Endocardial 3D Ultrasound Segmentation using Autocontext Random Forests

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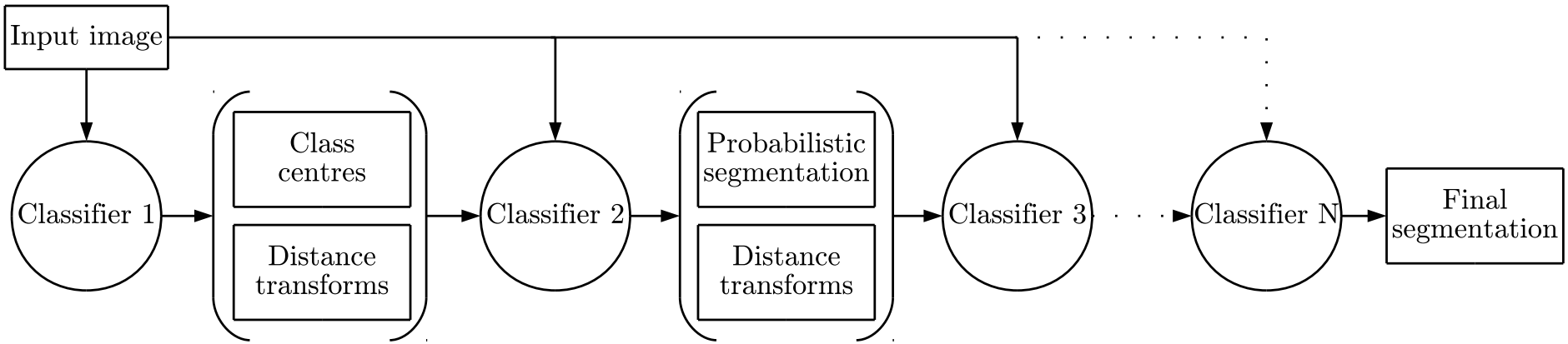
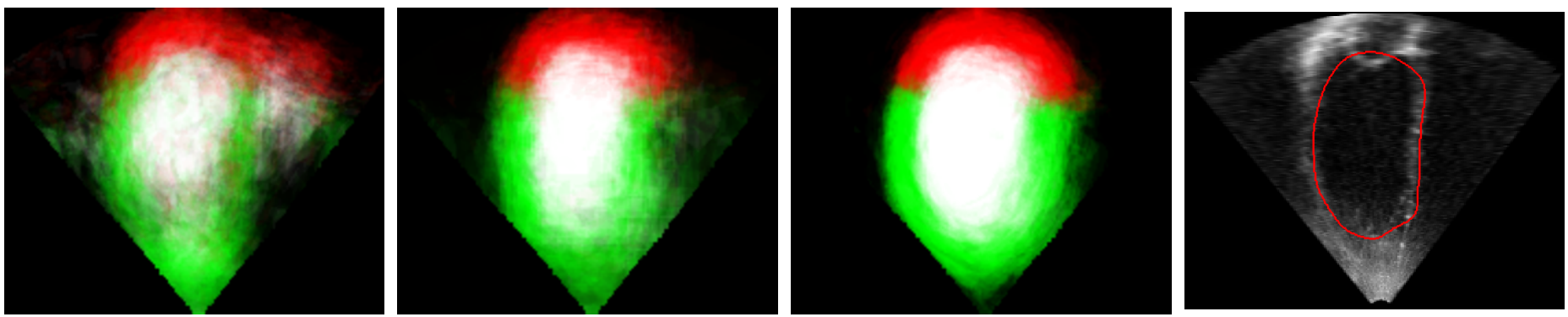
Autocontext framework

Successive classifiers,
each one gaining contextual information from their predecessors:



Iteration 1 Iteration 2 Iteration 3 Iteration N



Autocontext framework

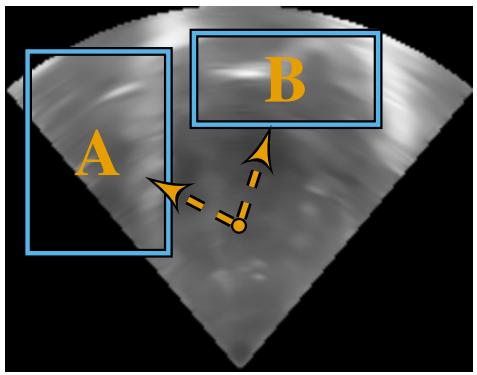
- The successive classifiers are Random Forests.
- The first iteration defines the center of each class: *left ventricle endocardium*, *myocardium* and *mitral valve*.
- Subsequent iterations perform tests on:
  - the input image
  - the current probabilities of classification
  - geodesic distance maps relative to the center of each class.

Image features

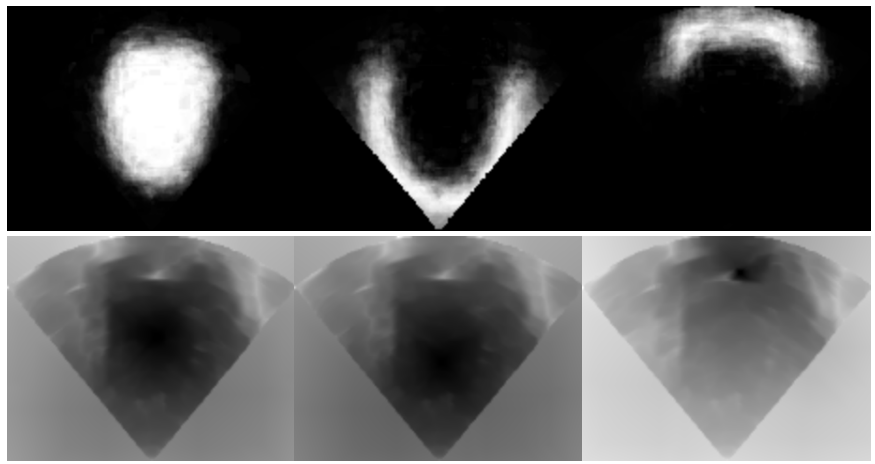
The tests performed at the nodes of the decision trees compare the mean intensities of two offset patches:

$$\mu(I_A) > \mu(I_B)$$

Input image



Probabilities of classification



Geodesic distance maps

Patches can be taken from the input image, or from the probability maps and their corresponding geodesic distance maps.

Implementation

- 4 iterations of autocontext
- Random Forests of 20 trees, maximal depth 20
- Images are resampled to $1 \times 1 \times 1$ mm^3
- Maximal patch size: 60 pixels, maximal offset: 30 pixels
- 1 day for training
- 90s for testing