



Biomed. Imaging
& 3D Visualization

Sorantin

Introduction

Basic Facts

Enhancement

CAD – Breast
Cancer

Virtual Reality

End...

Biomed. Imaging & 3D Visualization

Selected Applications

Univ.-Prof.Dr.Erich Sorantin

<mailto:erich.sorantin@meduni-graz.at>
ICQ: 197720993, Skype: guru-graz

Research Unit of Digital Information and Image Processing
Department of Radiology, Med. University Graz

July 15, 2008



Person

Wanted: Erich Sorantin

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- **Children:** 51a, 3 sons 19.5,21,23a
- **Education:** Certified Pediatrician and Radiologist, Univ.-Prof. of Radiology
- **Hobbies:** Rockmusic - guitar, keyboards
- **Military:** Chief Lieutenant, Commander of "Mobile Army Hospital Graz"
- **Scientific Interests:** Image Processing, Machine Vision, 3D, Multimedia, Biosimulation
- **IT:**
 - OS: Win(98 – XP), Unix (Irix, Solaris, Linux) VMS
 - Programming: Basic, Modula2, C/C++, Perl, PHP, SQL, IDL, SAS.....
 - Text: \LaTeX (<http://www.dante.de>)



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IT – joy or pain?

Bill Gates claims:

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- If General Motors (GM) would have the same development speed as the Computerindustry than everybody would use a 25-Dollar car, driving 1000 miles per gallon.....

IT – joy or pain

Car industry answers..



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- Your car would have 2x/d a crash without any reason
- If the roadmarks are painted new, everyboy has to buy a new car
- Sometimes the car would stop on the highway and you would have to press the reset button in order to continue
- In certain situations eg. driving to the left, the engine would stop und would not start any more. The engine must be installed new.



IT – joy or pain

Car industry answers..

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- Macintosh would built cars too,they would use solar energy, would be 5 times faster and 2 times easier to drive, but only on 5% of the roads
- Only one person is allowed to use a car, otherwise you have to use "CarXP" In that case every user has to pay for his own seat.
- New seats will demand the same ass-size of everybody
- Before inflating the airbag would ask "Are you sure?"

IT – joy or pain

Car industry answers..



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- Sometimes you cannot unlock your car. A workaround would be to pull the bucket handle, to screw the key and to touch the radio antenna simultaneously
- GM would force you to buy together with a car roadmaps of McNally even if you do not need it. If you do not take that option the car would be 50% more expensive.
- You have to push the "Start" button in order to stop the engine.



....CEEPUS....

What is CEEPUS?

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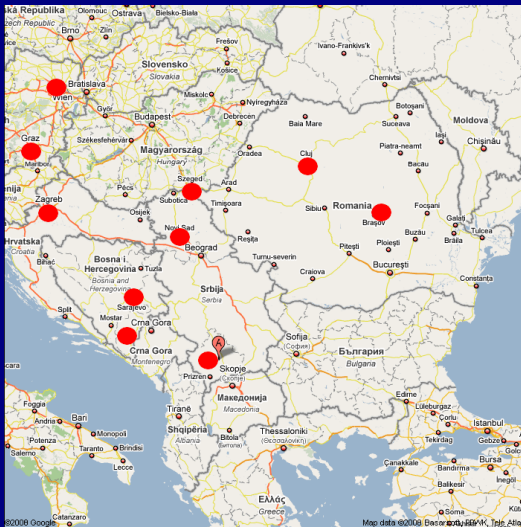
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Basic Facts

Amount of Data

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- **Cross sectional imaging modalities like Spiral – CT & MRI**

- Geometrical & temporal resolution (4D) ↗
- Up to 2000 images / examination ⇨
- Datasize \approx human genom ⇨

⇨ **Traditional reporting techniques "out of service"**



Solution: Biomedical Imaging & Visualization

Examples

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3D Display:

- "Multiplanar Rekonstruction (MPR)"
- "Maximum / Minimum Intensity Projektion"  MIP, MinIP
- "Shaded Surface Rendering (SSD)", " Volume Rendering (VRT)"

Type of Projection?

- from outside  Parallelprojection
- from inside  perspective Projection 

Virtual Endoscopy (VE)



Solution: Biomedical Imaging & Visualization

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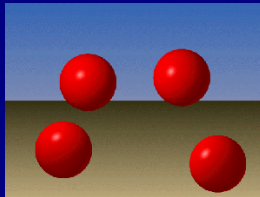
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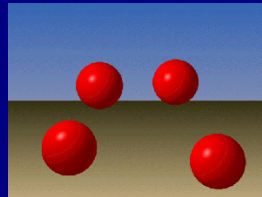
Virtual Reality

End...

