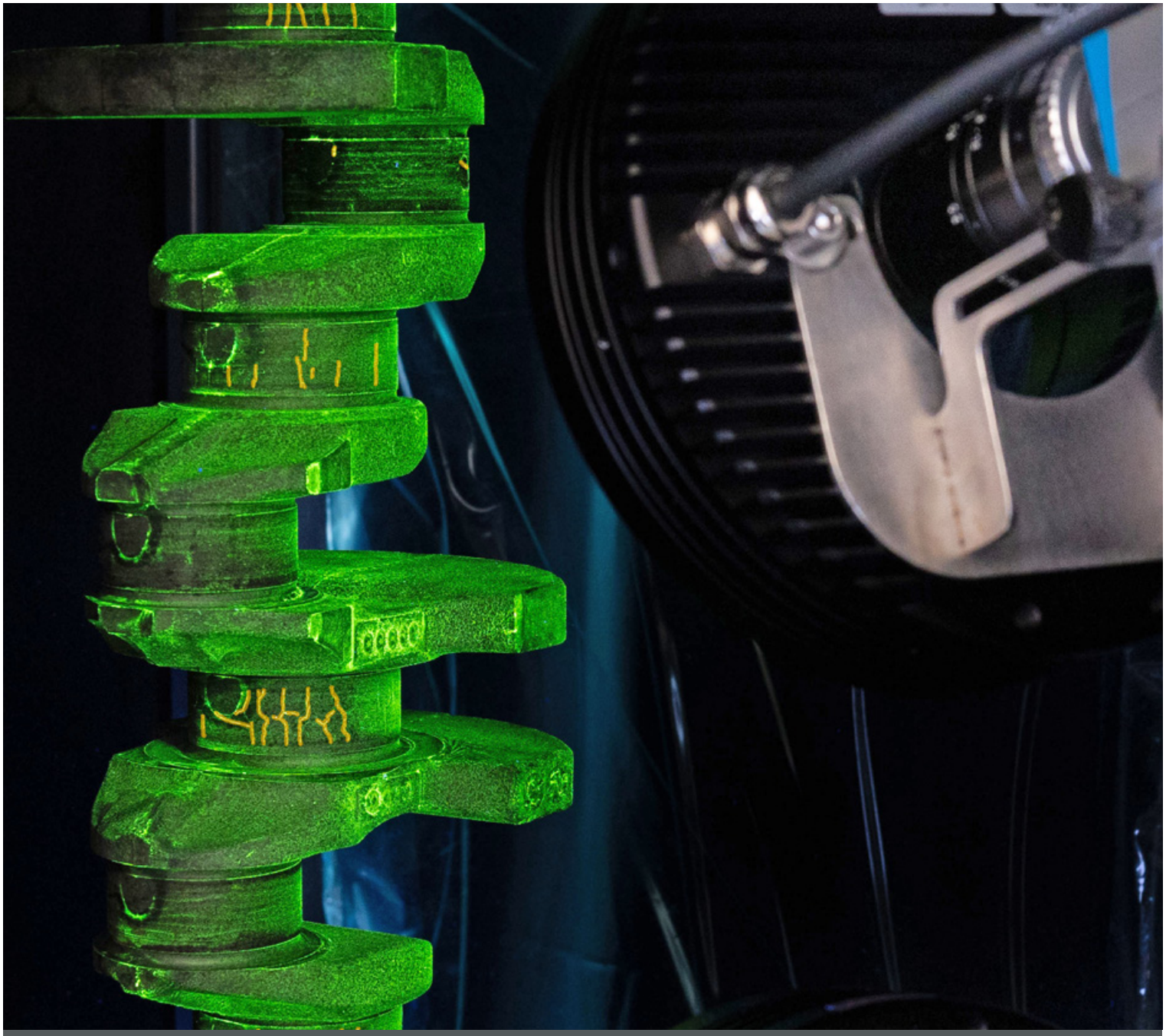


CRACKVIEW AI

Automated AI-based Detection of MT Indications

KARL DEUTSCH

CRACKVIEW AI
Automated AI-based Detection of MT Indications

CRACKVIEW AI enables automated detection of MT indications with the help of artificial intelligence

The CRACKVIEW AI system digitises magnetic particle testing. The surfaces of the test parts prepared with magnetic particle are photographed using industrial cameras. The images of the surfaces are then analysed by a neural network (artificial intelligence / AI) trained by KARL DEUTSCH. It carries out a semantic segmentation of the images and determines the shape, position and number of possible crack indications with the associated crack probability. Thus, the components can be sorted to OK / NOT OK without a human inspector having to view them. The system significantly reduces inspection costs and delivers consistent inspection quality 24/7, all year round. In addition, the individual test results of the components can be documented, archived and traced for the first time.

