Visualisierung Medizinischer Daten 2
1. Vorlesung

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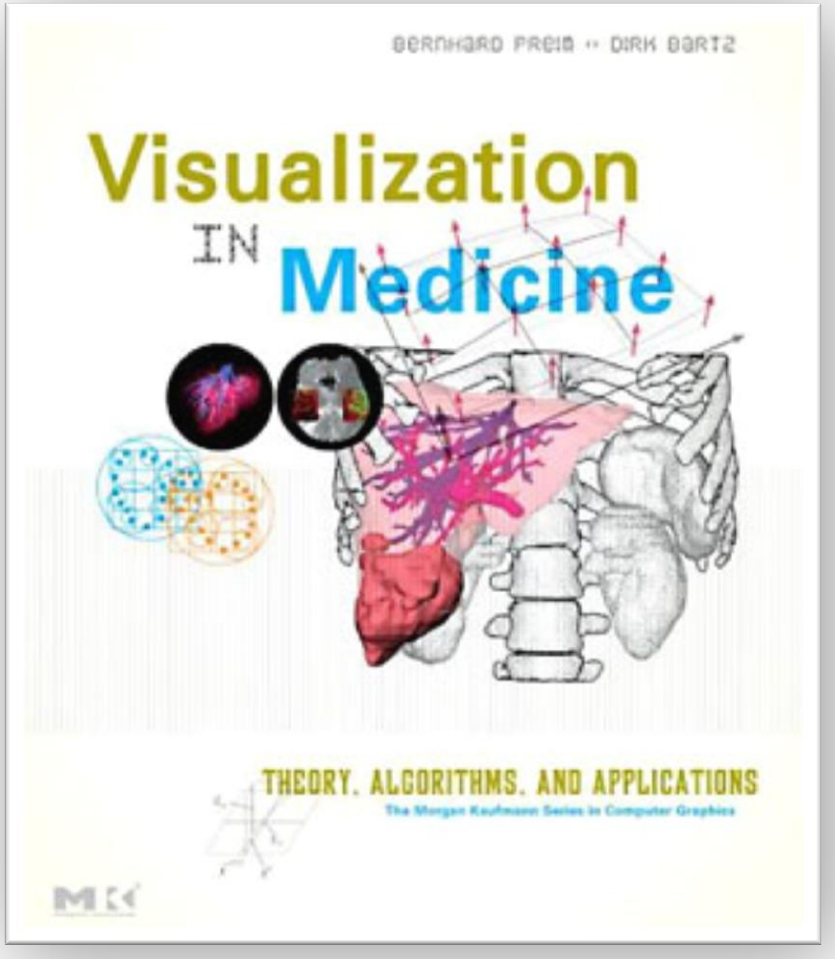
Literature

- Visualization in Medicine
- www.medvis-book.de

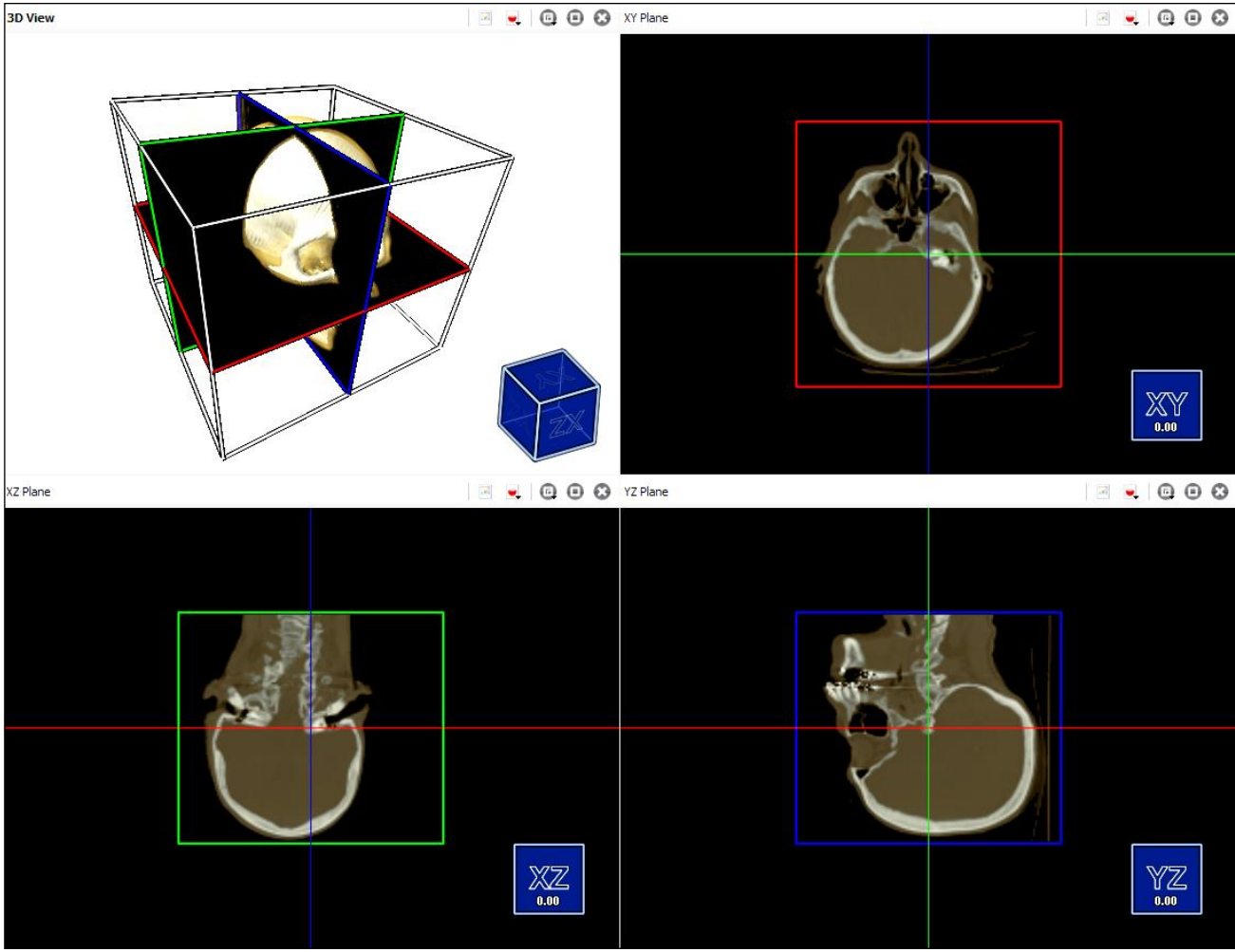


Outline

- Slices
- Volume rendering
- Transfer functions
- Surface rendering
- Segmentation
- Data enhancement
- Miscellaneous

Slices (1)

- Axis-aligned slices
  - Axial
  - Coronal
  - Sagittal
- Linked views

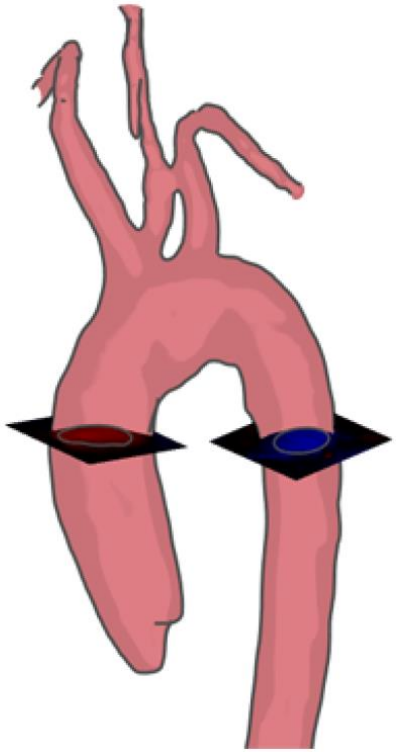


[VolumeShop, Bruckner et al.]

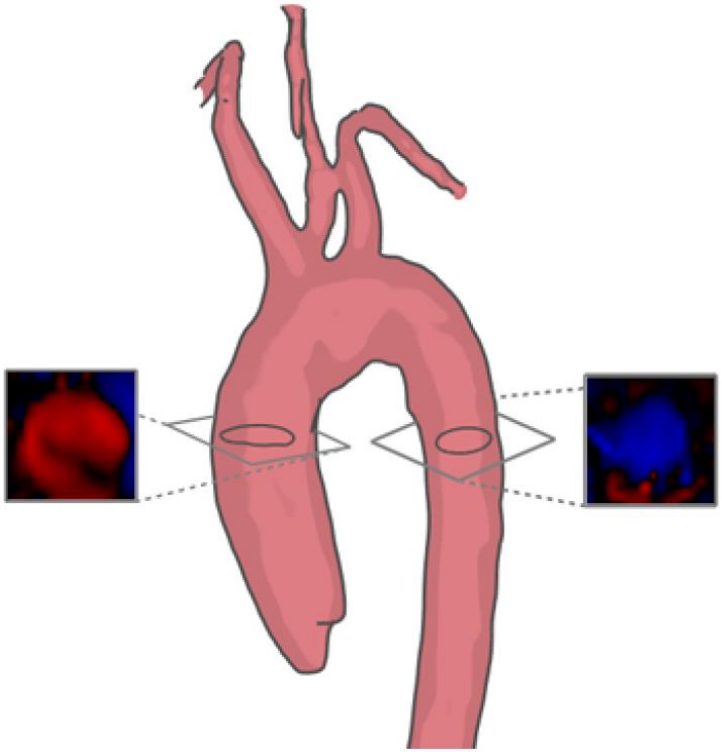
Slices (2)

- Oblique planar cuts through the data set
- Multi-planar Reformation (MPR)

MPR



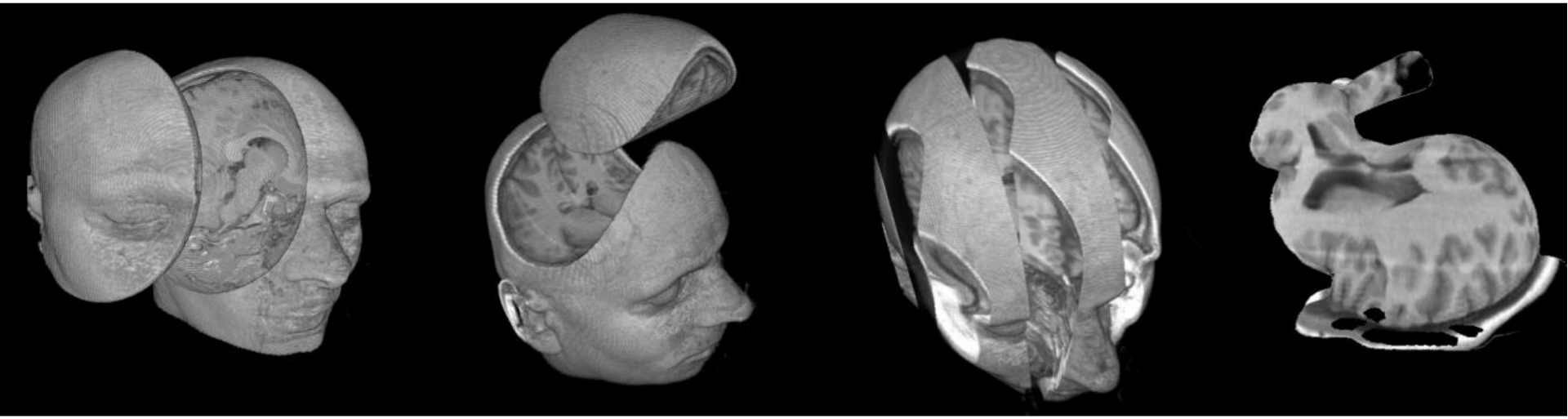
Exploded Views



[Roy van Pelt et al. 2009]

Slices (3)

