RISC Software GmbH

by Fritz Robeischl

1st SAGEX Scientific Workshop

30 July 2019

Softwarepark 35, 4232 Hagenberg, Austria

RISC Software GmbH JKU JOHANNES KEPLER UNIVERSITY LINZ Forschungs LAND OBERÖSTERREICH Member of UAR INNOVATION NETWORK

About **RISC Software GmbH**

working group for industrial applications at RISC Institute
1989

1990
Foundation of **Softwarepark Hagenberg** under the management of RISC

Foundation
RISC Software GmbH
(Prof. Bruno Buchberger)
1992

1995
RISCSW specializes in software for logistics and production planning

RISC Software GmbH
100%-subsidiary of JKU
2004

2008
Incorporation of the department of **Medical Informatics** and equity stake of State Upper Austria with 20%

RISC
RESEARCH INSTITUTE FOR SYMBOLIC COMPUTATION

Basic Research
in Symbolic Computation

Chair: Prof. Peter Paule
Founder(1987): Prof. Bruno Buchberger
60 Members (including PhD Students)

RISC Software GmbH

Software Development
Applied Research
(*Algorithmic Mathematics*)
Transfer of Technology

Employees:
70 (Headcount, 2018)

Betriebsleistung:
about. 5,3 Mio Euro (2018)

Ownership structure:
80% Johannes Kepler University Linz and
20% Upper Austrian Research GmbH (State Upper Austria)

About **RISC Software GmbH**

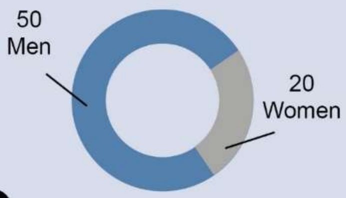
Hagenberg:

