

Scientific staff / Ph.D. student in Mechanical Engineering

for the research project:

Data-Driven Analysis of Medical and Simulation Data for Improved Patient Treatment in Rhinology

Contact:

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Our profile:

The Institute of Aerodynamics and Chair of Fluid Mechanics (AIA) performs excellent research in fundamental and applied Fluid Mechanics and is internationally renowned for its cutting-edge research achievements. The Institute's experimental facilities enable to investigate turbulent, compressible, and incompressible flow in technical and biomedical applications. The numerics group advances research in various fields ranging from combustion processes to respiratory flows. The Jülich Supercomputing Centre (JSC) operates one of the most powerful supercomputing infrastructures in Europe and makes it available to researchers at Forschungszentrum Jülich (FZJ), in Germany, and throughout Europe. As part of this task JSC conducts various types of Research and Development, often in close collaboration with local, national and international partner institutions. The Jülich Aachen Research Alliance - High Performance Computing (JARA-HPC) will together with other units from RWTH Aachen University and FZJ be merged to become the JARA Center for Simulation and Data Sciences (JARA-CSD), aiming at facilitating joint research, education, and industry projects between the participating institutions.

Your profile:

- very good university degree (M.Sc. or equivalent degree) in one or more of the fields of Mechanical Engineering, Physics, Mathematics, and/or Computer Science
- experience in one/ideally in more than one of these fields: (Computational) Fluid Dynamics, Machine Learning, High-Performance Computing, Software Development, especially in C++ and Python
- solution-oriented, social, and independent enthusiast with a strong interest for highly interdisciplinary research and good communication and team skills

Your tasks:

In cooperation with JSC and the medical partner Park-Klinik Berlin Weißensee, the student will develop new methods to analyze patient and simulative data to support decision processes of rhinologists a-priori a surgery and to predict according intervention outcomes. Cutting-edge numerical methods to enrich clinical data with simulation data will be extended and used to provide enough data to enable training of selected Machine Learning (ML) algorithms that use state-of-the-art deep learning (DL) tools (i.e. Tensorflow/Keras). The particular DL model to extract hidden features from medical and simulation data for pathology classification and surgery decision support will be Convolutional Neural Networks. Parallel and scalable ML models and their algorithms developed at JSC will continuously learn from the available data to pre-categorize pathologies, find similar cases, trigger new simulations, and to suggest most promising surgery strategies. Furthermore, a surgery success probability, based on historical data taking into account medical and simulation data, will be derived. The hybrid modeling approach employs real patient data, simulative data, and ML predictions to yield a full loop, in which new results are fed back into the whole processing chain. The project will extensively cooperate with the *Rhinodiagnost* project (www.rhinodiagnost.eu), in which the according numerical tools for the simulation of respiratory flows will be developed. The position includes limited participation in education.

Our offer:

The employment will be at RWTH Aachen University. The position is to be filled at the earliest possible date and limited to 4 years (an evaluation deciding on a continuation will take place after one year). It is a full time position and rated at TV-L 13. The opportunity to graduate with a Ph.D. degree exists. The position will be associated with AIA, RWTH Aachen University, JSC, FZJ, and JARA-CSD, i.e., with the Simulation Laboratory *Highly Scalable Fluids & Solids Engineering*. The position will be integrated into the School for Simulation and Data Sciences (SSD) as part of JARA-CSD.

RWTH Aachen University is certified as a family-friendly university. We want to promote the careers of women and are therefore looking forward to receiving according applications. Women are given preference under equal qualifications, aptitude, and professional performance, provided that they are underrepresented in the organizational unit and do not prevail in the person of a competitor. Applications of suitable disabled people are expressly desired.

Your application:

Please send your application including a cover letter, a letter of motivation, your CV, and your certificates to *Dr. Andreas Lintermann, Institute of Aerodynamics and Chair of Fluid Mechanics and JARA-HPC, RWTH Aachen University, Wüllnerstr. 5a, 52062 Aachen, Germany*. We also accept applications sent per email to A.Lintermann@aia.rwth-aachen.de or J.Jitsev@fz-juelich.de. In this case, please provide your application in PDF format.