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Institut Thématique Multi-Organismes
Technologies pour la santé

Predictive cardiac modelling for the study of myocardial injuries

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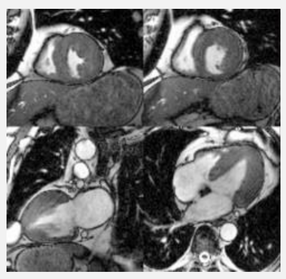
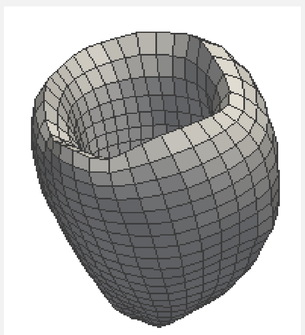
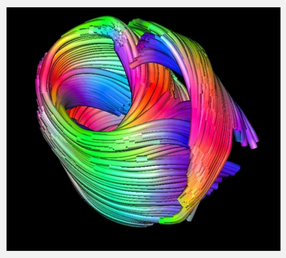
Motivation
- *Myocardial remodelling* post-myocardial infarction is still poorly understood
- In clinical setting, *control images* of post-myocardial infarction, e.g. via cardiac MR, are available

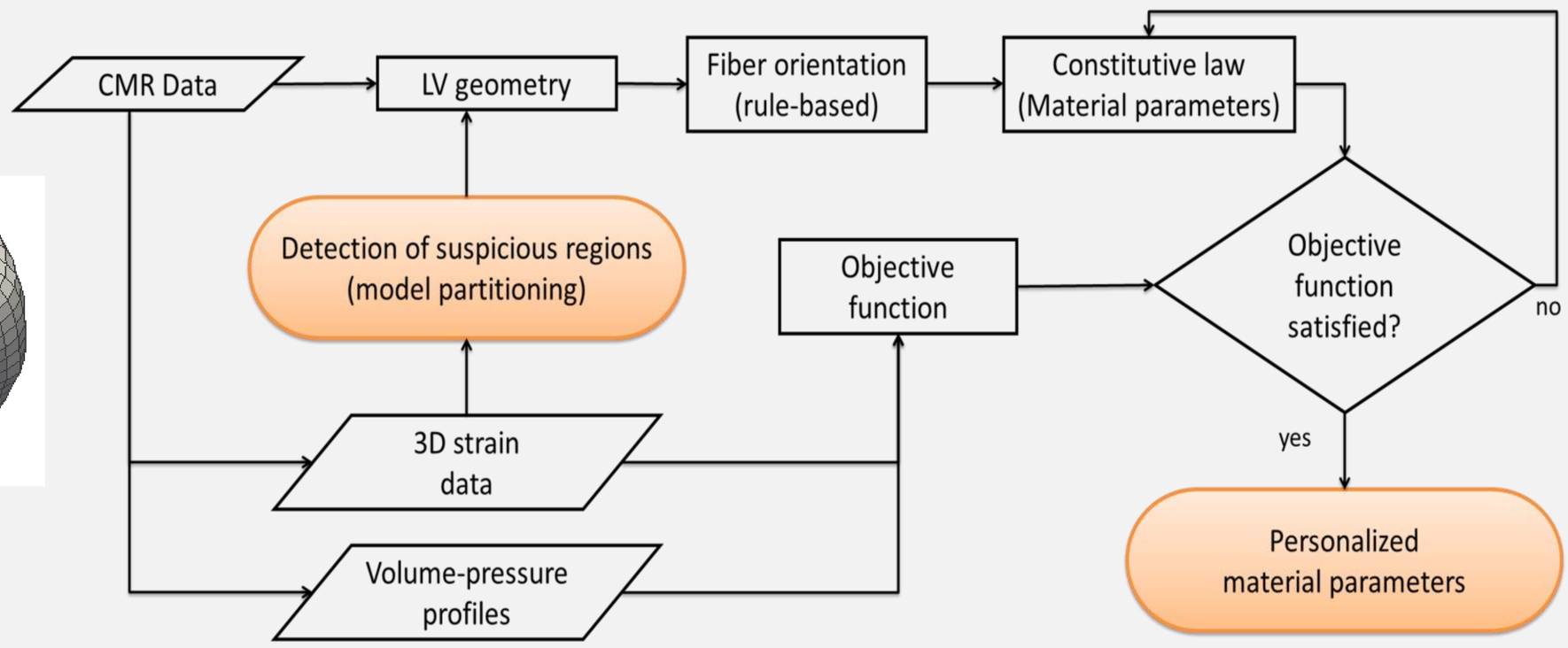
Goals
By analyzing control images and combining *infarct detection* algorithm and *finite-element modelling*, we would like to provide clinicians with extra information on injured myocardium functional status

