Dr. Wilhelmy VDE Prize 2024: Better management of signals and data flows for applications in 6G, medical technology and industry

- **The Dr. Wilhelmy VDE Prize is endowed with EUR 3,000 and is awarded to outstanding young female scientists in electrical engineering and information technology**
- **More efficient signal processing for applications in 6G or medical technology and economical solutions for handling data in the Industrial Internet of Things (IIoT) - these are the topics of the two selected dissertations 2024**
- **The prize was awarded this year at the VDE Bayern evening in Munich**

(Frankfurt a. M., 22.11.2024) Once a year, the Dr. Wilhelmy VDE Prize, awarded by the Dr. Wilhelmy Foundation and the VDE, goes to up to three young female engineers in electrical engineering and information technology. The award is endowed with EUR 3,000 each and gives outstanding dissertations greater visibility. As successful role models, the award winners also show how women are shaping their careers in electrical engineering and working on technologies for the future. At the VDE Bavaria Evening 2024 in Munich, Dr.-Ing. Liana Khamidullina and Dr.-Ing. Julia Rosenberger were honored for their work as part of the award ceremony.

Compact data representation and processing: Applications from 6G to EEG

Dr. Liana Khamidullina completed her doctorate at the Faculty of Electrical Engineering and Information Technology at TU Illmenau and dedicated her dissertation to the topic of signal processing. The core issue is that data in many applications has a high-dimensional structure and relying on matrix-based, i.e. two-dimensional, approaches leads to a loss of information during processing. For her dissertation "Tensor Decompositions and Algorithms for Efficient Multidimensional Signal Processing", Khamidullina defined various applications in order to demonstrate the advantages of tensor-based, i.e. multidimensional, processing and to develop powerful algorithms for this purpose.

The communications expert explains: "There are already algorithms for special cases in the literature for this problem, but they do not work for the allocation of subscribers in modern 6G mobile communications standards, for example. My aim was to develop a generally valid approach that can be used in multidimensional signal processing." For medical applications such as EEGs, Khamidullina has developed a model that is based on data fusion and is therefore able to process information from many sensors simultaneously. This increases precision and makes it easier to detect errors - such as those caused by poorly positioned sensors or patient movements during recording.

"Working on the dissertation was a first step for me," says Khamidullina. "I now want to carry out basic research and develop solutions for other applications to enable better signal processing and exploit the benefits."

Software-based management of data flows: optimization potential for the IIoT
Dr.-Ing. Julia Rosenberger completed an industrial doctorate at the University of Duisburg-Essen in cooperation with Bosch Rexroth AG and dealt with the processing of industrial data flows in her dissertation. The focus was on the problem that vast amounts of data need to be processed in industrial plants, while at the same time expensive hardware is often not invested in for this purpose. Julia Rosenberger explains: "My aim was to show how data flows can be handled in a software-based and therefore economical way. I evaluated the various approaches in a simulation and demonstrated their interaction in an overall system." The efficient processing of data flows is the basis for network participants in autonomous systems being able to make decentralized decisions.

In her dissertation entitled "Data flow optimization with dynamic allocation of resources in industry", Rosenberger used compression algorithms that are already available for processing data in order to further develop them for processing data flows. She also worked on filtering out relevant information - i.e. anomalies - from the constant flow of data at an early stage and thus reducing the amount of data to be transmitted. "In addition to processing the data, I also focused on security," says Rosenberger. "To do this, I built a kind of blockchain network from industrial end devices." In order to make the best possible use of the limited hardware for all tasks, the software expert adapted methods from machine learning. IoT devices that are not working at 100% capacity are continuously identified so that they can be used for data processing with sufficient bandwidth.
"What I have developed is not very far from feasible," says Rosenberger. "The patent applications are in progress. But for now, I'm going to work on developing a new product - maybe I'll come across the topic again at some point."

About the VDE

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The VDE (VDE Association for Electrical, Electronic & Information Technologies) is based in Frankfurt am Main. More information at www.vde.com

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