- **Perspective:** near objects \gg more close ones
- **Perspective:** distant point infinite
- **Human Vision** \Rightarrow perspective



Parallelprojection



Perspective Projection



Solution: Biomedical Imaging & Visualization

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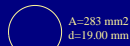
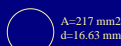
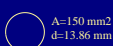
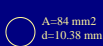
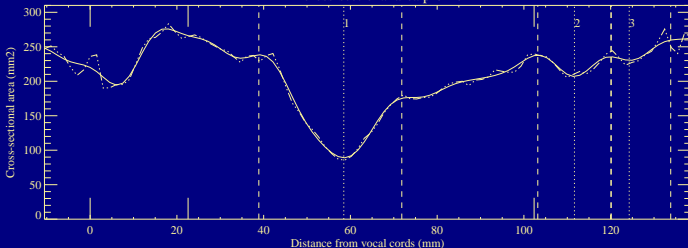
Virtual Reality

End...

Quantification:(Airway Stenosis, Tumor Volumes)

Patient name: N N Birth date: YYYYMMDD Study date: YYYYMMDD
 Landmark0: 0.00mm (10.54mm) Landmark1: 22.58mm (33.11mm) Landmark2: 102.35mm (112.88mm)

LTT cross-sectional area profile



sten#	degree (%)	Bdegree (%)	Edegree (%)	length (mm)	min pos	min cross	begin pos	end pos
1	56.79	62.52	49.00	52.96	58.47	89.25	38.88	71.85
2	12.27	12.68	11.87	16.90	111.65	207.31	103.20	120.10
3	6.78	1.94	11.17	13.75	124.28	230.67	120.10	133.84



Solution: Biomedical Imaging & Visualization

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Navigation & CAS (Computer Aided Surgery)





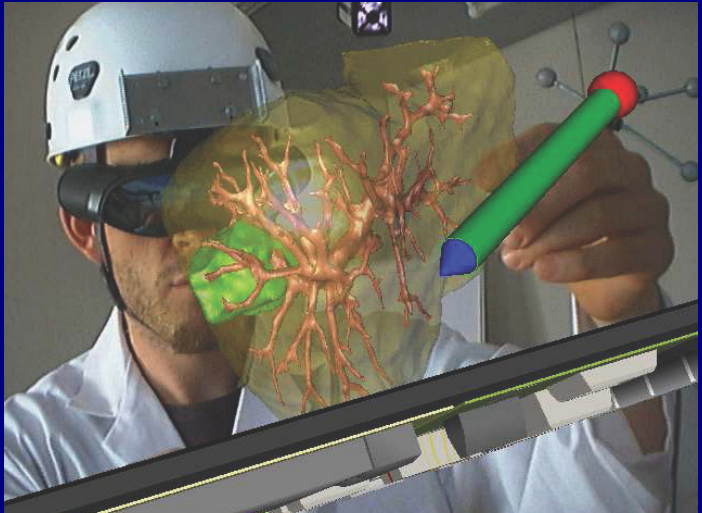
Solution: Biomedical Imaging & Visualization

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Navigation & CAS (Computer Aided Surgery)

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Solution: Biomedical Imaging & Visualization

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Functional Imaging



Solution: Biomedical Imaging & Visualization

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CAD – Computer Aided Diagnosis

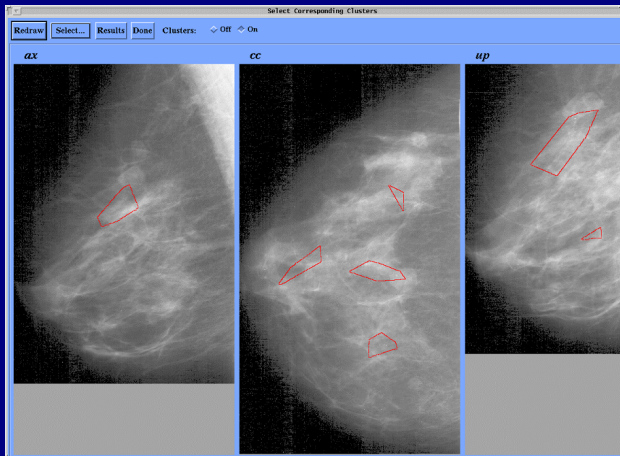




Image Processing Enhancement

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- **Image Processing for LTS**
- **Virtual Dissection of the Colon**



Computer Aided Diagnosis (CAD)

Breast Cancer

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- **Computer Aided Diagnosis - Breast Cancer**

3D – Display Virtual Reality



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Virtual Liver Surgery Planning System

End Everything is virtual....



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Unterlagen I

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