2.600 inhabitants

1.700 students at University of Applied Sciences

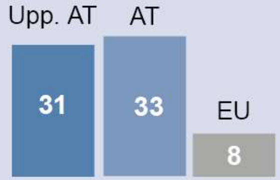
1.240 employees in Software Park

Key Figures 2018



70 Employees
86% of them researchers

34.0%
Research Rate



72 Projects
35% of them funded

5.3 Mio. €
Operating Revenue

12 Publications
of them 7 Conference Papers

97 Company Partners
76 Scientific Partners

173
Cooperation Partners

Selected references and international cooperation partners

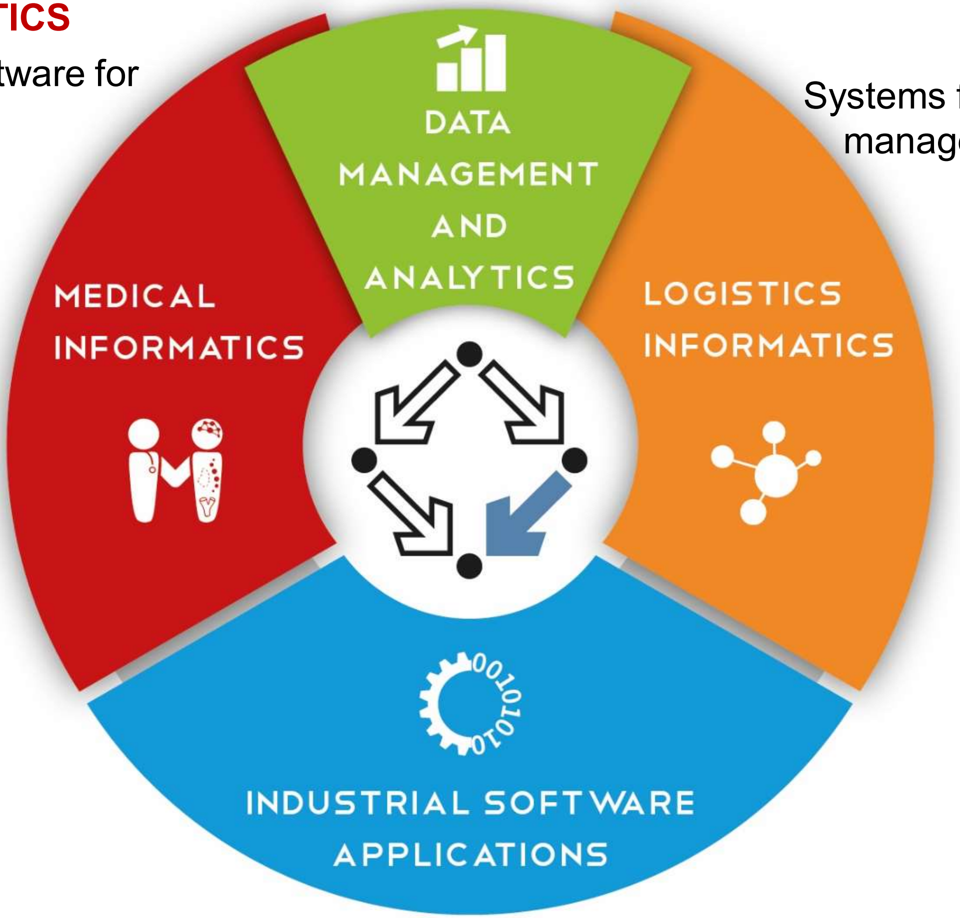
RISC Software GmbH - Units

MEDICAL INFORMATICS

Highly specialized software for modern medicine

DATA MANAGEMENT AND ANALYTICS

Systems for data analysis, knowledge management and machine learning

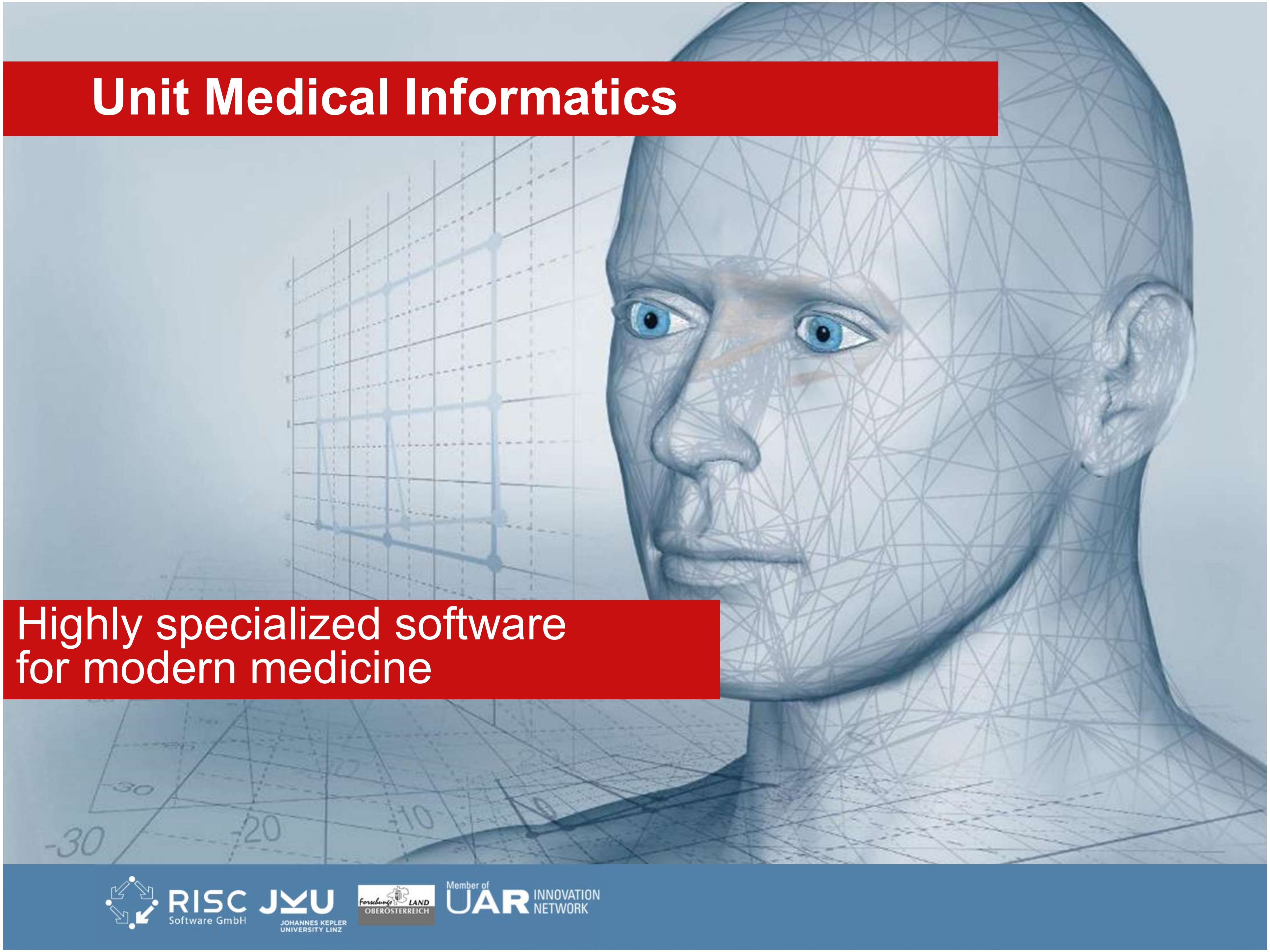


LOGISTICS INFORMATICS