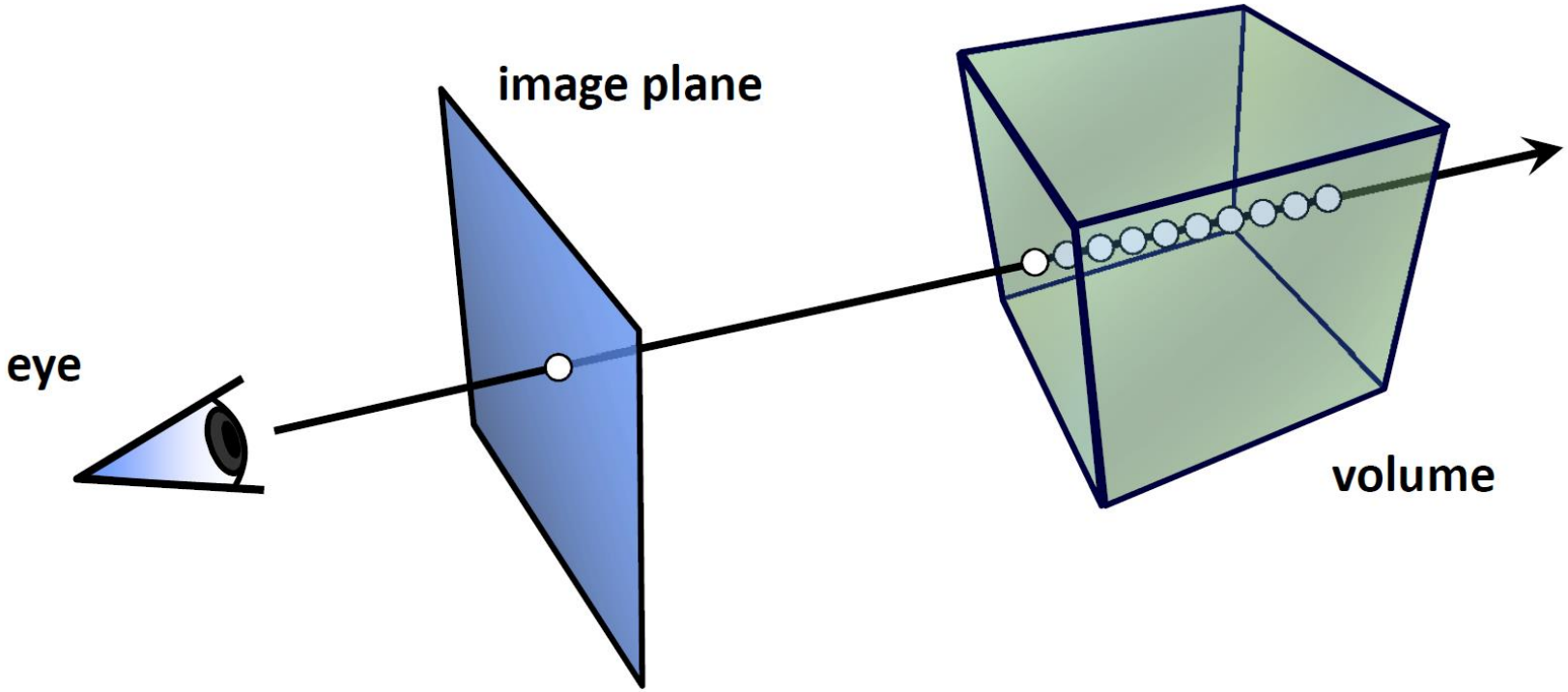
- Cutaway planes
- Clipping planes / geometry



[Weiskopf et al. 2002]

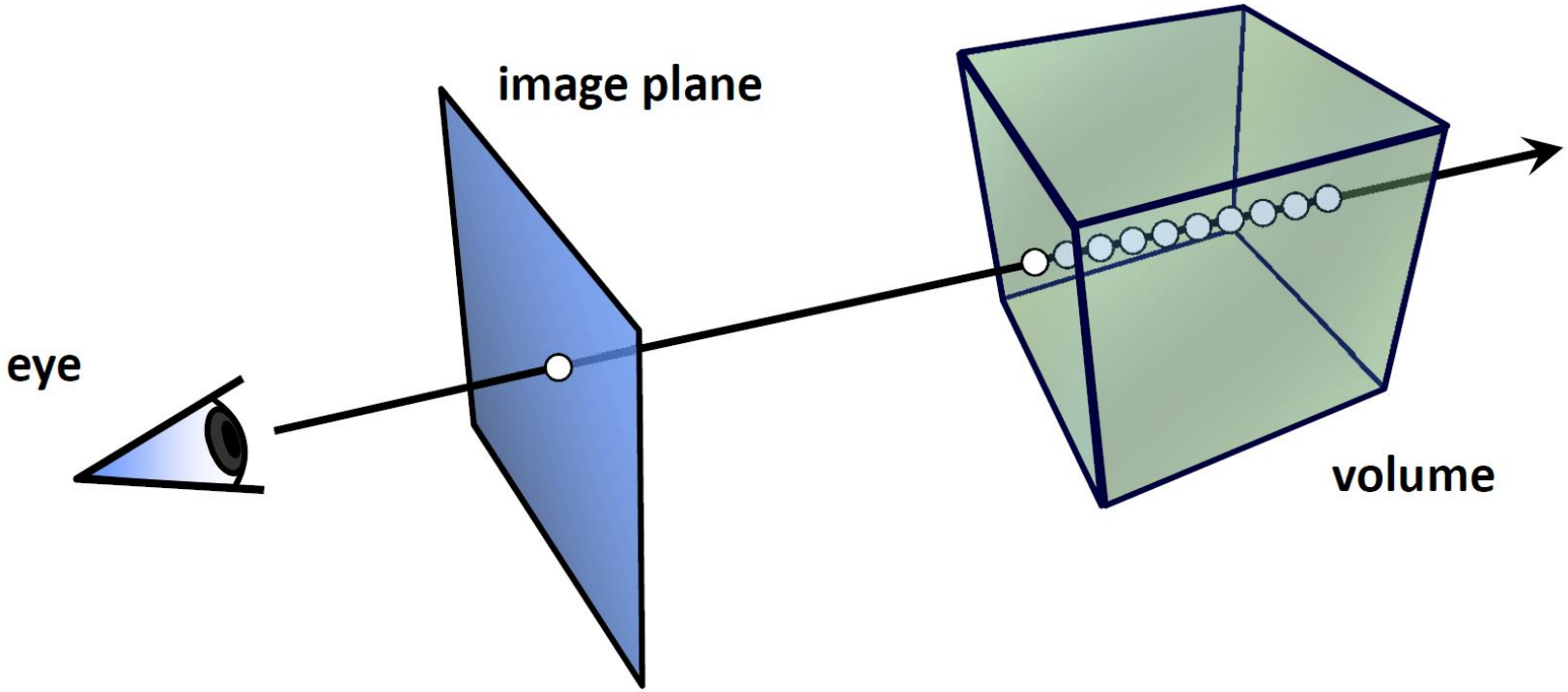
Volume Rendering (1)

- Maximum Intensity Projection (MIP)



Volume Rendering (1)

- Maximum Intensity Projection (MIP)



- Depicts maximum intensity along the ray
- Spatial perception deteriorates

Volume Rendering (1)

- Maximum Intensity Projection (MIP)
- Depicts maximum intensity along the ray

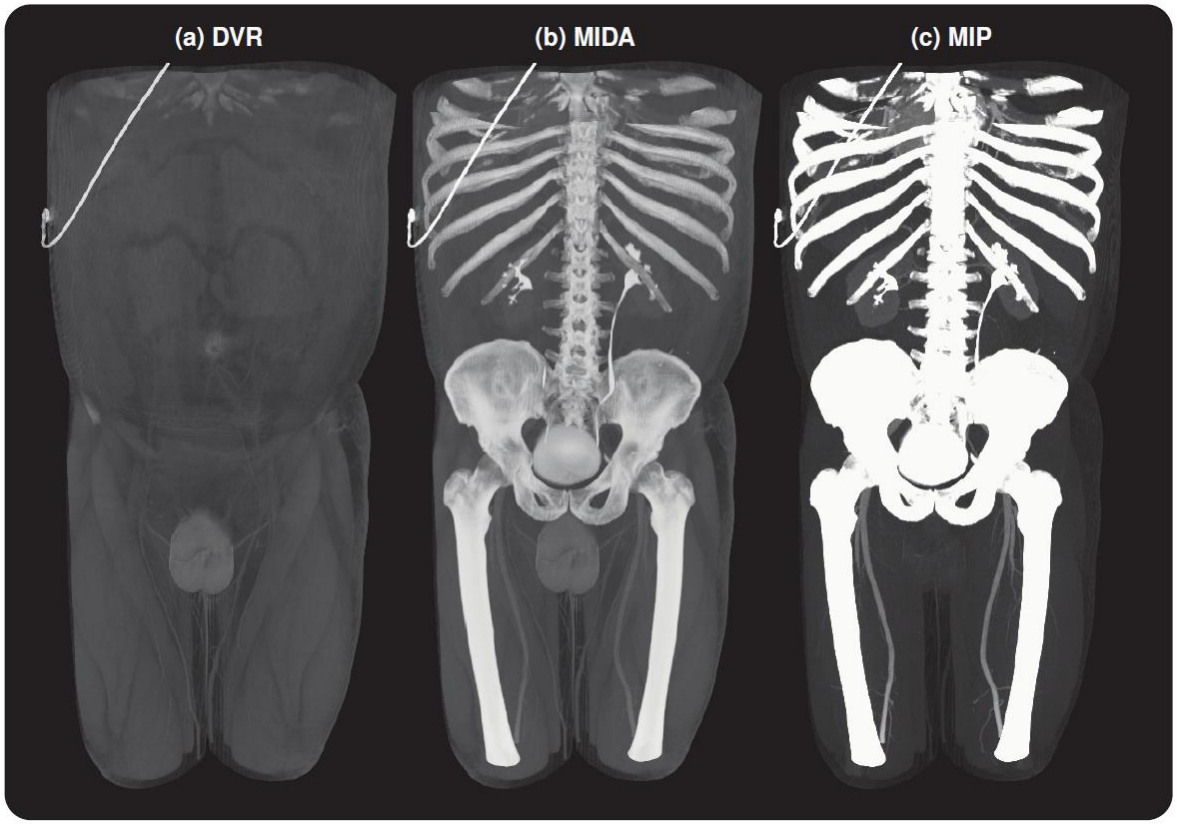
Volume Rendering (2)

- Local Maximum Intensity Projection (LMIP)
- Depicts first maximum greater than a user-specified threshold

[Sato et al. 1998]

Volume Rendering (3)

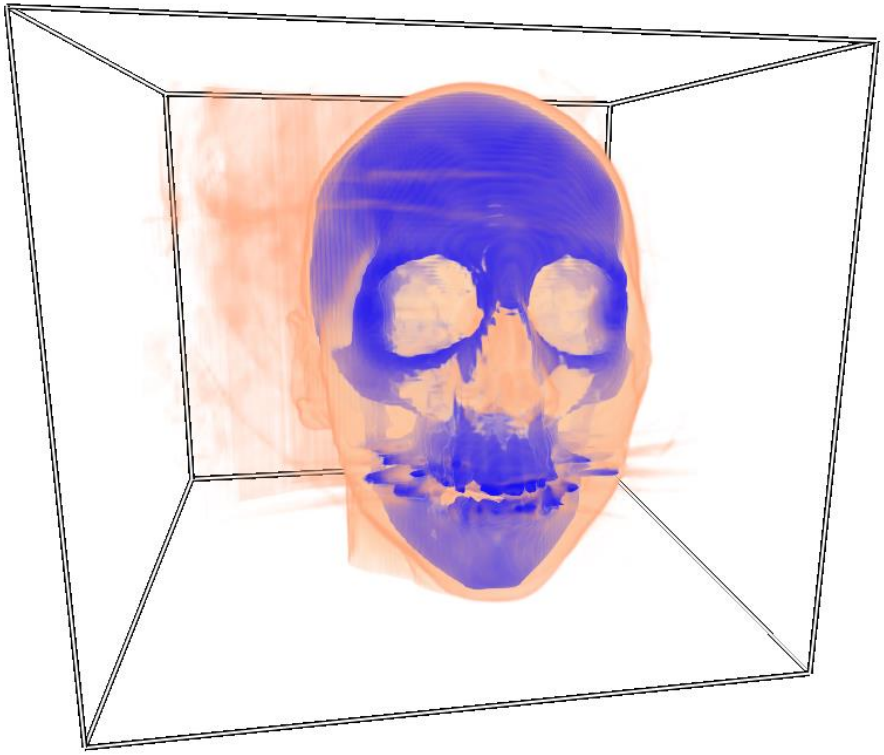
- Maximum Intensity Difference Accumulation
- Better spatial cues than MIP



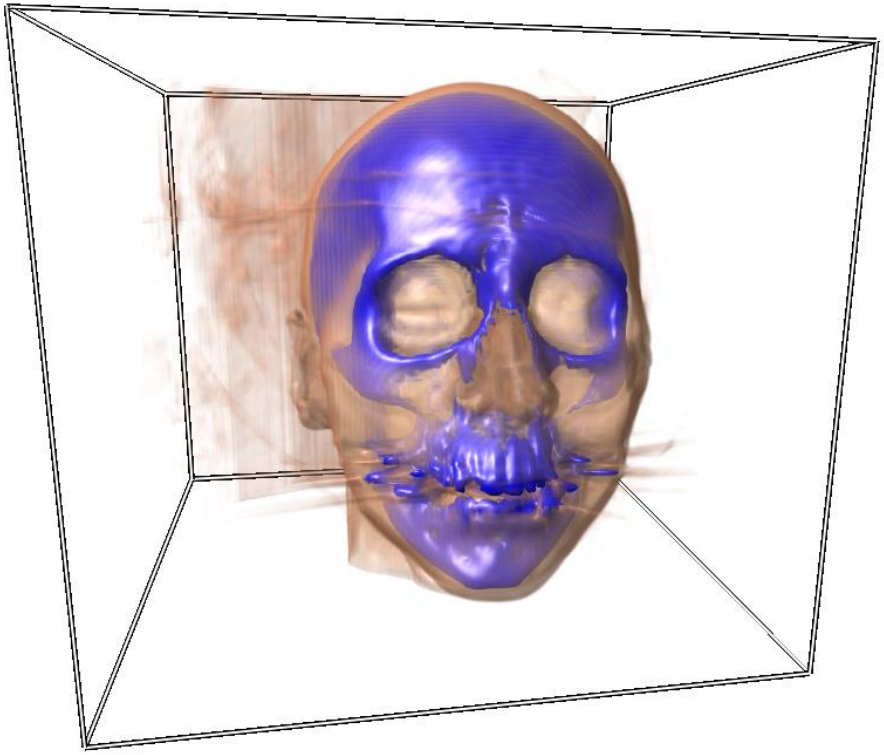
[Bruckner and Gröller 2009]