Proposed approach: inverse biomechanical approach

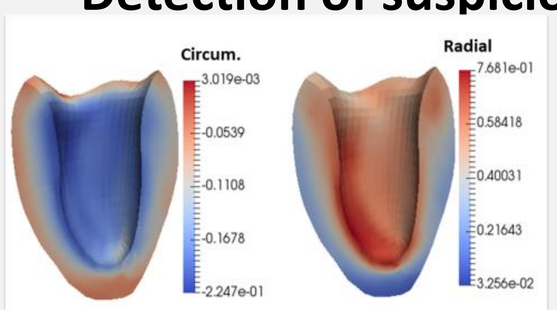




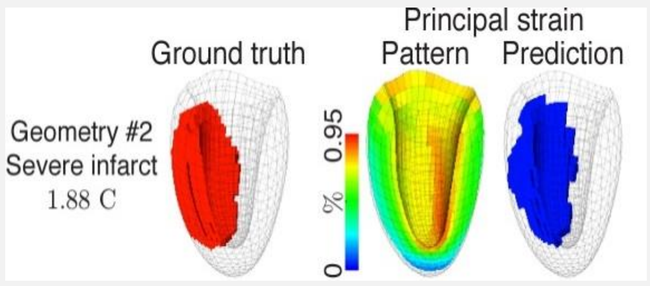




Detection of suspicious regions



suspicious regions?

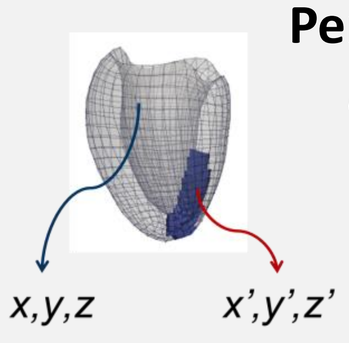


Finding the best parameter for infarct localization(diastole)

Novel evaluation approach combining:
- Finite-element *personalized* model
- Virtual pathological cases (200)
  various size, shape, location, severity
- Learning-based infarct detection
  with various *training set size*

Strain-based parameters	Localization performance
Radial strain	Second group
Circ strain	Third group
Long strain	Third group
Fiber invariant	Third group
Cross-fib invariant	Second group
Sheet-norm invariant	Third group
Principal strain	First group
Effective strain	First group
Fractional anisotropy	First group

Personalized model



Extract info on cardiac remodelling

$f_{(x,y,z,x',y',z')}$ → *healthy OR diseased? reversible OR irreversible?*

Validation of healthy personalized model

- Against *TU/e model*
- Personalized based on *P-V curves*
- Validation by comparing simulated *strain values*

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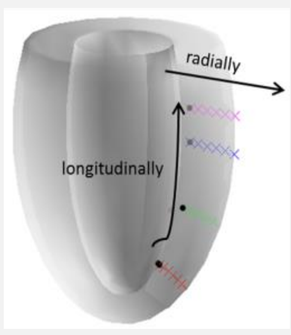
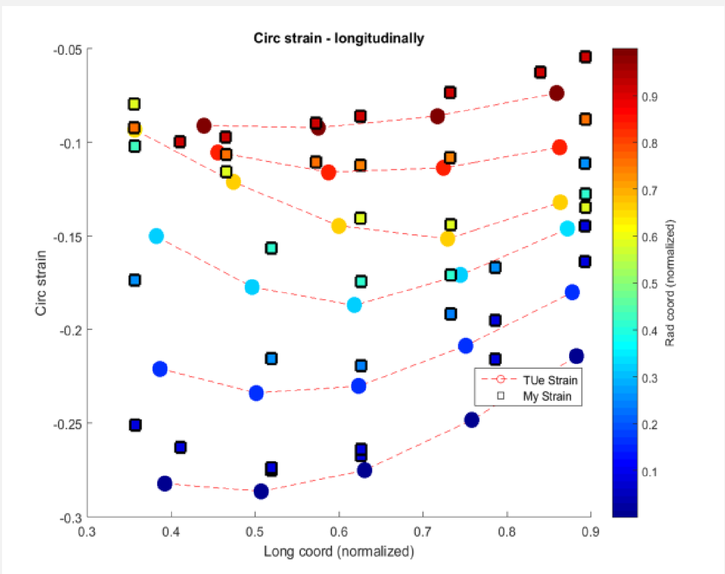
Systolic strain





Future work Evaluation/validation *with clinical data*