

Measuring and segmentation in CT data using deformable models

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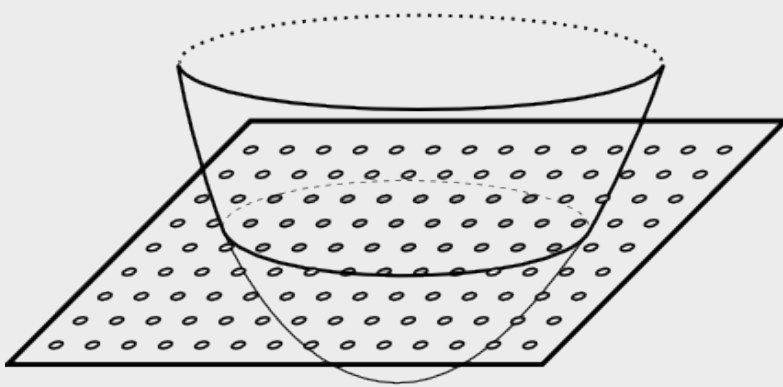


Task

- Volume measuring through object reconstruction
- Based on deformable models
- Build-up fast, robust, extensible framework for segmentation, reconstruction
- Evaluate efficiency
- Reconstruction from successive slice segmentation

B-Spline Snakes

- Relatively fast
 - Least parameters to optimize from all known methods
 - But more work concentrated to each parameter
- Noise aware



a) Implicit



b) Explicit



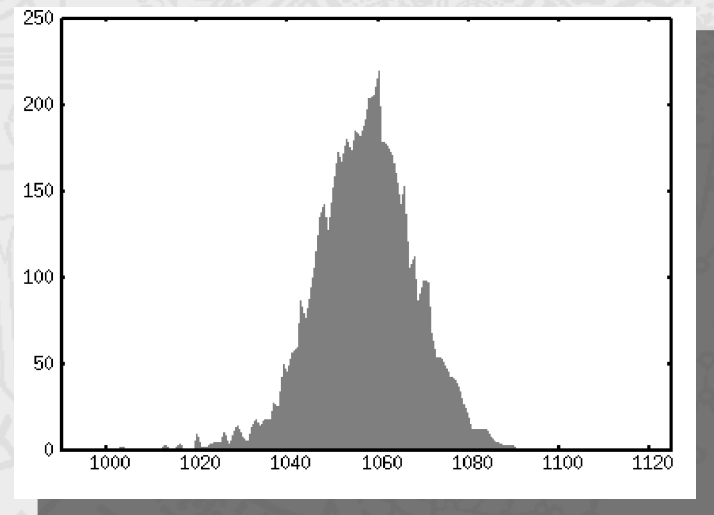
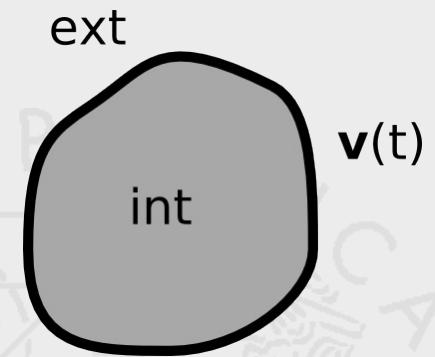
c) B-Spline

Model

- Region based
 - Edges are unreliable
 - Statistics of region known a priori
- Incorporated similarity to template