Volume Rendering (4)

- Direct Volume Rendering (DVR)



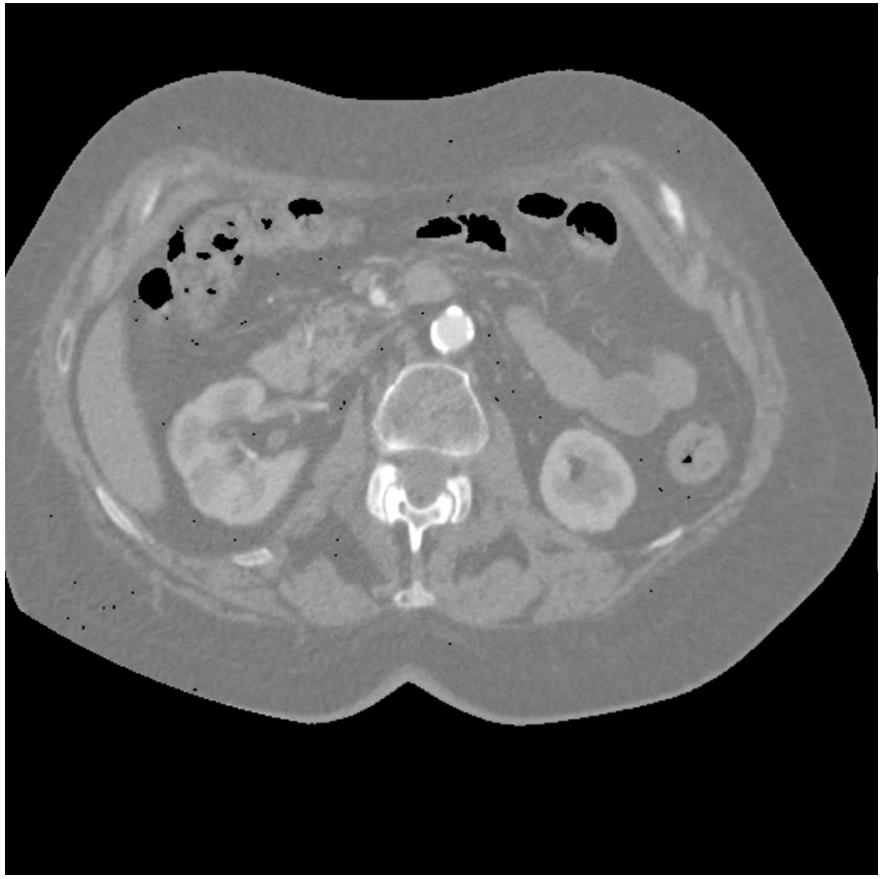
unshaded



shaded

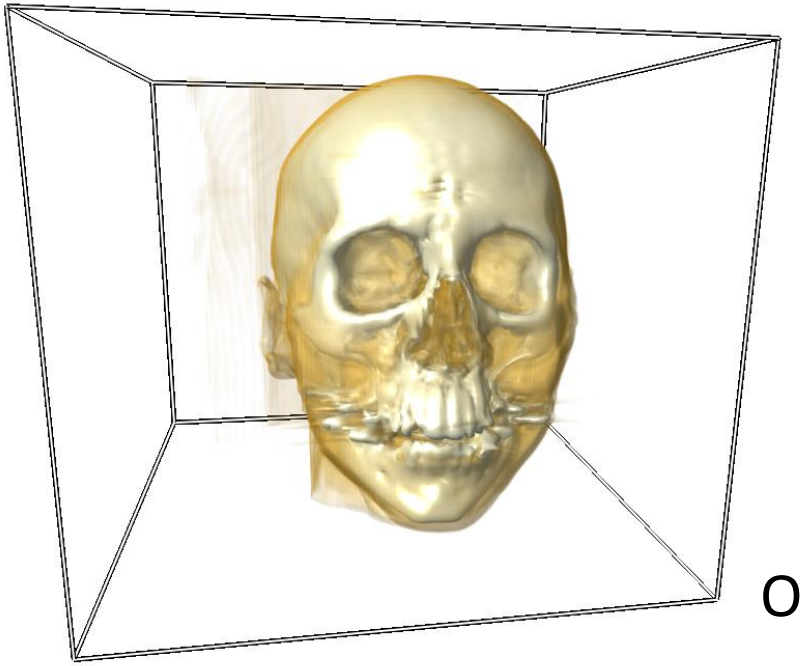
Transfer Functions (1)

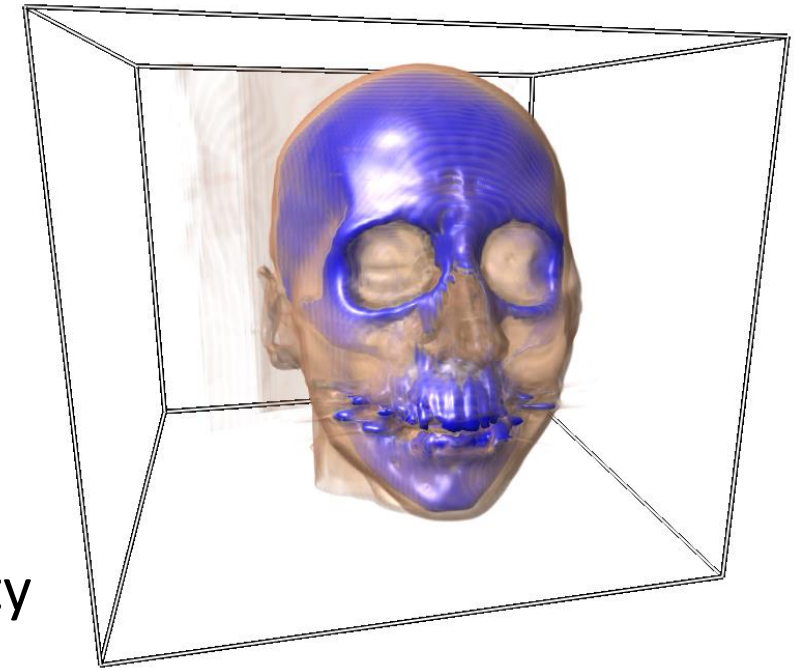
- Windowing function
- Two parameters: center & width



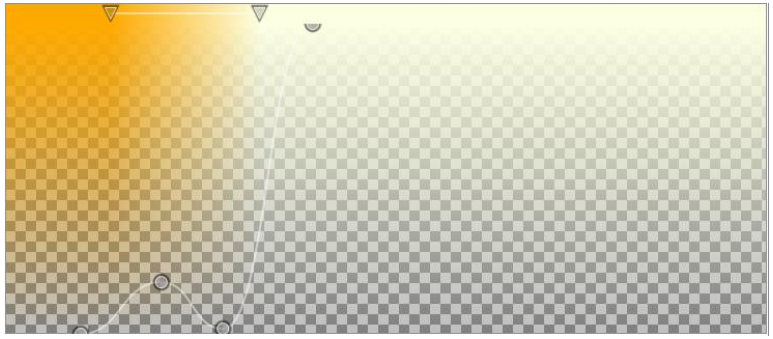
Transfer Functions (2)

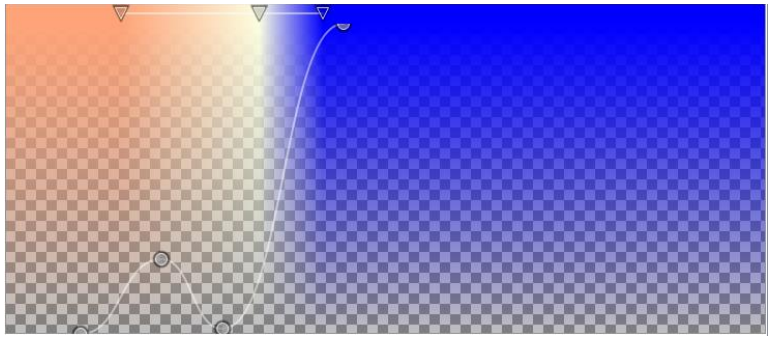
- 1D Transfer Functions





Opacity



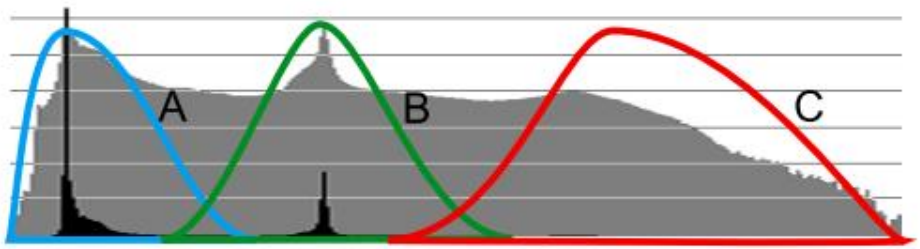


Data value

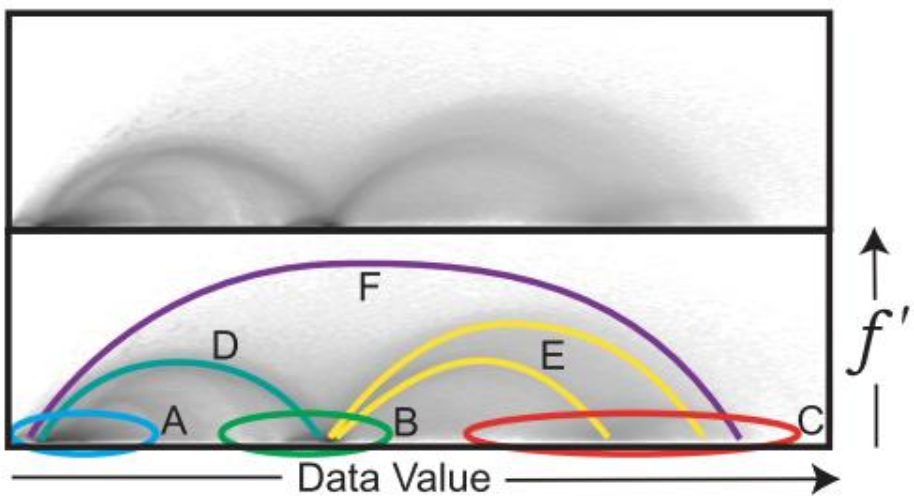
Data value

Transfer Functions (3)

2D Transfer Functions

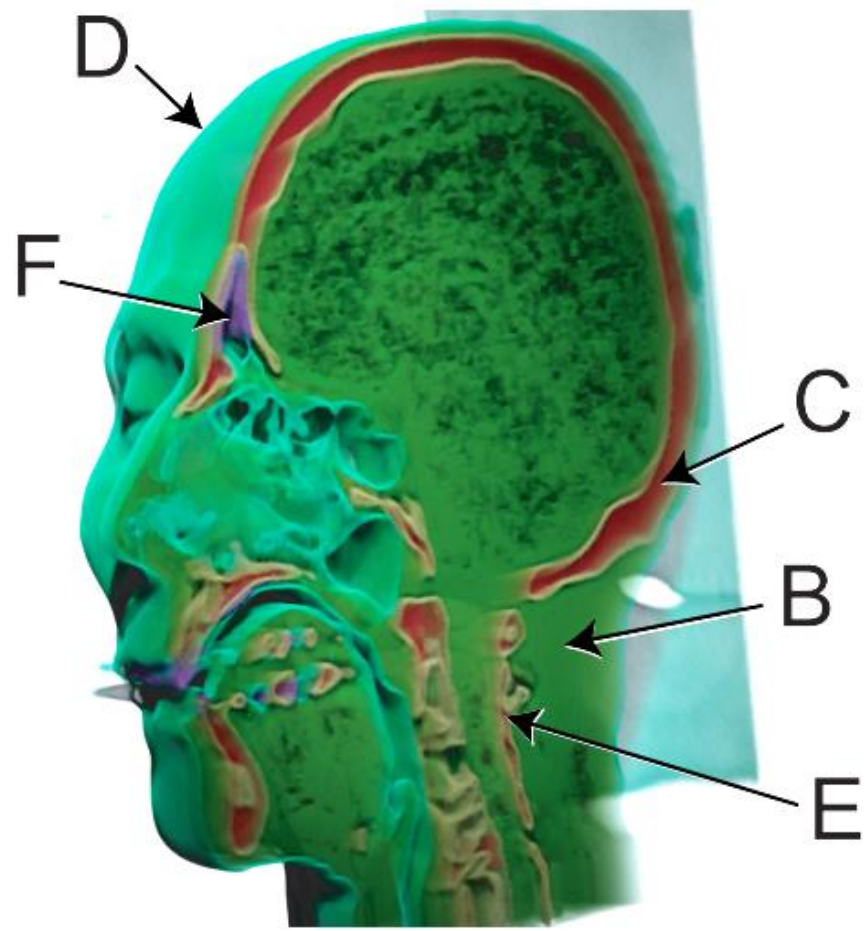


(a) A 1D histogram. The black region represents the number of data value occurrences on a linear scale, the grey is on a log scale. The colored regions (A,B,C) identify basic materials.



