AI-based evaluation of technical, biological and speech data

Prof. Dr. Constanze Tschöpe, Dr. Ilkin Alkhasli, Maximilian Gast, Rovshan Hasanov, Dr. Yong Chul Ju, Dr. Mathias Käso, Dr. Ivan Kraljevski, Prof. Dr. Hans Rüdiger Lange, Dario Lembcke, Huajian Li, Maximilian Mühle, David Schiemenz

The IKTS project group "Cognitive Material Diagnostics" (KogMat^D) was founded January 1, 2019 and is located at Brandenburg University of Technology (BTU) in Cottbus.

The group develops intelligent methods for material diagnostics and for the monitoring of systems based on artificial intelligence (AI) and machine learning (ML). Working with numerous companies in the region, departments at BTU, national and international universities and research institutions, as well as hospitals, the group creates and develops application-oriented projects. These rely first and foremost on acoustic diagnostics and include the quality assessment of manufactured components, predictive maintenance of industrial plants and wear parts, the processing of spoken and written language, and the analysis of biological and medical data.

The project group underwent a successful evaluation in 2023 and, following its original five-year term, achieved permanent status.

Predictive maintenance

Several current projects of the KogMat^D group focus on the predictive maintenance of plants and machinery. Suitable machine data, process and environmental parameters are extracted from systems in the energy, mobility and production sectors and combined in order to produce automatic, AI-based predictions of the systems' condition. The goal is to optimize maintenance routines for the machines under inspection and prevent unforeseen downtimes.

Speech recognition

Another area of research is the automatic analysis and recognition of spoken and written language, used in current projects for robot and machine control, dictation systems and video transcription. A special focus is on making the analysis self-

sufficient and secure, without any transmission to third parties or external servers.

Moreover, the project group works actively to preserve rare languages. 2024 saw the start of another follow-up project – the fourth one – focused on recognizing the Upper Sorbian language.

Health data

In a current project, the group, together with the Faculty of Medicine of Dresden University of Technology and application partners, is working to develop a diagnostic setup including AI-based evaluation algorithms. The setup is to help detect and treat back pain, one of the most common health problems, as early as possible. It is used to perform sensor-based functional measurements on the patient. The project group analyzes and qualifies existing health data from previous measurements and uses them to evaluate the new data recorded with the diagnostic setup.

Open-ZfP AI Portal for anomaly detection

The project group developed a free and publicly available AI-based portal with which users can analyze audio data from plants and machines and examine these for anomalies (deviations from the standard condition, Fig. 1). It is user-friendly and offers easy access even for users with little or no prior know-how in AI. AI-proficient users can make use of a professional mode which allows to adjust various parameters.
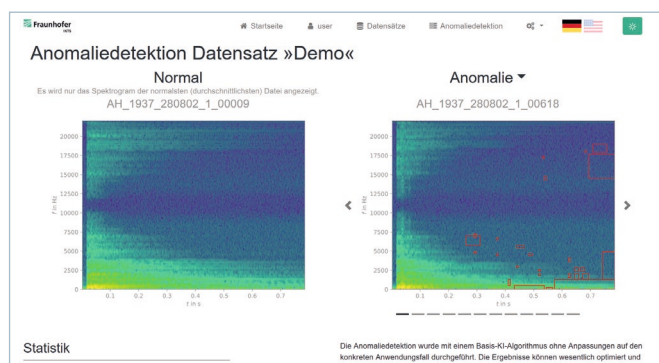

Fig. 1: Open-ZfP AI Portal: Spectrogram of the normal condition without faults (left) and spectrogram of the fault condition (right; anomalies in red).

Contact   Constanze Tschöpe • Phone +49 351 88815-522 • constanze.tschoepe@ikts.fraunhofer.de