$$E_{region} = \int_{int} \log \left(\frac{P_{int}}{P_{ext}} \right) dx dy$$

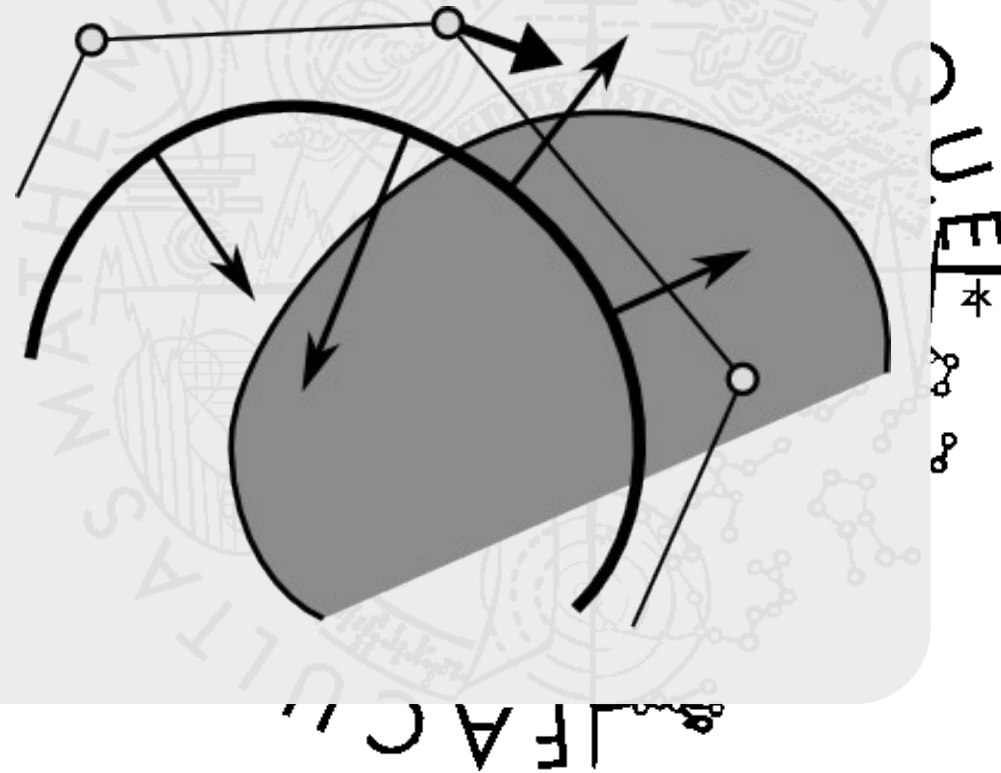
$$E_{temp} = \int_0^N \min(\sqrt{(v(t) - temp)^2}) dt$$



Optimization

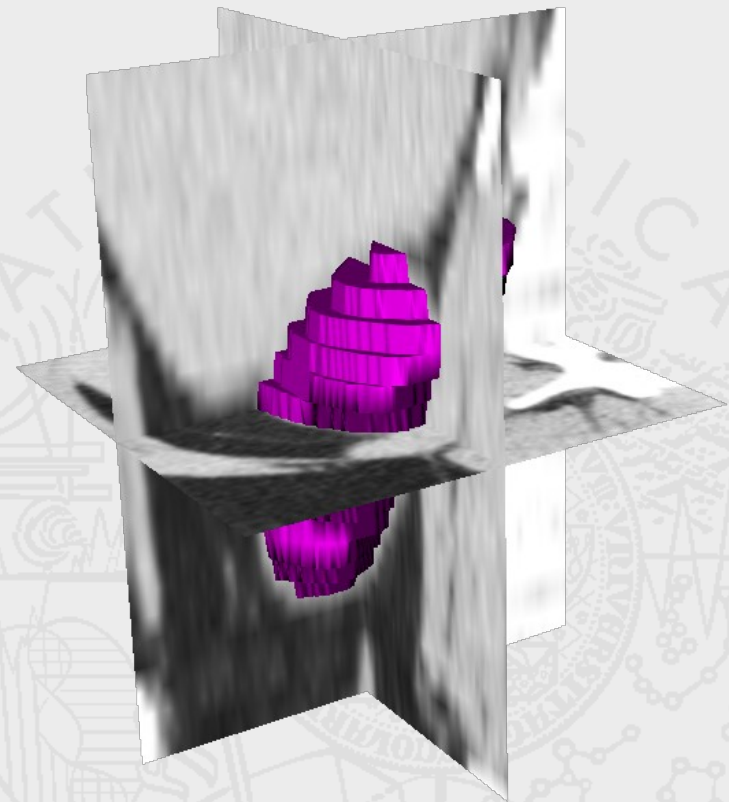
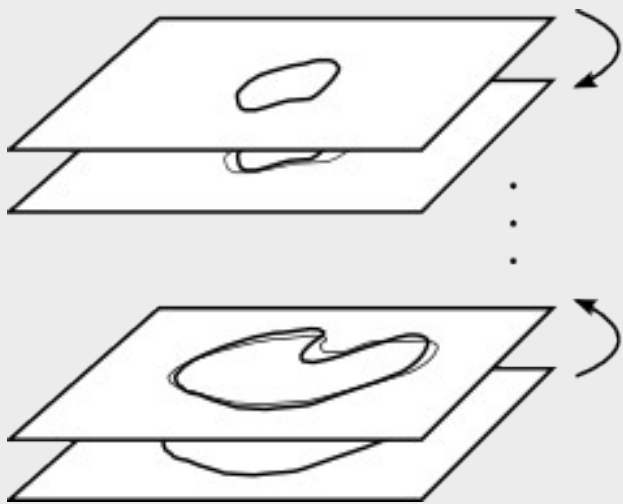
- Gradient descent
- Computation of derivatives
- Heuristic equivalent to exact computation
 - In fashion of balloons

$$\begin{aligned} & \nabla_{c_k} E_{region} = \dots \\ & = \int_k^{k+deg} F \cdot B(t-k) \cdot \mathbf{n}(\mathbf{s}) \cdot |d\mathbf{s}| dt \end{aligned}$$