(b) A log-scale 2D joint histogram. The lower image shows the location of materials (A,B,C), and material boundaries (D,E,F).

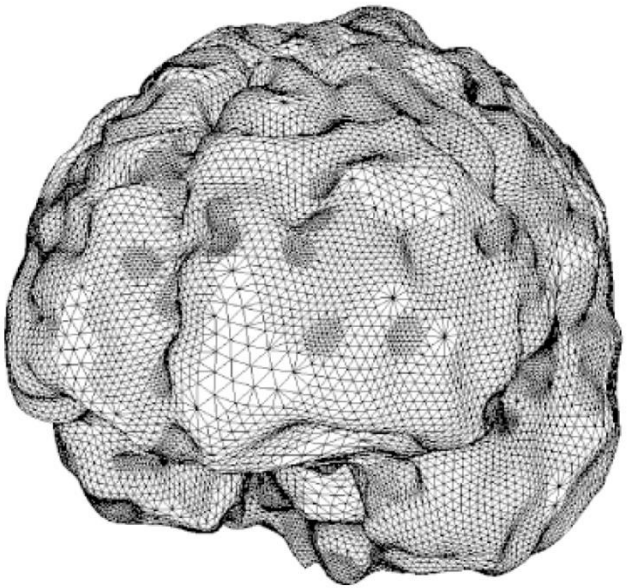
[Kniss et al. 2002]



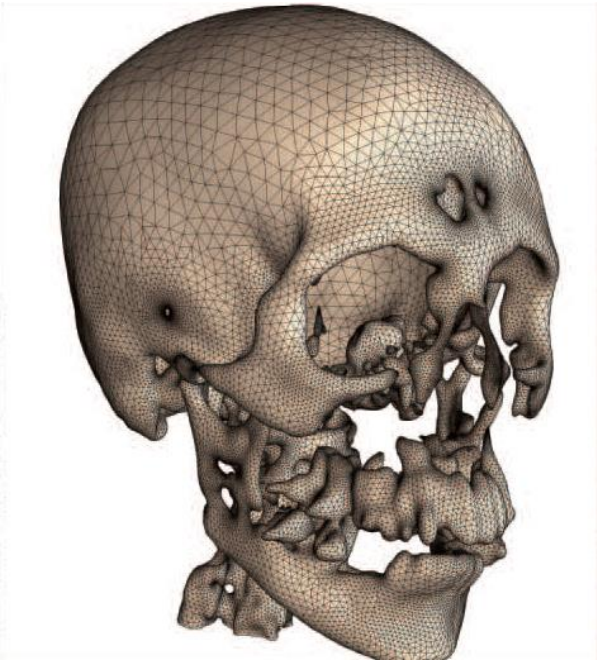
[Kniss et al. 2002]

Surface Rendering (1)

- Iso-surface rendering
- Marching Cubes



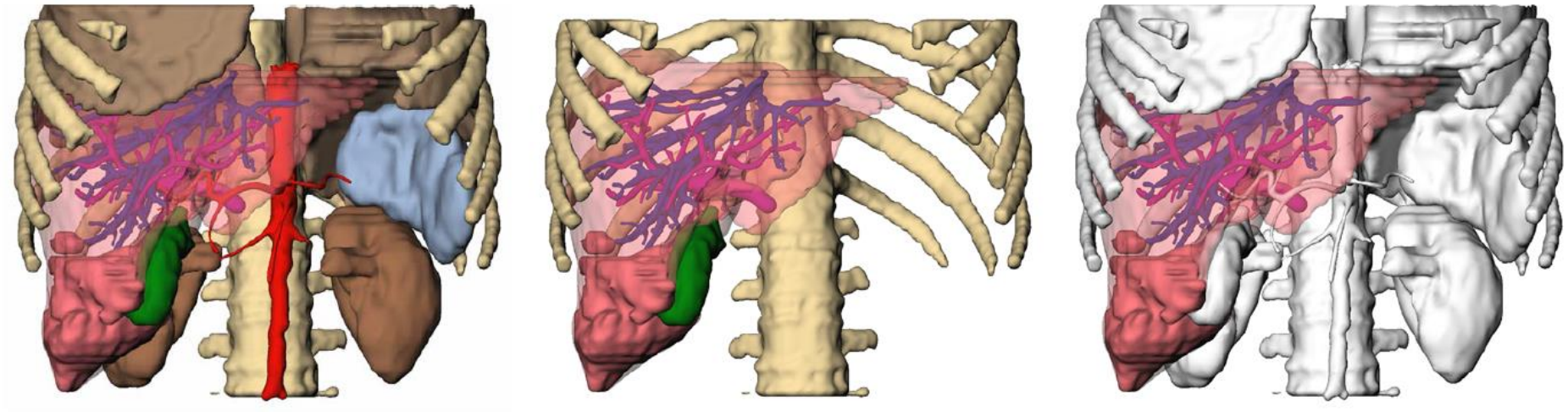
Brain surface [Labsik et al. 2002]



Skull [Schreiner et al. 2006]

Surface Rendering (2)

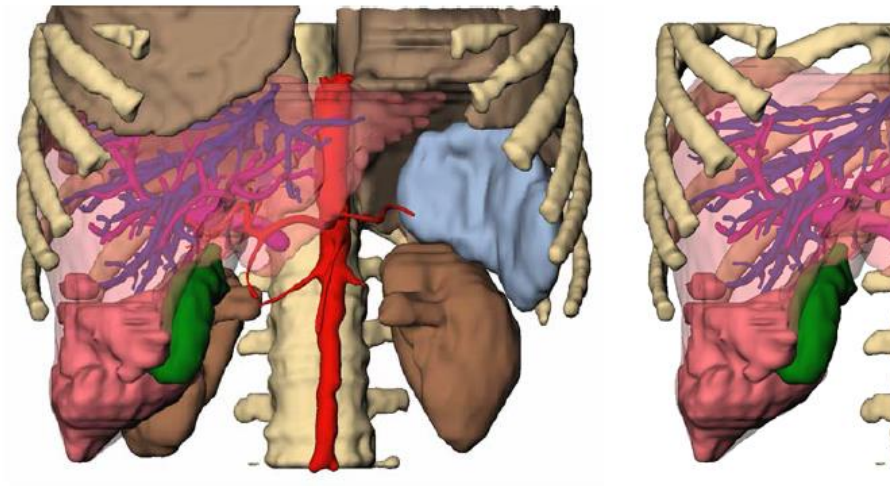
- Combined volume and surface rendering



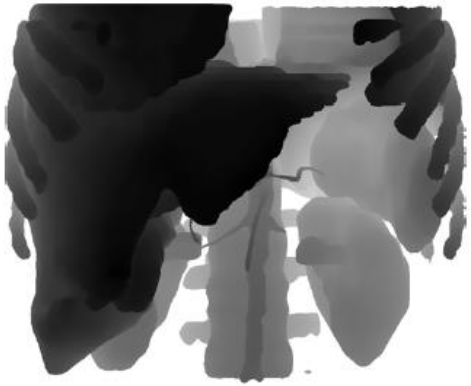
[Tietjen et al. 2005]

Surface Rendering (2)

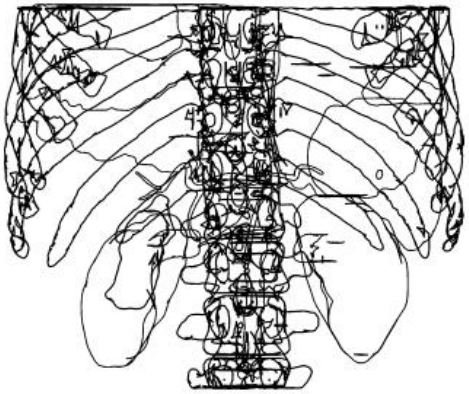
- Combined volume anc



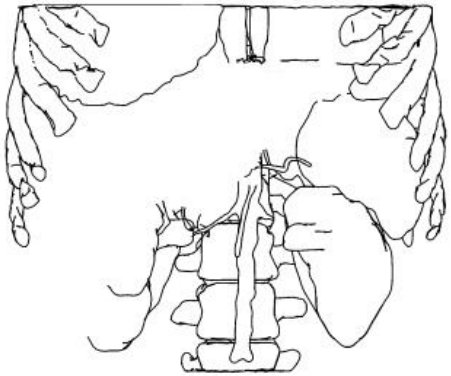
[Tietjen et al. 2005]



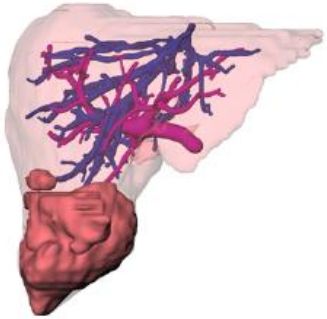
(a) Z-buffer.



(b) All lines.

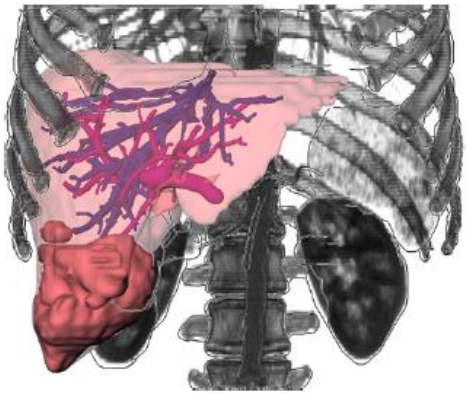


(c) Visible lines.



(d) Surface shading.

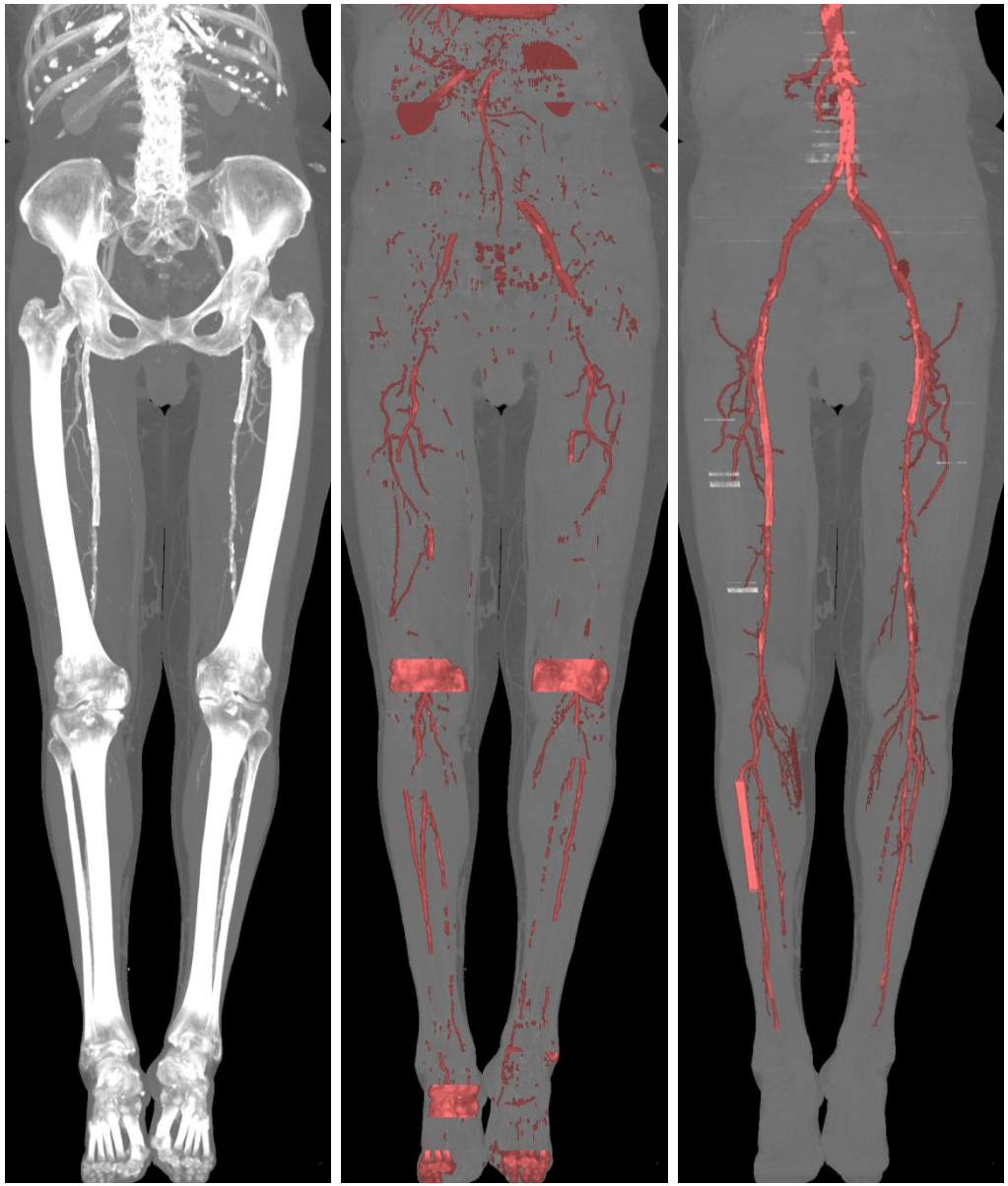
(e) Lines & shading.