Software for planning, optimization, simulation and control of processes

INDUSTRIAL SOFTWARE APPLICATIONS

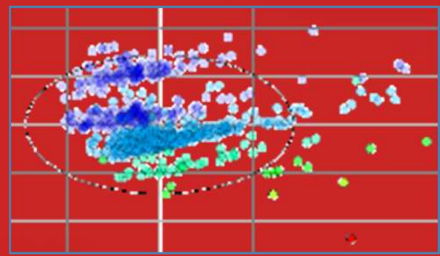
Software for simulation, analysis and optimization in engineering disciplines


Unit Medical Informatics
Highly specialized software
for modern medicine
RISC Software GmbH
JKU
JOHANNES KEPLER UNIVERSITY LINZ
Forschungs LAND OBERÖSTERREICH
Member of UAR INNOVATION NETWORK

Selected references

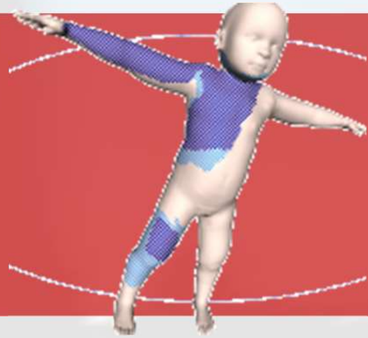
CALUMMA OMEDA

Ontology-based medical data analysis



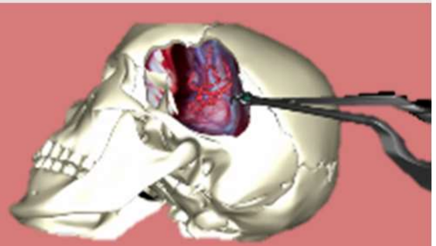
BURNCASE 3D

Objective diagnosis and documentation on virtual patients



Virtual Aneurysm

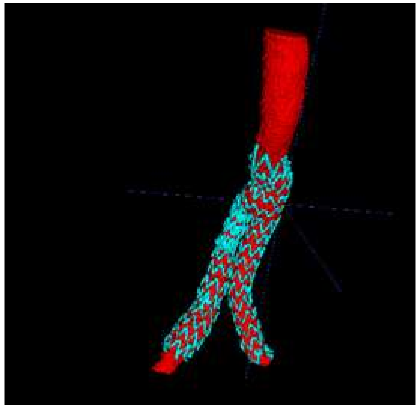
Development of a haptic simulator for neurosurgical clipping operations on brain arteries