Reconstruction

- Slice-to-slice propagation
 - Co-registration
 - Statistics recalculations
 - Nearest distance field

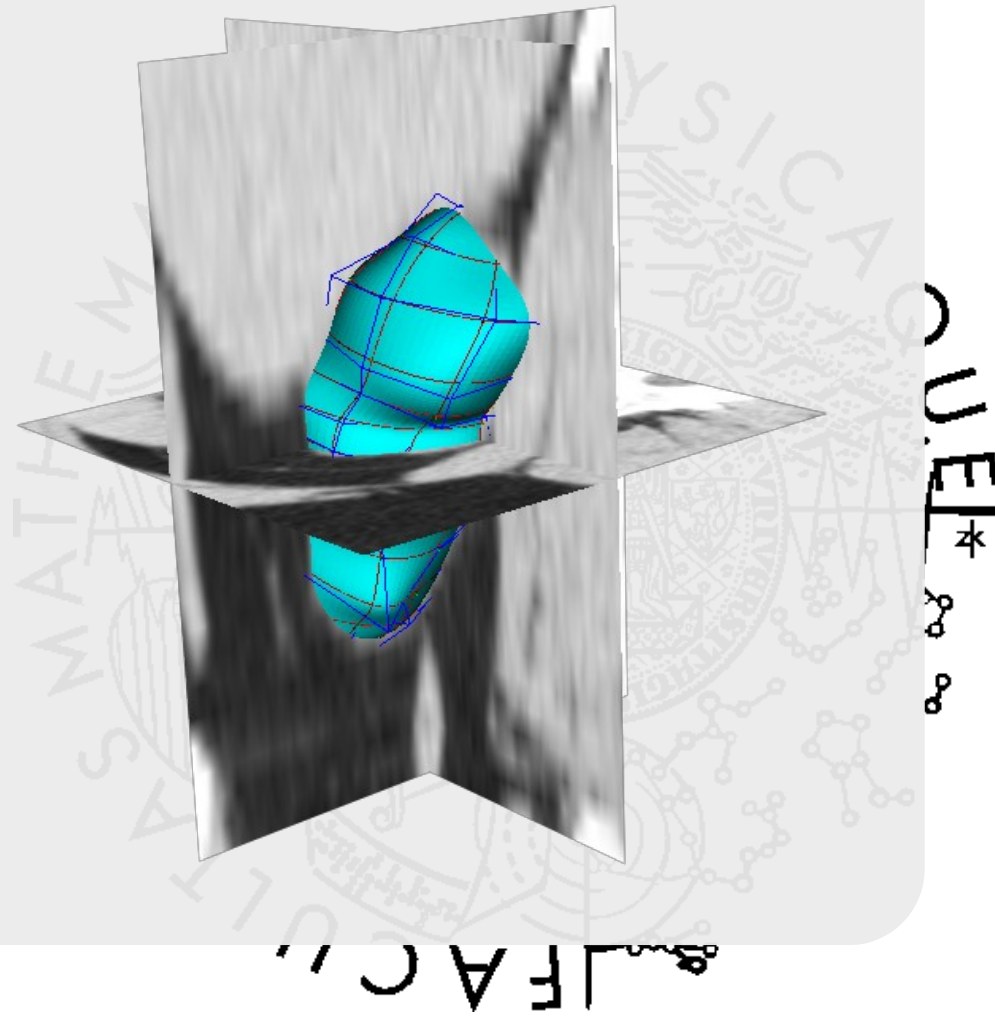


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Future work

- Medical studies using our software
- B-Spline planes



References

- M.Kass, A. Witkin, and D. Terzopoulos, Snakes: Active contour models, 1988
- T. Chan and L. Vese, Active contours without edges, 2001
- Mathews Jacob, Thierry Blu and Michael Unser, Efficient energies and algorithms for parametric snakes, 2004
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Q & A