(f) The resulting hybrid image.

Segmentation (1)

- Thresholding
- Simple
- Sometimes effective
- Vessel / bone segmentation
- But, tissues not distinctly separable with a single threshold (e.g., bone marrow)



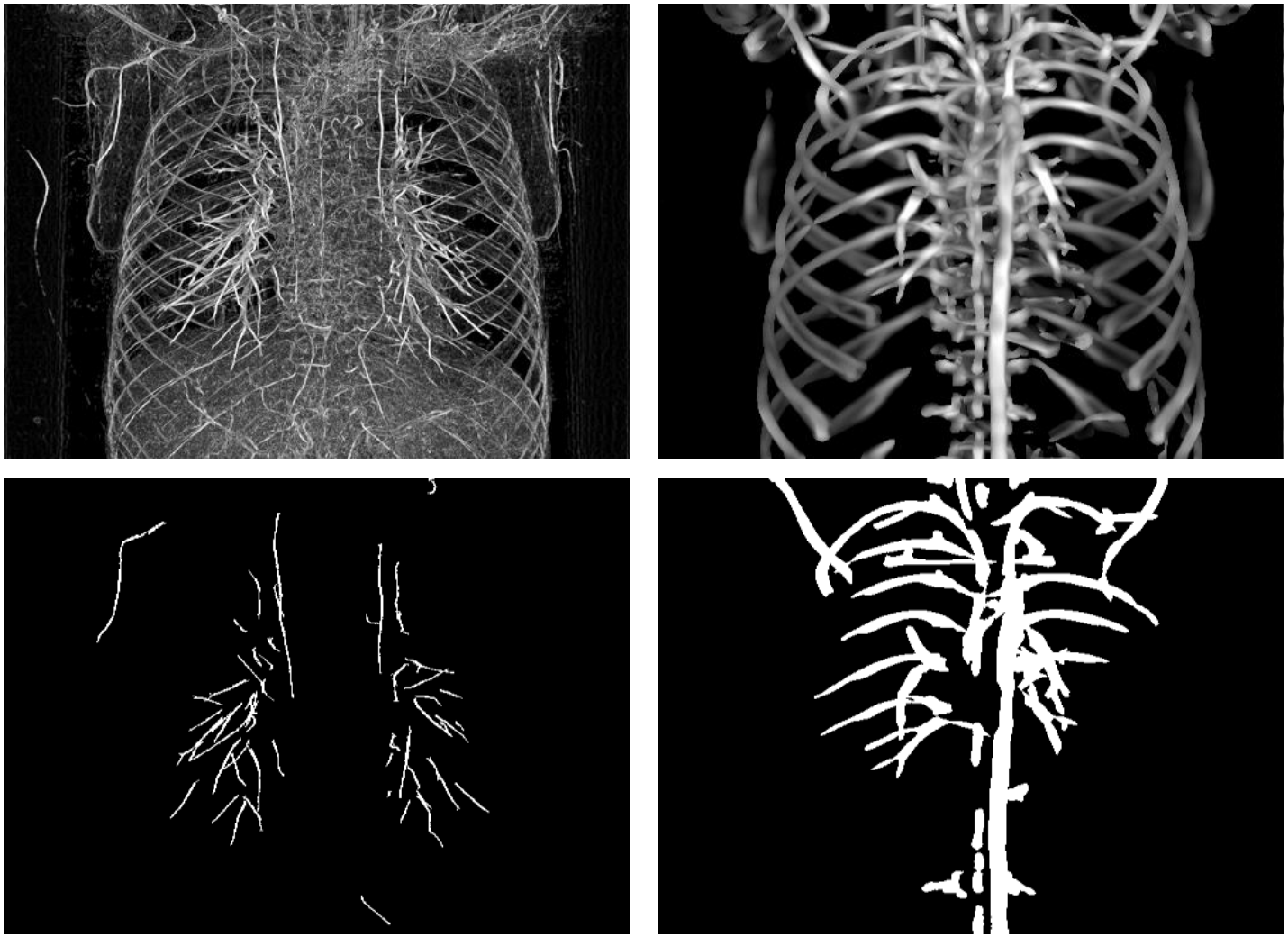
original threshold active contour

Segmentation (2)

- Hysteresis thresholding
  - Two thresholds: low and high
  - Low values connected to high ones along an edge are taken, others are removed

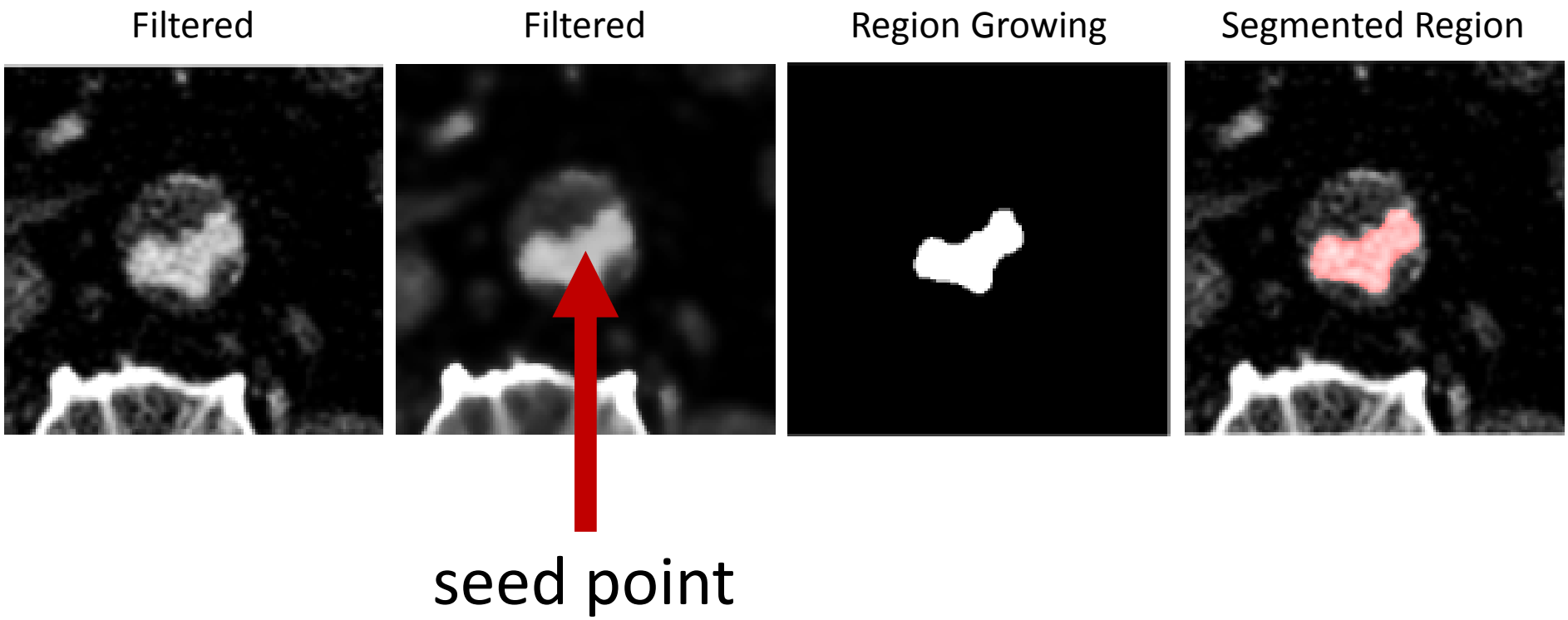
Segmentation (2)

- Hysteresis thresholding



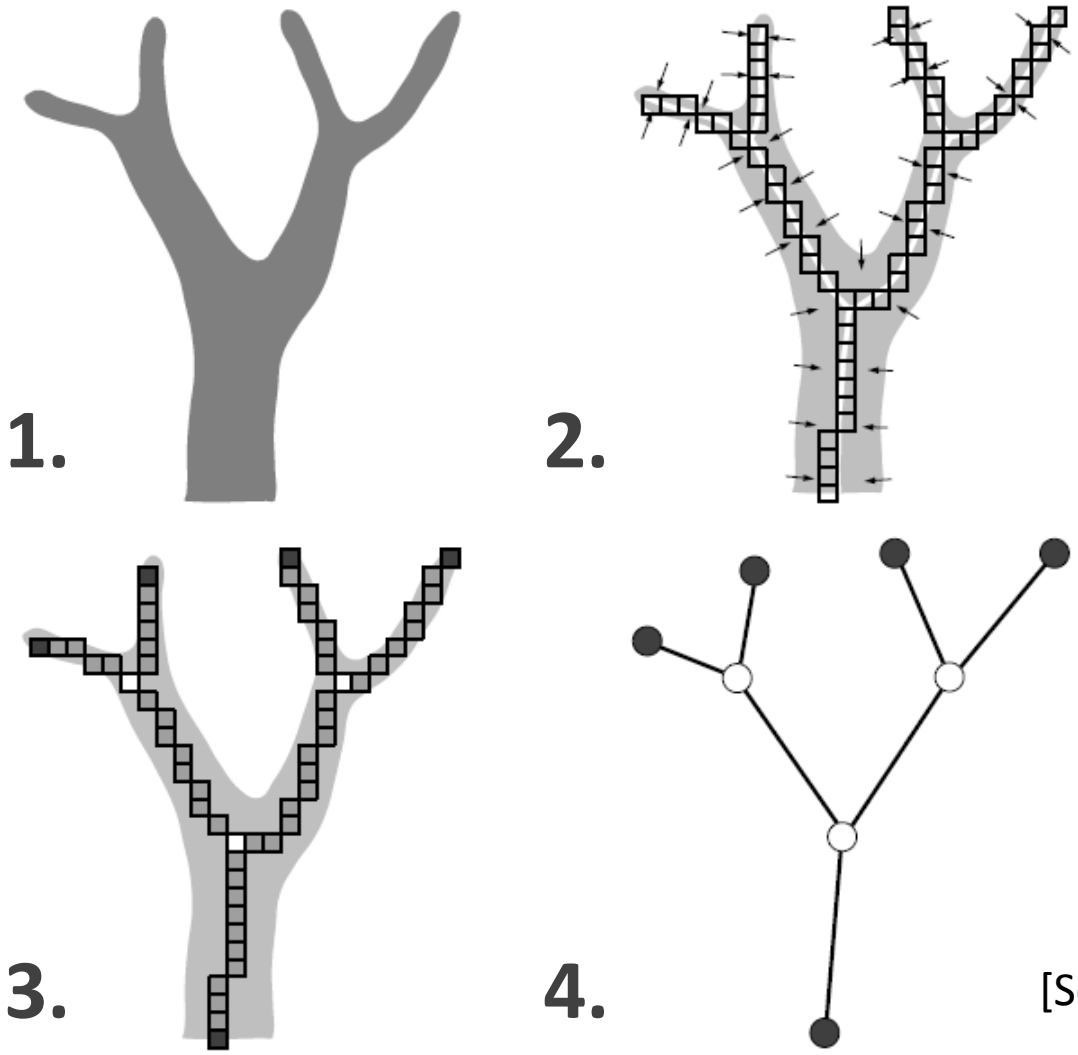
Segmentation (3)

- Region growing
- Requires seed points



Segmentation (4)

