Fast Registration of Cardiac Perfusion MRI

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Synopsis
This abstract presents a novel method for registration of cardiac perfusion MRI sequences. By performing complex analyses of variance and clustering in an annotated training set off-line, our method provides real-time segmentation in an on-line setting. This renders the method feasible for live motion-compensation in MR scanners. Changes in image intensity during the bolus passage are modelled by an Active Appearance Model augmented with a cluster analysis of the training set. Preliminary validation carried out using five subjects showed acceptable segmentation accuracy produced very rapidly (below 40 ms per image).

Introduction
Within the last decade magnetic resonance imaging has been proven able to assess myocardial perfusion. However, the required amount of manual post-processing renders the method prohibitive to clinical practice. Most work is spent marking up of points of correspondence on the myocardium, thus registering the perfusion sequence. We propose a replacement of this tedious and error prone labour, which provides a structured manner of collecting and applying expert knowledge given by medical doctors.

Discussion
To evaluate the proposed method a Cluster-aware AAM using five classes was built on four perfusion sequences of 50 frames each. The stable period was manually set to the last 25 frames of each sequence. Using hold-out evaluation the model was tested on the fifth sequence. The mean landmark error for LV and RV was 1.25 pixel (distance from landmark to ground truth contour) using 1.7 second of CPU time on a standard PC. Selected frames are shown in Fig. 1 (right).

Results
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Fig. 1. Left: First versus second principal component of 200 texture vectors from four perfusion sequences. Middle: Unsupervised classification result using five classes. Right: Segmentation results before, during and after the bolus passage.

References