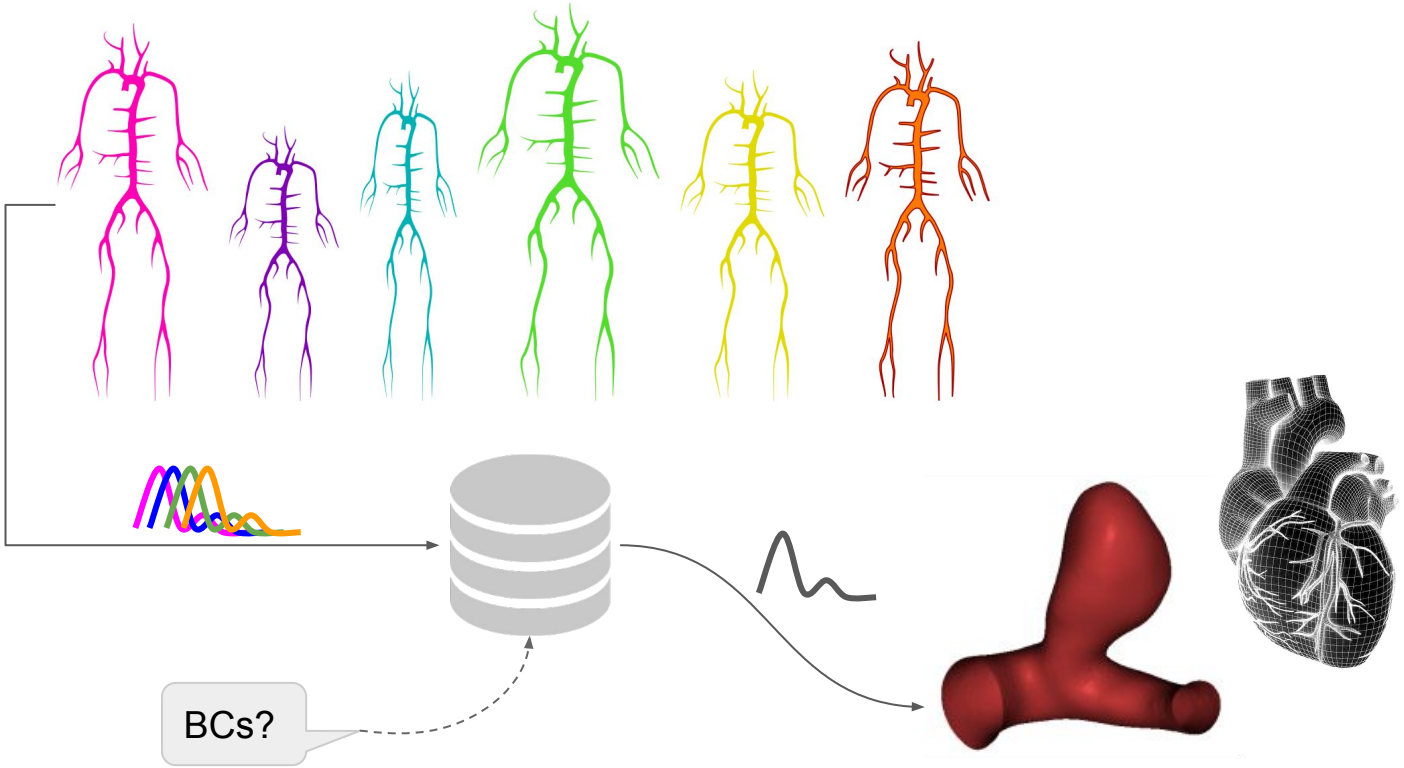
Aim



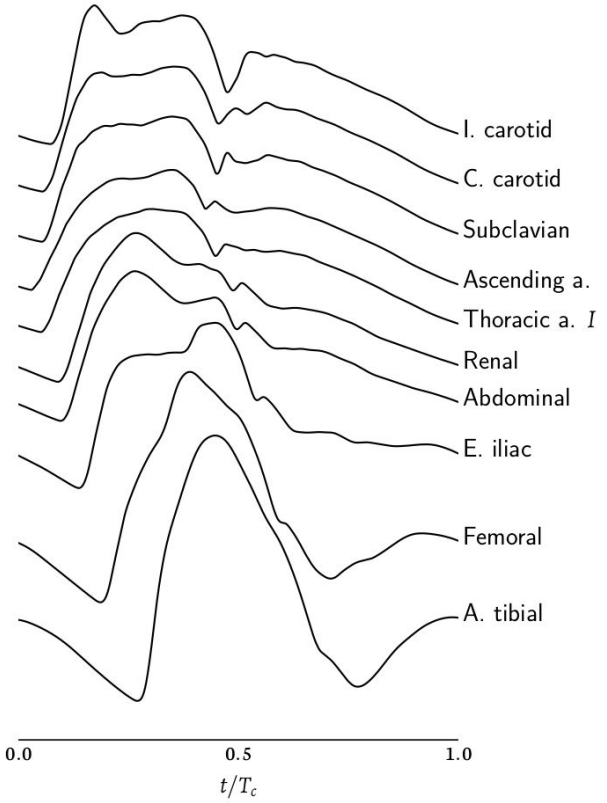
Pulse waveforms

- Pulsatile regime
- Wave transmission and reflection
- Rich in diagnostic information
- Provide insights on the onset and development of cardiovascular conditions

P3538

Improved diagnosis of cerebral vasospasm through a sensitivity analysis of a 1D cerebral circulation model

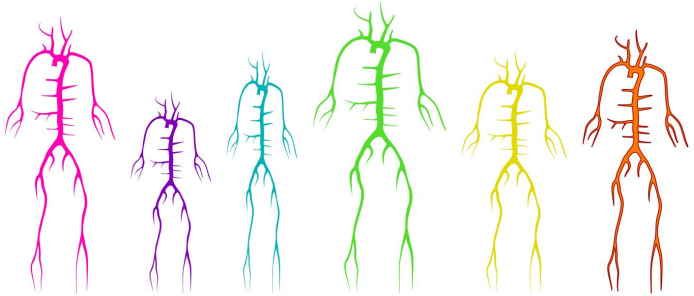
Alessandro Melis[1,2], Fernando Moura[3], Ignacio Larrabide[4], Richard Clayton[5,2], Ana Paula Narata[6], Alberto Marzo[1,2]



openBF.jl

- 1D finite-volume solver
- Predict wave mechanics in networks of compliant arteries
- Validated on experimental and clinical measurements
- Fully documented (case studies and tutorials)
- Open-source and available at https://github.com/INSIGNEO/openBF

