Motivations

• Heart disease is the leading cause of morbidity and death in the Western world. In particular, heart failure is a major public health problem, affecting approximately 5 million people in the United States and 22 million people worldwide.
• The primary function of heart is mechanical pumping. The basic measures of myocardial mechanics are the 3D strains and stresses.
• Tagged MRI (tMRI) is a non-invasive way to track the in vivo myocardial motion during cardiac cycles.
• Reconstructing 3D LV motion from tMRI can assist doctors to diagnose cardiac diseases earlier, and can also be used for 3D strain analysis.

Methods

• The input are a sequence of long-axis and short-axis tMRI data during one cardiac cycle.
• The contours and tagging lines are semi-automatically labeled with active contour model. There are two directions of tagging line in short axis, and one in long axis.
• Tracking the movements of the short-axis tagging line intersection points with robust point matching. The movement shows the heart deform in 2D plan.
• Extending the intersection point movements to the long axis based on the tagging line in the long axis with thin plate spline.
• Constructing the 3D heart model based on the contour, and deforming the model based on the intersection point movements.
• Computing the strain inside the left ventricle using meshless deformable models, and analyzing the difference between the healthy and hypertrophic heart.

Results