Topic: Implementation of a perceptual loss function

Context

- deep neural networks are state-of-the-art for many medical segmentation tasks
- one core building block of the DNN is the loss function
- currently very simple loss functions (e.g. DICE-loss) are employed
- **research area**: medical image segmentation using deep learning



Idea

- more advanced (perceptually meaningful) loss functions (e.g. based on distance transform) might improve training (speed and accuracy of final model)

Your task …

- derive and implement a perceptual loss function using Tensorflow, Python and C++
- Evaluate the influence of the loss function on training for the task of aortic vessel segmentation for existing 2D / 3D U-Nets

Topic: 3D medical image data augmentation

Context

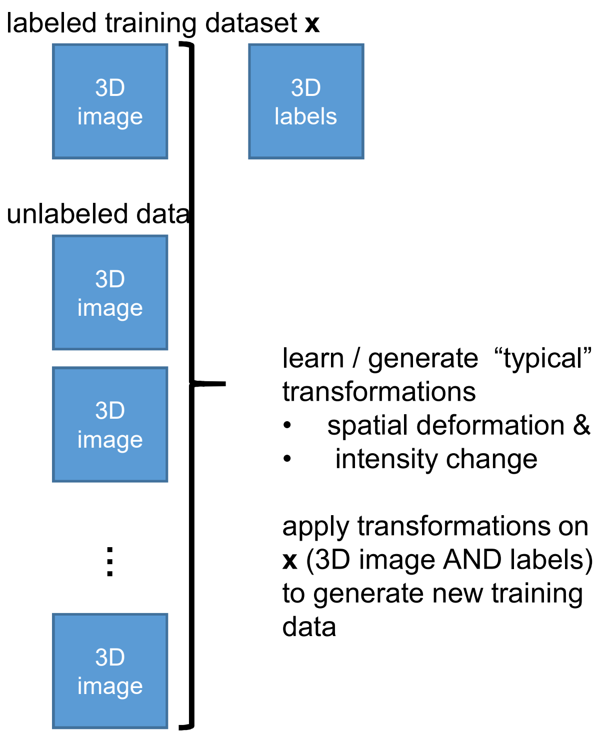
- in medical image segmentation labeled training data is a scarce resource
- generation of labels is costly, however a lot of unlabeled data is available
- a lot of unlabeled data is available
- **research areas**: non-rigid registration, generative adversarial networks (GANs), one-shot medical image segmentation

Idea

- starting with a single labeled 3D image dataset **x** – generate many deformations of **x** that are realistic (e.g. represent natural deformation of organs)
- use the deformations to generate “new” labeled 3D images for training

Your task …

- implement a non-rigid deformation method (using methods from non-rigid registration or GANs) using Tensorflow, Python and C++
- apply the deformation method to generate new labeled training samples
- Evaluate the influence of data augmentation on training for the task of aortic vessel segmentation



Topic: Nonlinear Elasticity Simulation

Context

- Real-time simulation of realistic deformation of organ tissues
- Finite element method (FEM)

Current state

- Corotational FEM for tetrahedral volume elements implemented in C++ and CUDA

Your task

- Implement and compare other FE algorithms, e.g.
  - Nonlinear (corotational) shell elements
  - Alternative fast and stable volumetric methods (Kugelstadt, Chao, Marchesseau,…)

Thank you for your attention.

See you in Hagenberg!

RISC Software GmbH

Softwarepark 35, 4232 Hagenberg, Austria

RISC Software GmbH JKU JOHANNES KEPLER UNIVERSITY LINZ Forschungs LAND OBERÖSTERREICH Member of UAR INNOVATION NETWORK