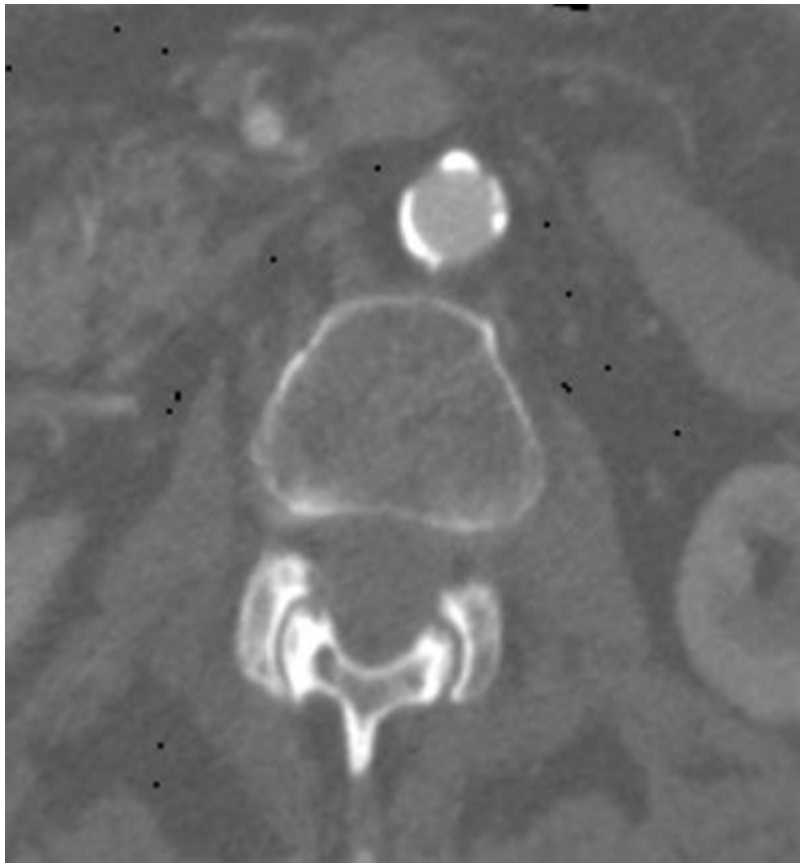
- Skeletonization



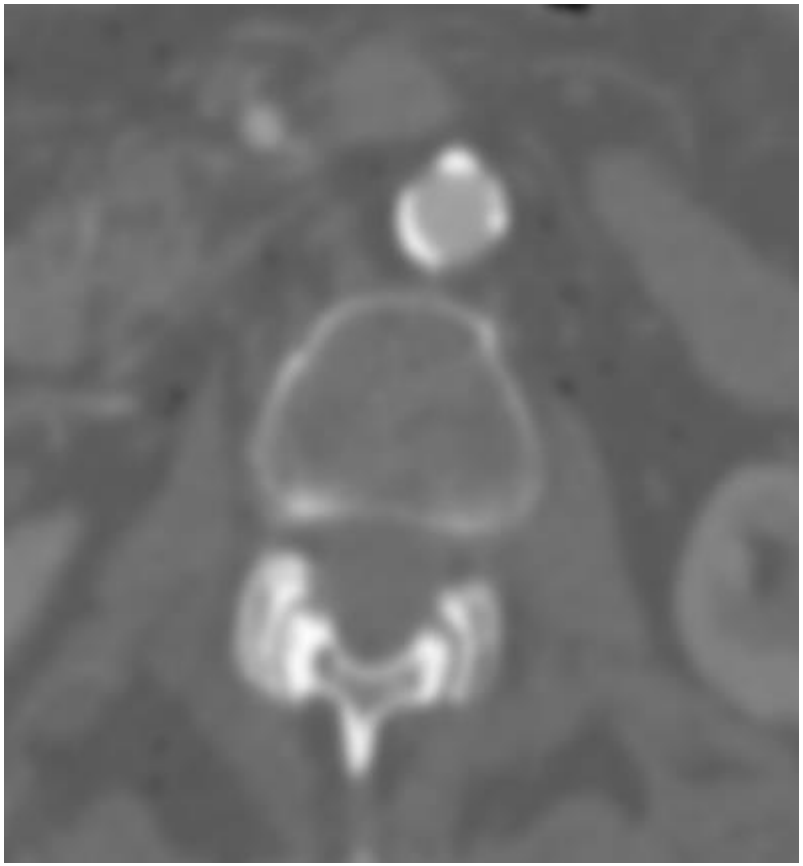
[Selle et al. 2002]

Data Enhancement (1)

- Noise reduction using Gaussian smoothing
- Edges are smoothed



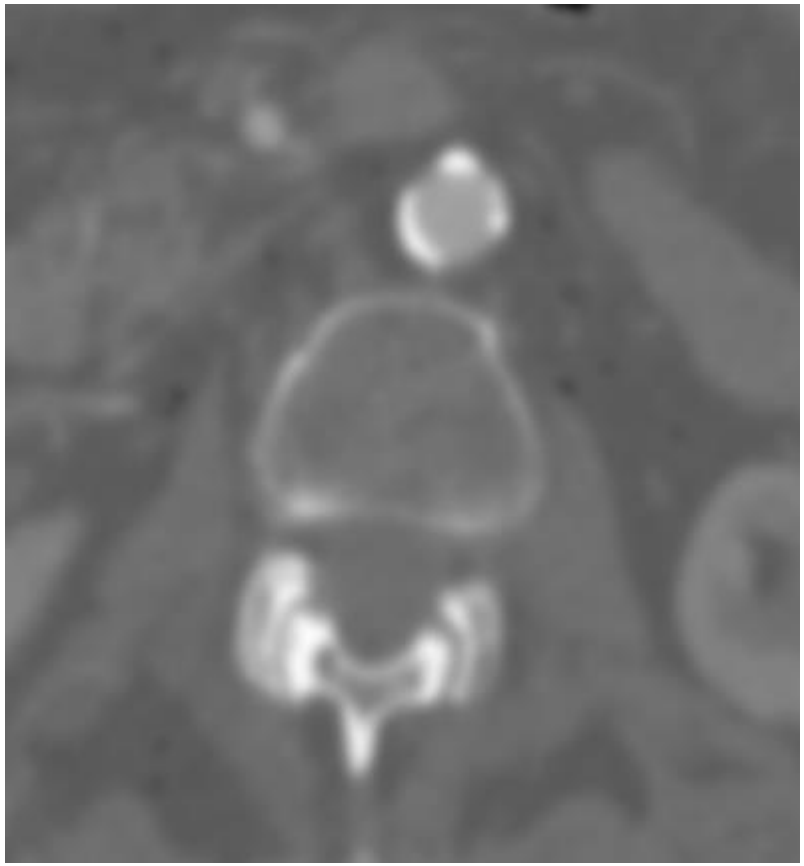
original



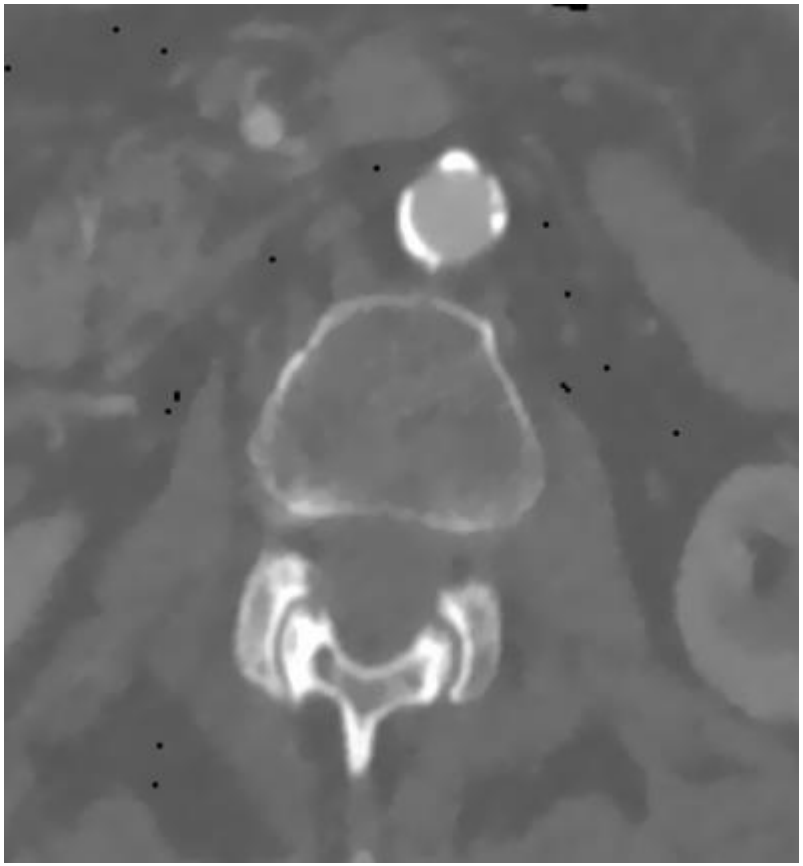
Gauss

Data Enhancement (2)

- Bilateral filtering
- Preserves edges



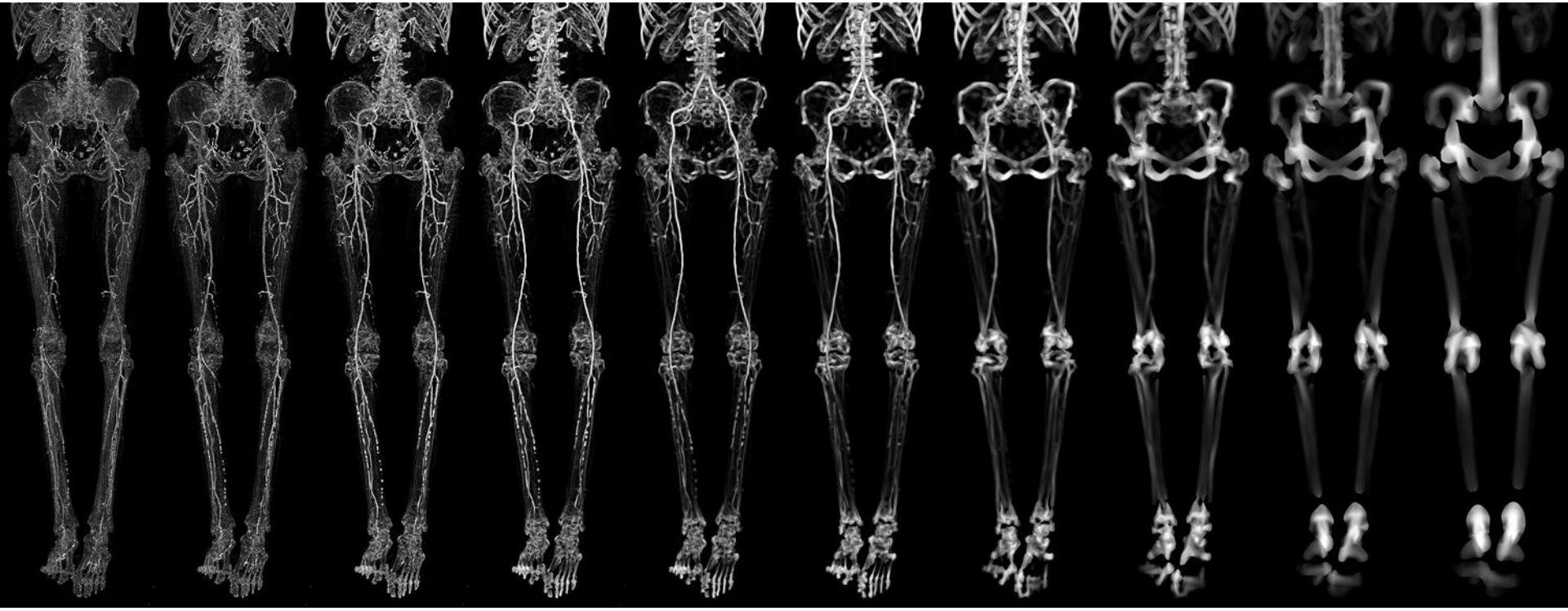
Gauss



Bilateral

Data Enhancement (3)

- Vessel enhancement
- Scale-space analysis / theory



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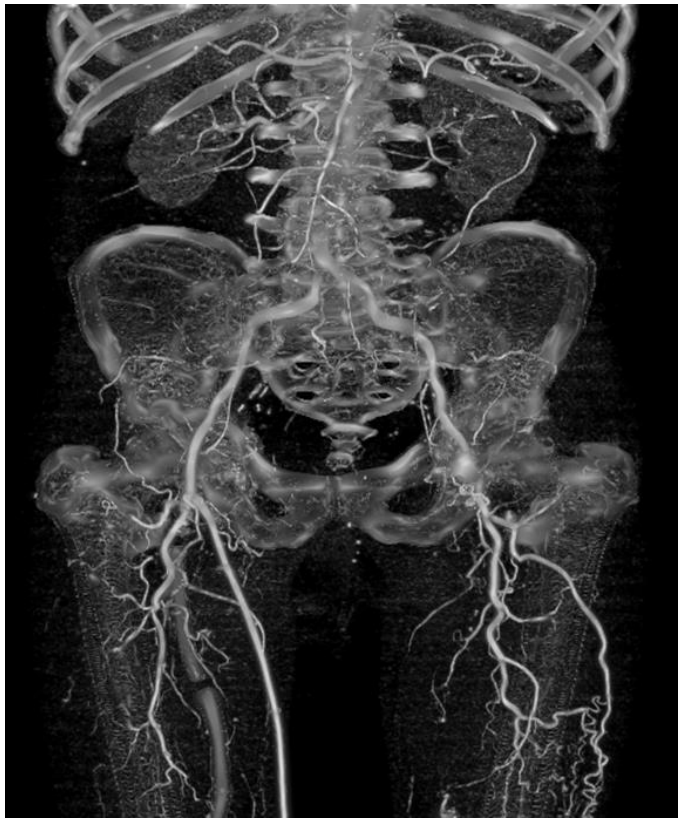
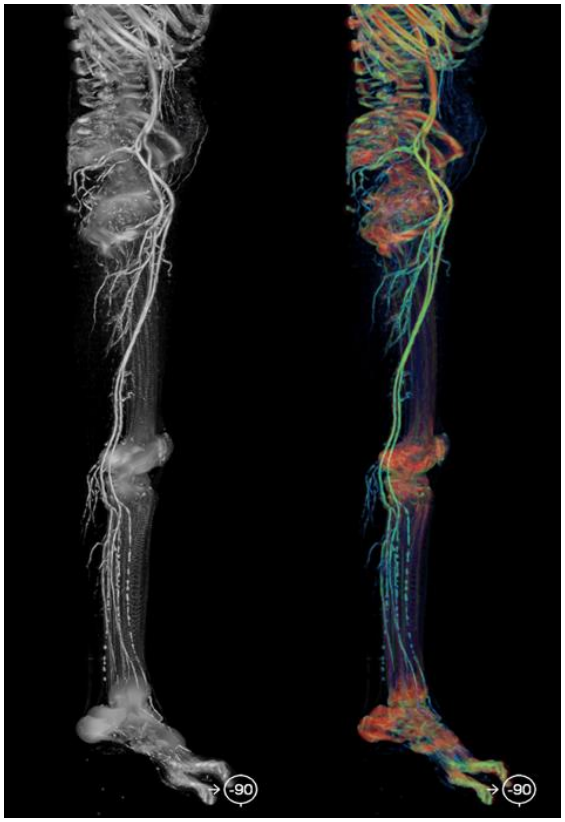


