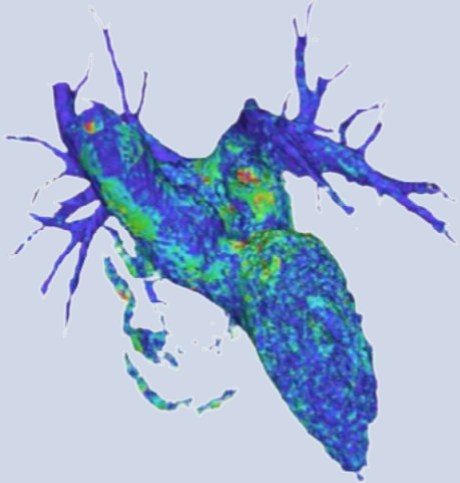
RoSEN –

Investigation and Visualization of Multidimensional Data Sets

Today's digitalization leads to a rising flood of data with increasing complexity and lack of transparency. By handling data correctly, the potential can be exploited and the opportunities of digitalization can be used. Thus, multidimensional data sets are already analyzed, developments are investigated and complex correlations are presented in an easily understandable way.

GSI's own RoSEN method takes up these potentials and examines multi-dimensional data sets for similar data characteristics. The results of the examination can then be digitally processed and graphically evaluated. The method is based on the determination of hyper-surfaces, in other words, the determination of boundaries in multi-dimensional spaces. This determines self-contained separations without any holes or rifts, which are continuous and purely geometric, perfect for a further numerical processing. In this way, developments can be captured and changes can be graphically visualized, for example.



Technology Transfer proposal BSBF 2022

Original/Potential Field of Application

Our technology has been originally developed to enable in 4D space-time the numerical construction of isotherms from resulting data of relativistic hydrodynamical simulation codes for heavy-ion collisions. The knowledge of these so called freeze-out hypersurfaces (FOHS) allows the theorist to calculate various particle production spectra for the various heavy-ion collisions under consideration, and to compare his theoretical findings with the measurements. As a side product, the construction of the hyper-surfaces allowed visualization of the temporal evolution of 3D isotherms.

One area of application is the time-dependent processing of 4-dimensional CT, MRI and X-ray images, such as the continuously changing surface of a breathing lung. Furthermore, the method is applied to quantify and visualize static or time-dependent point clouds from photogrammetry into continuous geometric data or – as another field of application – to evaluate business indicators. The method is highly versatile and can be used wherever large amounts of data need to be displayed, evaluated and/or visualized.

Proposal SWOT Analysis

Strengths

- 100% reliable results (hyper-hole free), while using minimal computational resources
- Parallelizable on GPU
- Visualization in N dimensions
- Data-driven calculation and high resolution

Weaknesses

- Highly specialized expertise required to develop applications
- Visualization of more than 10 Dimensions becomes to opaque

Opportunities

- More efficient calculations of surfaces without any errors
- Calculations up to real-time analyses
- Enabling technology for further data processing in higher dimensions

Threats

- Not available via open-source

Technology Transfer proposal BSBF 2022

IPR Status & Contact Information

IP-Protection:

The technology is patented in following countries:

- BE, CH, DE, GB, NL, SE (EP 2,715,673)
- USA (US 9,607,431)

Publications:

- B.R. Schlei, “Volume-Enclosing Surface Extraction“ Computers & Graphics 36, p. 111–130, (2012)
- B.R. Schlei, “STEVE – Space-Time-Enclosing Volume Extraction“, arXiv:1302.5683 [cs.CG], (2016)

For further information, the contact point is:

Dr. Bernd Schlei

(Inventor of Technology)

Phone: +49 6159 71 1665

E-Mail: b.schlei@gsi.de

The GSI Helmholtz Centre for Heavy Ion Research in Darmstadt operates one of the world's leading particle accelerator facilities for research. At GSI, FAIR, an international accelerator center for research with antiprotons and ions, is currently being built at GSI in cooperation with international partners. It is one of the largest projects for research worldwide.
https://fair-center.eu; https://www.gsi.de/en