

TUD Dresden University of Technology, as a University of Excellence, is one of the leading and most dynamic research institutions in the country. Founded in 1828, today it is a globally oriented, regionally anchored top university as it focuses on the grand challenges of the 21st century. It develops innovative solutions for the world's most pressing issues. In research and academic programs, the university unites the natural and engineering sciences with the humanities, social sciences and medicine. This wide range of disciplines is a special feature, facilitating interdisciplinarity and transfer of science to society. As a modern employer, it offers attractive working conditions to all employees in teaching, research, technology and administration. The goal is to promote and develop their individual abilities while empowering everyone to reach their full potential. TUD embodies a university culture that is characterized by cosmopolitanism, mutual appreciation, thriving innovation and active participation. For TUD diversity is an essential feature and a quality criterion of an excellent university. Accordingly, we welcome all applicants who would like to commit themselves, their achievements and productivity to the success of the whole institution.

At the "**Friedrich List**" **Faculty of Transport and Traffic Sciences, Institute of Railway Systems and Public Transport**, the **Chair of Rail and Urban Public Transport**, offers a position as

**Research Associate / PhD student (m/f/x)**

(subject to personal qualification employees are remunerated according to salary group E 13 TV-L)

on the topic of Artificial Intelligence (AI) and Operations Research (OR) for Railway Traffic Rescheduling, starting **as soon as possible** and initially for a period of 3 years. The position offers the chance to obtain further academic qualification (usually PhD). There is the possibility of further employment in other research projects. The period of employment is governed by the Fixed Term Research Contracts Act (Wissenschaftszeitvertragsgesetz - WissZeitVG).

**Chair of Rail and Urban Public Transport**

At the Chair, we develop advanced quantitative techniques to promote more efficient, resilient, and sustainable railway transport systems. We address a wide range of problems, from long-term planning to real-time traffic management in passenger and freight transport combining optimization, AI, simulation and advanced analytics.

**Project description**

Railways play an important role in the shift towards green mobility of people and goods. To meet the high standards in the modern transport world and be an attractive alternative to other modes of transport, punctual and reliable rail services are necessary. Frequent and denser traffic requires better tools for real-time control which are responsible to mitigate the spread of delays after disturbances or disruptions. The current state-of-the art models are not capable of solving realistic real-time large-scale problems.

Within the REINFORCERAIL project, you will have an opportunity to contribute towards developing new intelligent Traffic Management System (TMS) based on Artificial Intelligence. In particular, the aim is to explore hybrid models that combine AI and OR to improve automated train rescheduling. Some of the questions that will be addressed include: How to improve computational times of future rescheduling models? Which areas and/or services will most likely to be impacted during disturbances? How to learn the most promising decisions from precomputed optimal rescheduling solutions?

This research facilitates the infrastructure managers of the largest European national railways, in France and Germany, to take a leading role in the shift from computer-assisted manual planning and control to advanced automated future-proof operations.

You will join an international, dynamic and diverse team at Chair for Rail and Public Urban Transport and collaborate with the Chair of Big Data in Transportation. The research will be conducted in close collaboration with DB Netz AG and you get the chance to regularly exchange with the colleagues and industrial professionals on the research project. Furthermore, you will become part of an international Franco-German project consortium.

#### **Tasks:**

You will have the possibility to work on research topics including:

- Develop state-of-the-art AI models (machine learning ML, neural networks NN) to explore railway network structures and operations characteristics.
- Formulate cutting-edge learning approaches for network and problem reduction.
- Predict and evaluate system performance in case of disturbances.
- Master and develop advanced approaches that combine OR and AI techniques for railway rescheduling, based on e.g. Learning to Optimize, Neural Combinatorial Optimization, Meta-Learning for Optimization, Transfer Learning.

We can offer the following opportunities:

- Participate in a dynamic and international research environment in collaboration with industry and leading universities around the world.
- Write scientific articles and present at premier scientific conferences.
- project-related teaching activities and co-supervising BSc and MSc students.
- You will also get coaching on education, transferable skills and research-related topics, as part of the TUD Graduate Academy.
- Collaborate with the railway operations laboratory (<https://tu-dresden.de/bu/verkehr/ibv/eb1>) to integrate and test own models and algorithms in a physical model railway system.
- Work in a unique research environment of the Faculty of Transport and Traffic Sciences that gathers researchers in planning, management, automation, sustainability and also simulation, optimization, analytics and machine/reinforcement learning.
- Regularly visit the project partner, the Digitale Schiene Deutschland department of DB Netz AG in Berlin to exchange on and align the PhD project with industry needs.

#### **Requirements:**

- university degree in M.Sc. in transport, artificial intelligence, computer science, operations research or a related field.
- Experience with ML modelling, mathematical optimization and/or data analysis.
- Passion for scientific research in collaboration with the industry.
- good communication skills in English, both written and verbal.
- Knowledge of the German language is not a prerequisite, although advantageous.

If you have any questions, please contact Dr. Nikola Bešinović [nikola.besinovic@tu-dresden.de](mailto:nikola.besinovic@tu-dresden.de).

TUD strives to employ more women in academia and research. We therefore expressly encourage women to apply. The University is a certified family-friendly university and offers a Dual Career Service. We welcome applications from candidates with disabilities. If multiple candidates prove to be equally qualified, those with disabilities or with equivalent status pursuant to the German Social Code IX (SGB IX) will receive priority for employment.

Please submit your detailed application with the usual documents (letter of motivation, curriculum vitae, list of publications, 2 references) by **August 18, 2023** (stamped arrival date of the university central mail service applies), preferably via the TUD SecureMail Portal <https://securemail.tu-dresden.de> by sending it as a single pdf file to [bsrv@tu-dresden.de](mailto:bsrv@tu-dresden.de) or to: **TU Dresden, Fakultät Verkehrswissenschaften "Friedrich List", Institut für Bahnsysteme und Öffentlichen Verkehr, Professur für Bahnverkehr, öffentlicher Stadt- und Regionalverkehr, Herrn Dr. Nikola**

**Bešinović, Helmholtzstr. 10, 01069 Dresden, Germany.** Please submit copies only, as your application will not be returned to you. Expenses incurred in attending interviews cannot be reimbursed.

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**Reference to data protection:** Your data protection rights, the purpose for which your data will be processed, as well as further information about data protection is available to you on the website: <https://tu-dresden.de/karriere/datenschutzhinweis>.