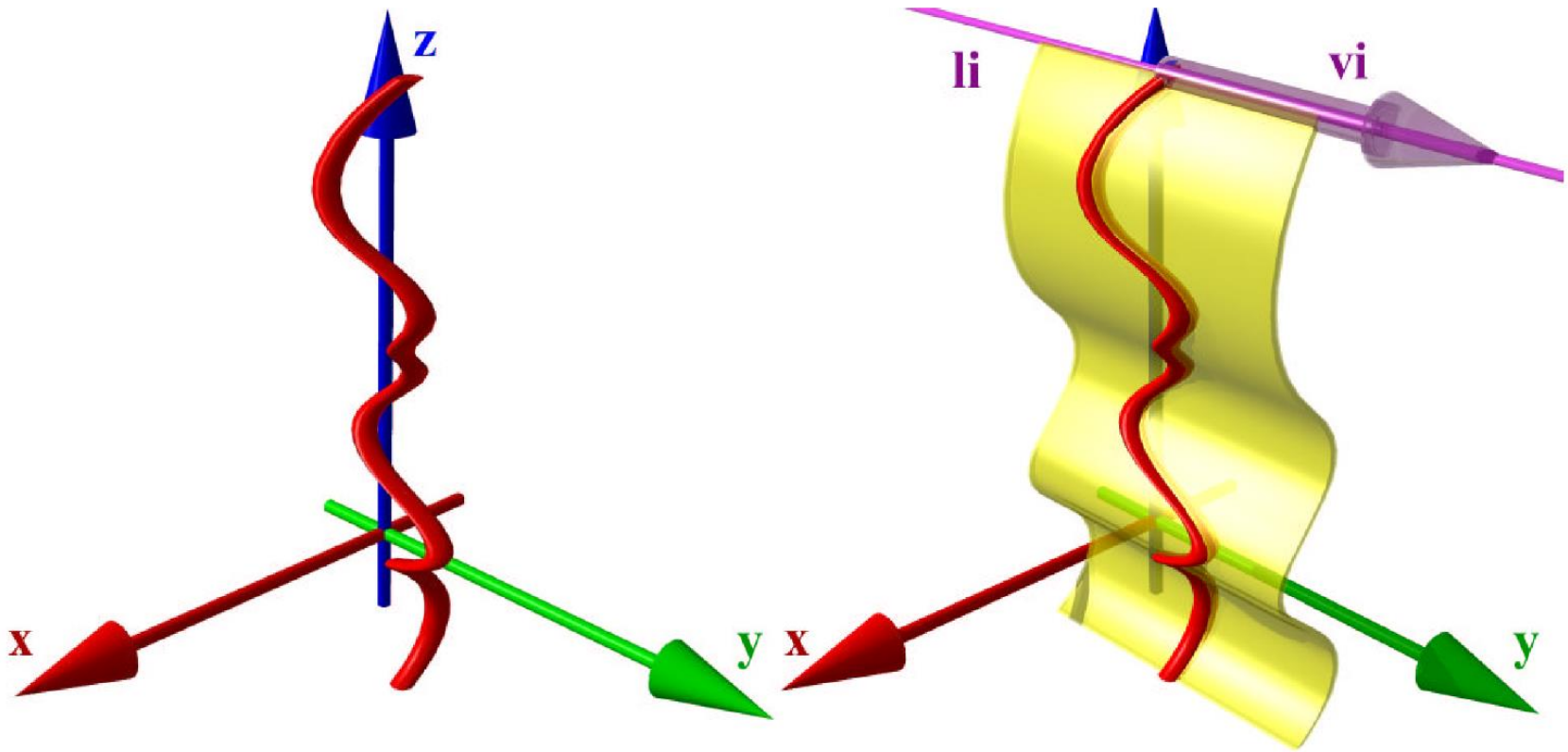


Miscellaneous (1)

- Curved Planar Reformation (CPR)
- Requires representation of vessels (vessel tree)
- Curved cut through a vessel along its centerline
- Visualizes the interior, or lumen
- Assesses vascular pathologies on the vessel walls

Miscellaneous (1)

- Curved Planar Reformation (CPR)



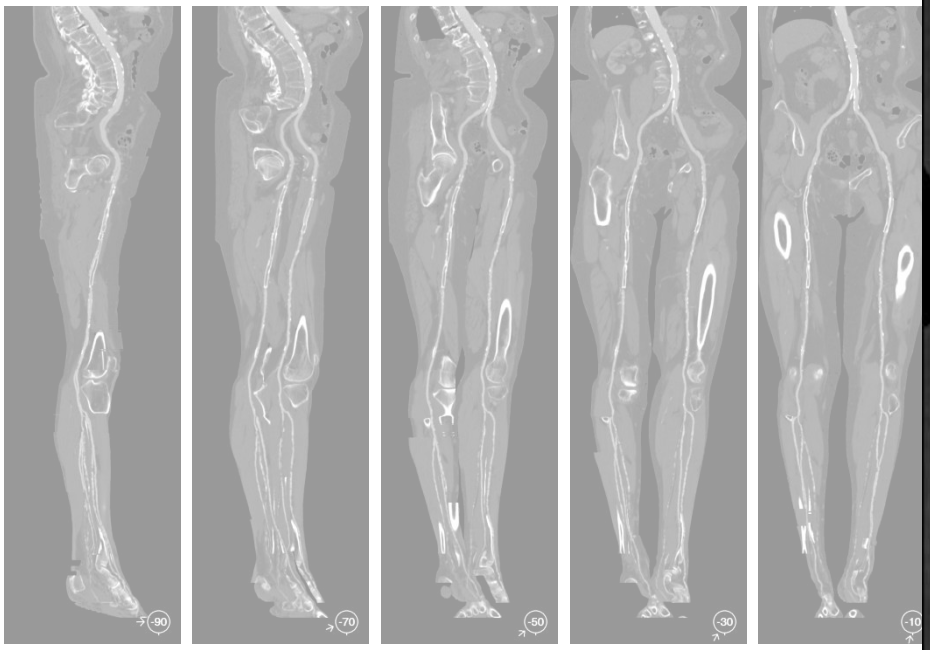
[Kanitsar et al. 2002]

Miscellaneous (1)

- Curved Planar Reformation (CPR)
- -90° to 90°, 10 images

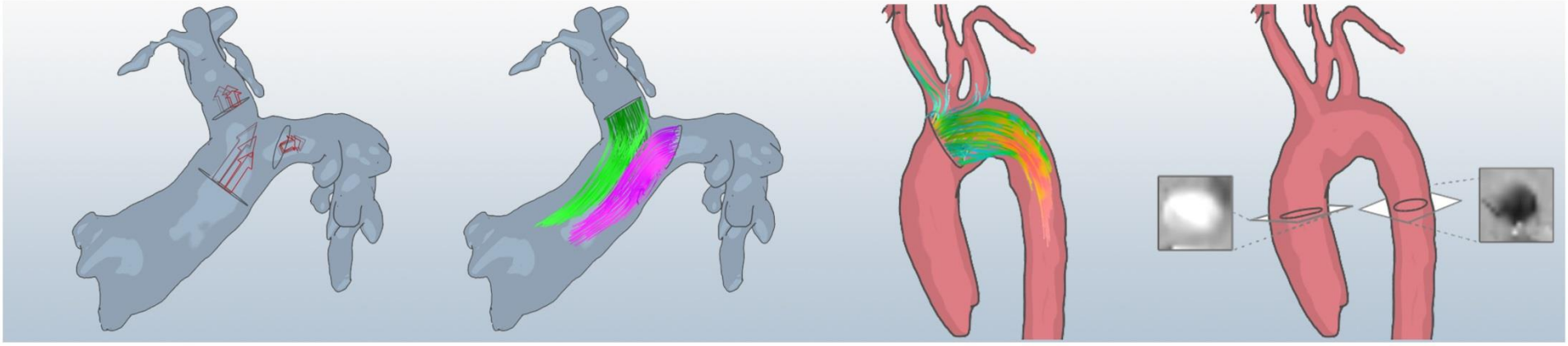
Miscellaneous (1)

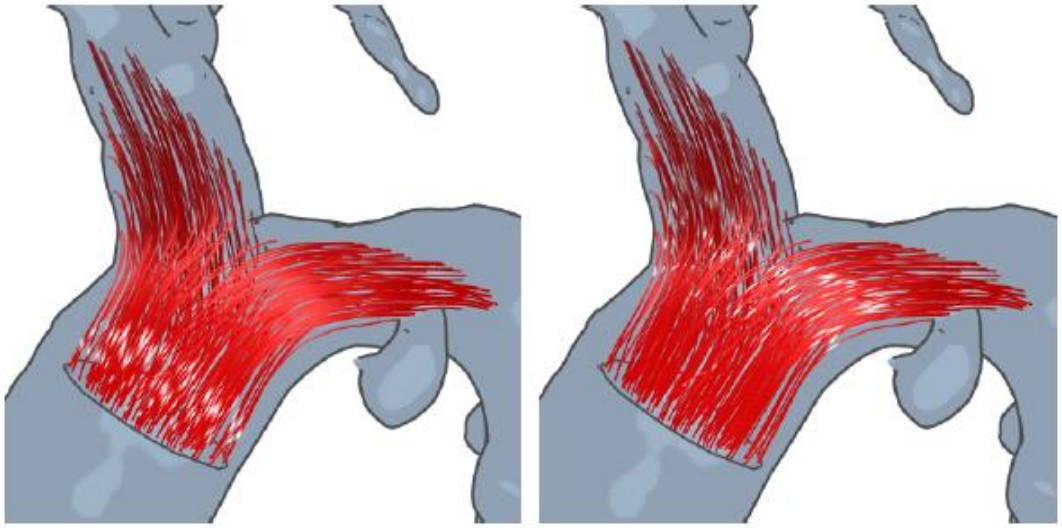
- Curved Planar Reformation (CPR)
- -90° to 90°, 10 images



Miscellaneous (2)

- Blood flow visualization

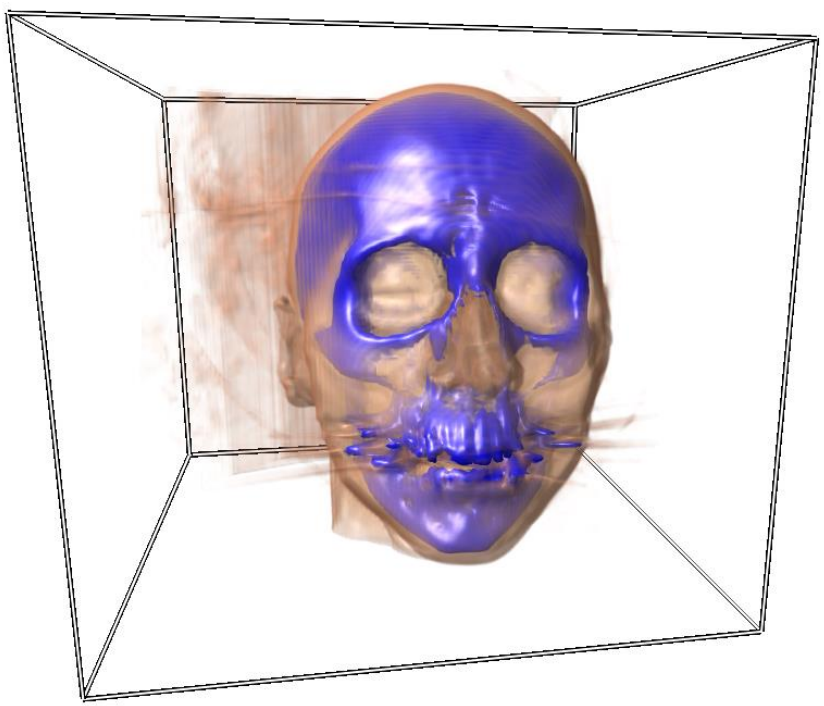


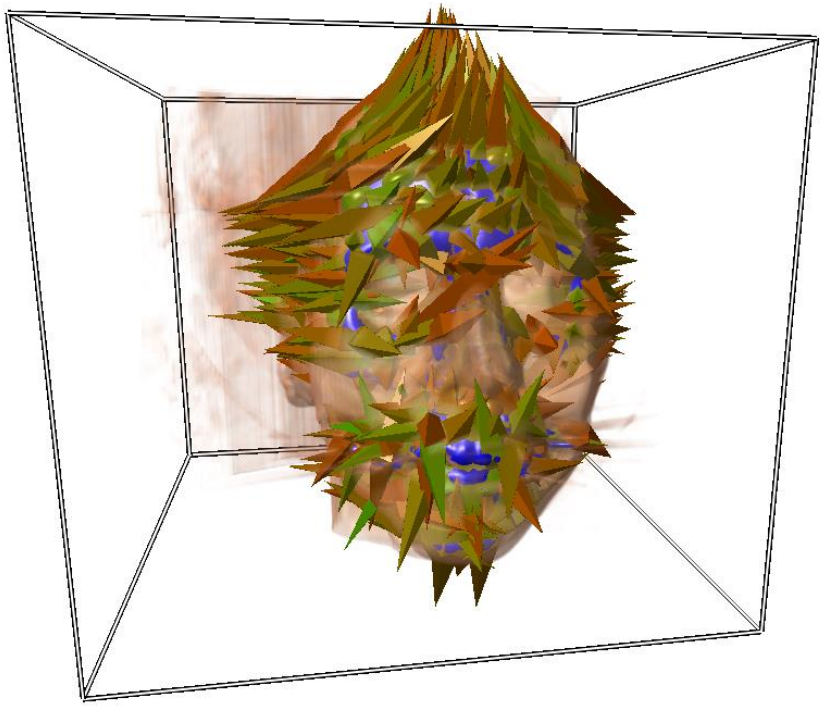


[Roy van Pelt et al. 2009]

