

Volumetric Texture Segmentation

Reyes-Aldasoro 2007

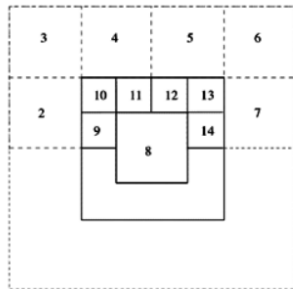
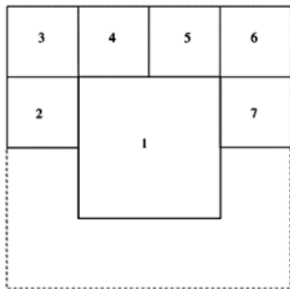
Jan Kybic

2020

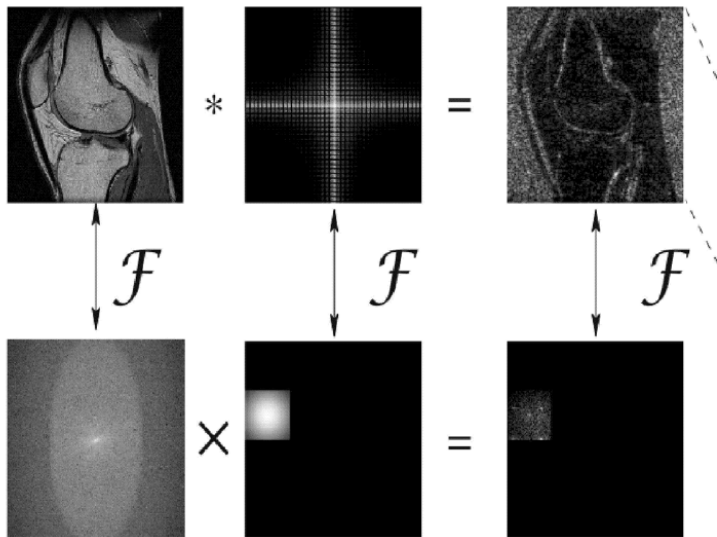
Overview

- ▶ medical, 3D
- ▶ Fourier subband descriptors
- ▶ Bhattacharyya space/distance
- ▶ oct tree in feature space
- ▶ boundary refinement

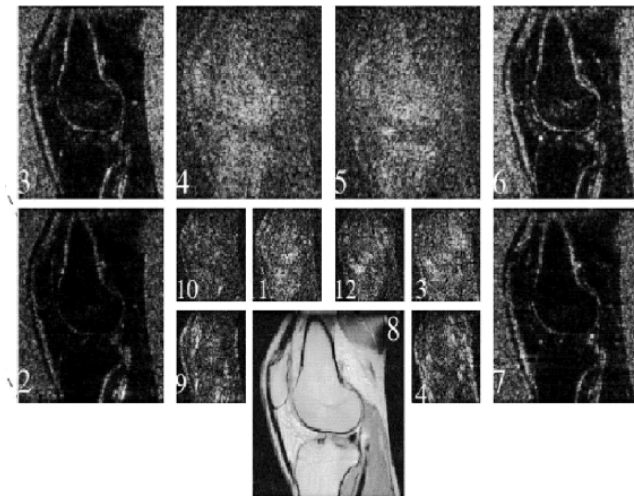
Fourier tessellation (2D)



Filtering



Orientation pyramid



Amplitude only. Real signal \rightarrow FT symmetry \rightarrow half space needed

Feature selection

- ▶ Bhattacharyya distance

$$D_B(p, q) = -\ln(BC(p, q)), \quad BC(p, q) = \int_{x \in X} \sqrt{p(x)q(x)}$$

- ▶ Bhattacharyya distance from variance and mean

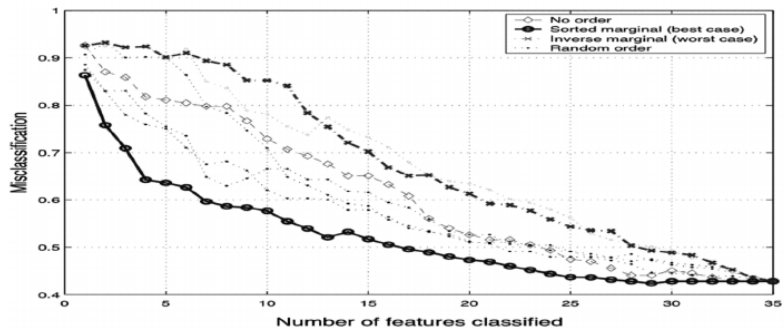
$$D_B(k_1, k_2) = \frac{1}{4} \ln \left(\frac{1}{4} \left(\frac{\sigma_{k_1}^2}{\sigma_{k_2}^2} + \frac{\sigma_{k_2}^2}{\sigma_{k_1}^2} + 2 \right) + \frac{1}{4} \left(\frac{(\mu_{k_1} - \mu_{k_2})^2}{\sigma_{k_1}^2 + \sigma_{k_2}^2} \right) \right)$$

- ▶ Sum D_B over class pairs p

$$B_I(i) = \sum_{p=1}^{N_p} B(i, p) = \sum_{p=1}^{N_p} D_B(S_{k_1}^i, S_{k_2}^i),$$

- ▶ consider features in the ordered of decreasing $B_I(i)$

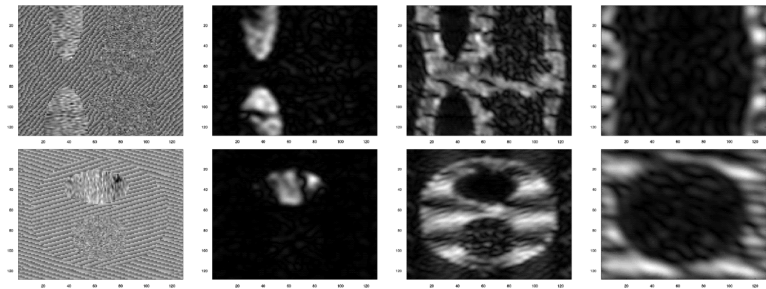
Feature selection experiment



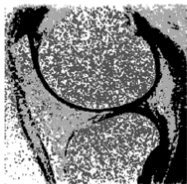
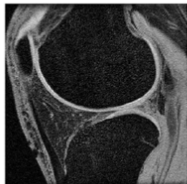
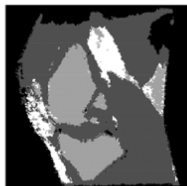
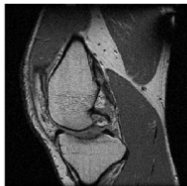
Multiresolution classification

- ▶ build a multiresolution pyramid by quad tree/oct tree
- ▶ segment/classify at the lowest resolution
- ▶ (*suboptimal classifier*) - calculate class means and then do NN clustering
- ▶ refine progressively at finer levels using “butterfly filters” (anisotropic filtering)

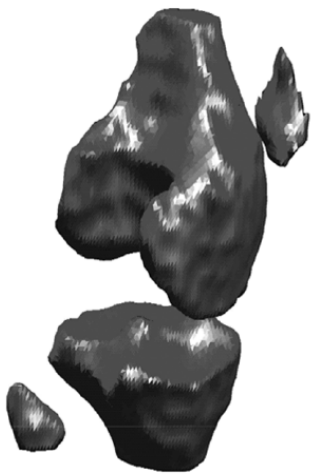
Orientation pyramid features



Segmentation



Knee segmentation



Cartilage segmentation

extracted heuristically from the bone boundaries