Monte Carlo analysis



Flat dist. sampling

15k cases

openBF

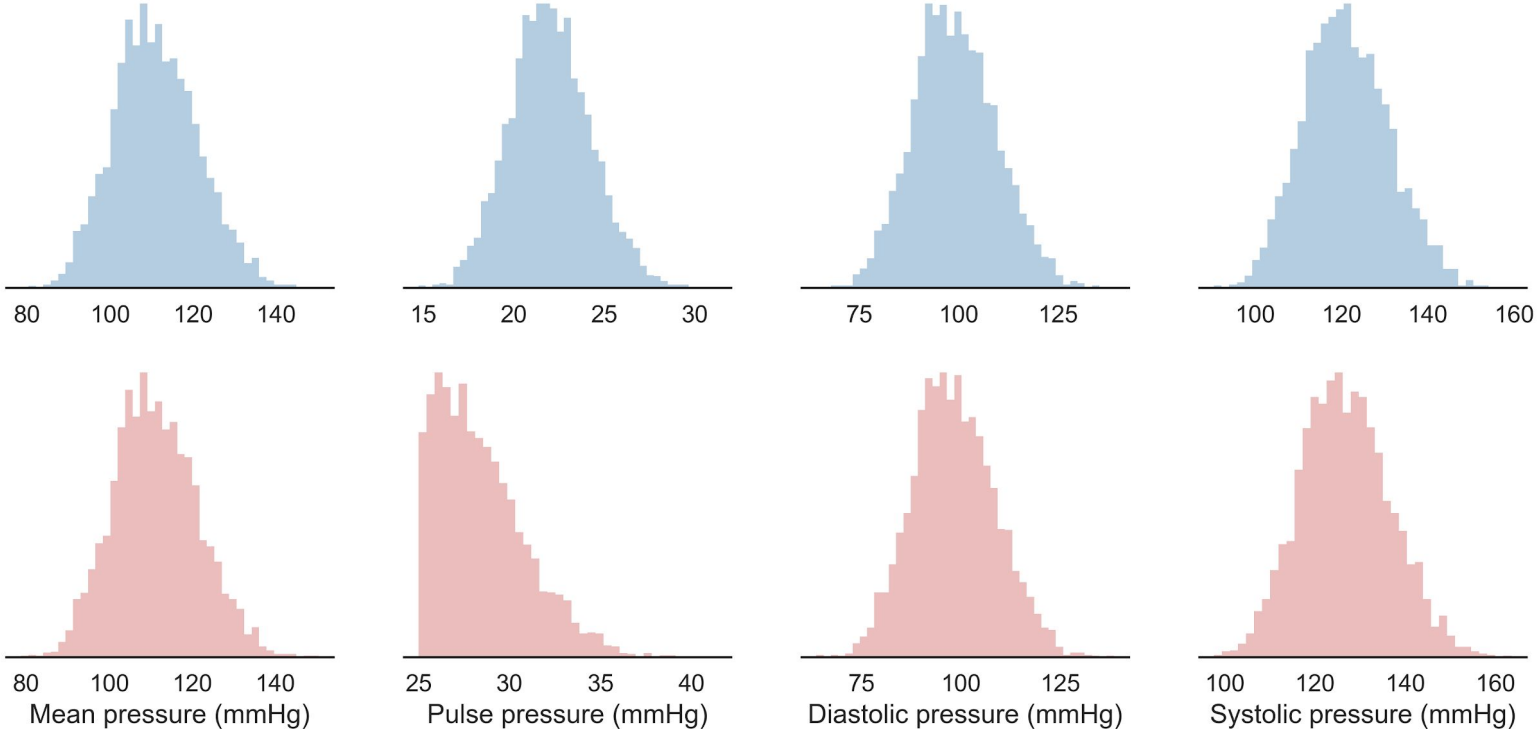
~16 hours

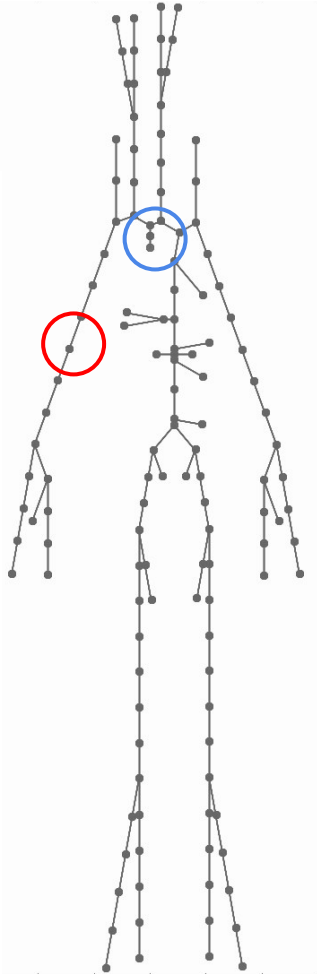
78 arteries
468 parameters

Ageing data

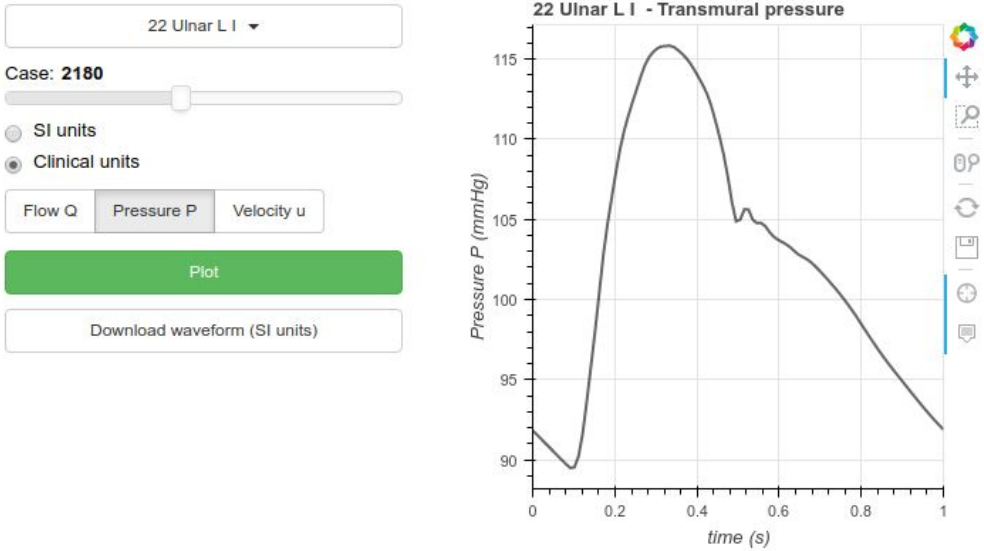
Healthy virtual ageing population

Results


80 100 120 140
15 20 25 30
75 100 125
100 120 140 160
80 100 120 140
Mean pressure (mmHg)
25 30 35 40
Pulse pressure (mmHg)
75 100 125
Diastolic pressure (mmHg)
100 120 140 160
Systolic pressure (mmHg)



Database



jupyter Spark SQL

Conclusions

- Healthy population waveforms database
- Embarrassingly parallel execution (cloud & traditional HPC)
- Open source queryable database

- Future plans:
  - Increase granularity
  - Annotation
  - Include pathologies

Thank You!

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