Miscellaneous (3)

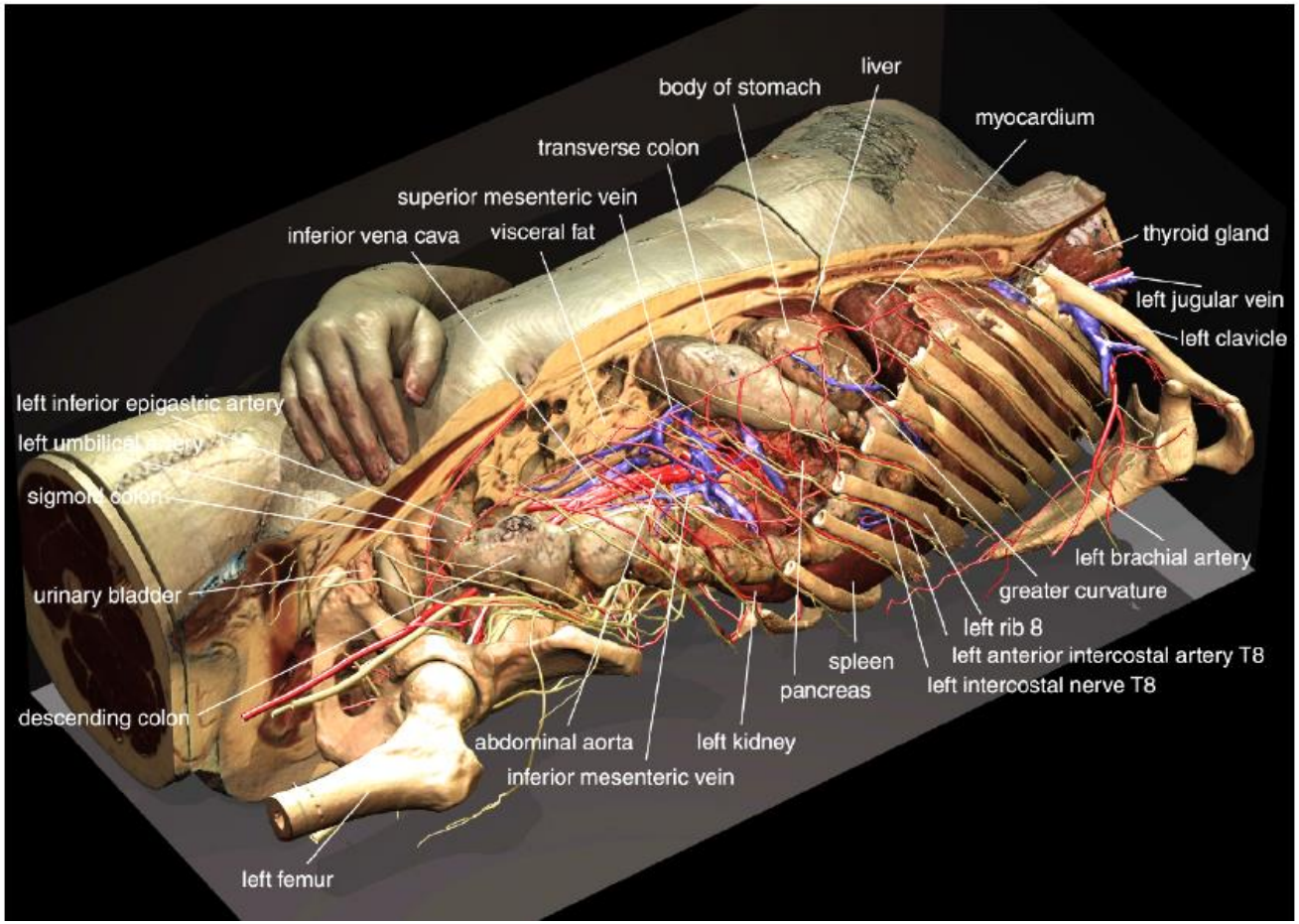
- Glyphs in visualization
- Specific shape and size
- E.g., in the direction of the gradient magnitude

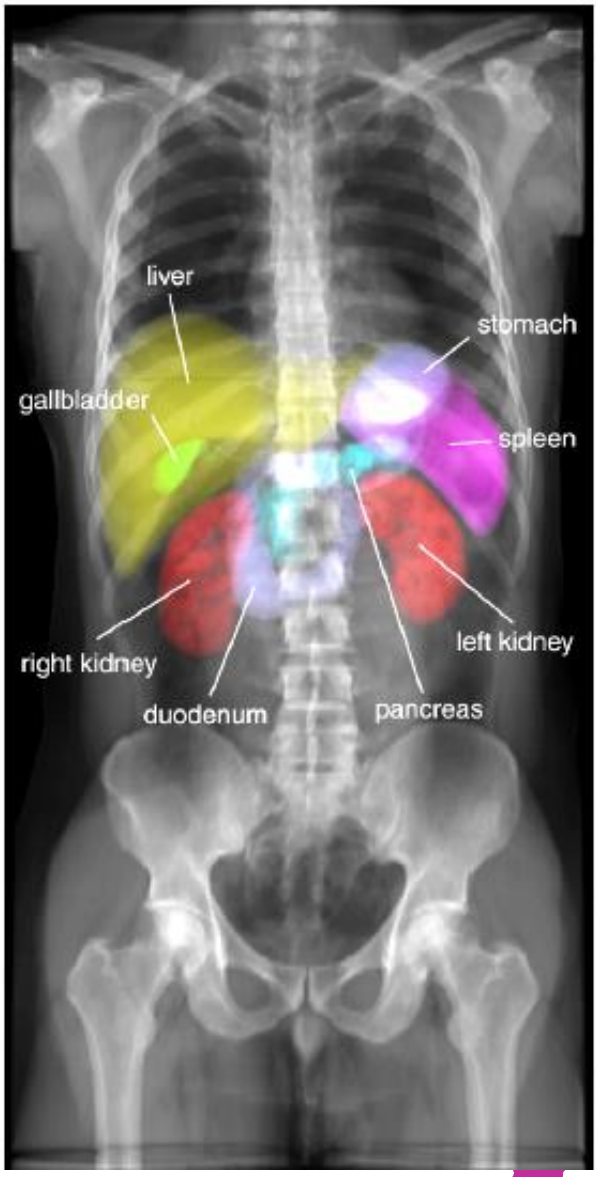




Miscellaneous (4)

- Labeling of medical visualizations
- Optimal placement of labels

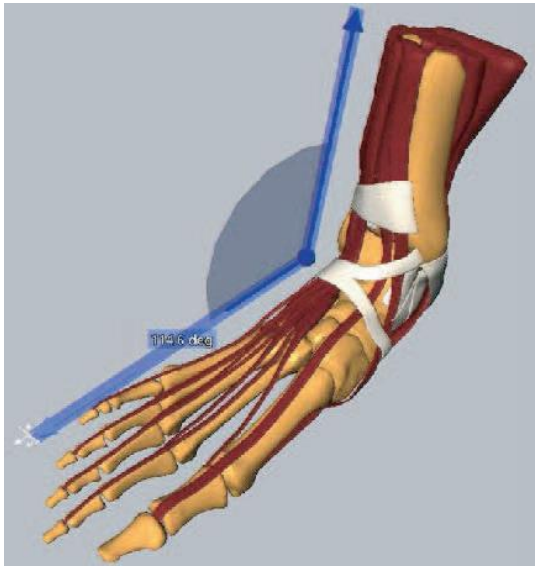




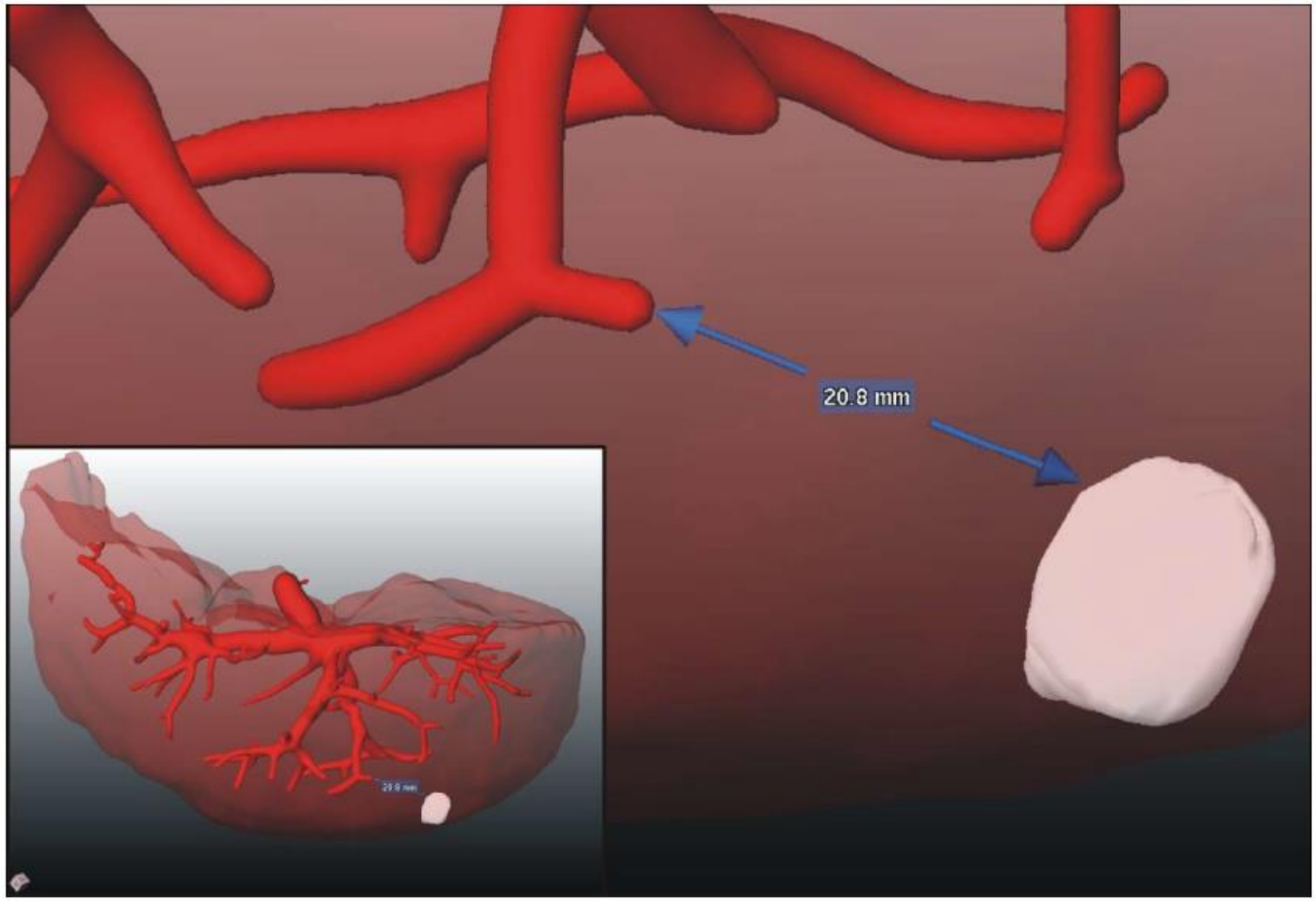
Pommert et al. 2001

Miscellaneous (5)

- Measurements in medical visualization
- Length and size of a vessel stenosis



[Preim et al. 2002]



[Oeltze et al. 2004]

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References (2)

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