CRACKVIEW AI all-in-one solution

The CRACKVIEW AI test station is designed as a compact complete system for viewing. It can be used directly on the customer‘s premises during production. This allows customers to experience the system‘s capabilities for themselves. The image data required for training the neural network can be generated before the entire system is finalised.

CRACKVIEW AI test station with a test part on a rotary plate

CRACKVIEW AI test station

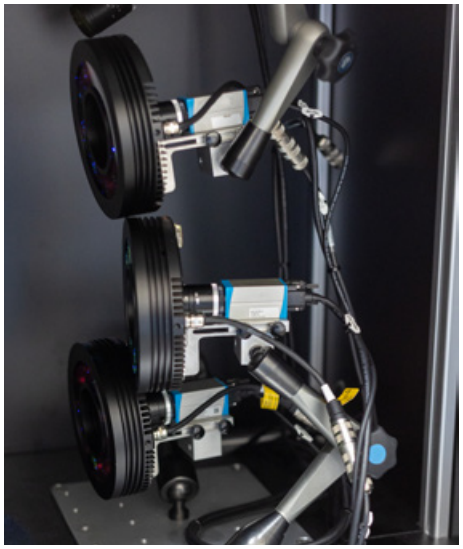
- CRACKVIEW AI software
- High-performance industrial PC with NVIDIA GPU
- Flexible multi-camera setup with UV-illumination complying with ISO 3059
- Motorised rotary plate with component fixture
- Automated image acquisition by PLC control

CRACKVIEW AI user interface

CRACKVIEW AI software

- Core of the CRACKVIEW AI system
- Interface between neural network, PLC and cameras
- Neural network for semantic segmentation
- 3 modes: Adjustment / Manual / Automatic
- Database for order/part-related test results
- Inspection statistics

Manual annotation of the training data


UV lamps with a camera system

Training of a neural network (AI) for crack detection

The neural network of an AI (artificial intelligence) emulates the way the human brain works and must be trained in the same way as the human brain. In the case of crack detection, this is done using images with crack indications. The images must be prepared for training by an annotation process. This means, that by manually tracing the crack contours, a pixel-precise mask is created for each image describing the shape and position of the crack.

During the training process, the neural network learns to recognise crack indications using the images and masks. The more cracks are presented to the network, the more reliable the subsequent crack detection will be. This usually requires several thousand images, however not all of which have to show a specific customer component. The CRACKVIEW AI software contains the necessary tools to annotate the image data directly during the inspection or afterwards.

CRACKVIEW AI implementation process

PHASE 0	PHASE 1	PHASE 2	PHASE 3
In its application technology laboratory, KARL DEUTSCH carries out a feasibility study using customer components that show the range of typical crack patterns.	From the start of the project, KARL DEUTSCH records additional image data of the customer's components before delivery. Ideally, the customer would provide at least about one hundred cracked parts (for each part type) that represent the most important flaw types and flaw positions. This image data is used to train an initial component-specific neural network.	The neural network is trained further throughout the production process. During the commissioning phase, the evaluation by CRACKVIEW AI runs in parallel to the evaluation by an experienced inspector. The CRACKVIEW AI software compares its own results with the tester's results. The inconsistent results, as well as the results of NOK parts, are collected and saved. This data is used for further AI training.	Recurrent training as part of the licence and maintenance contract for CRACKVIEW AI.

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Hardware buttons for manual component evaluation

SIMATIC HMI touchscreen for controlling of the detection process

Complete system solution from KARL DEUTSCH

When introducing AI-based, automated crack detection, the inspection process must be considered as a whole. Image analysis by the neural network is only the last step. It is essential that the parts are prepared in accordance with ISO 9934-1 using inspection media optimised for camera viewing and that the parts are conveyed to the viewing station without any loss of crack display quality. KARL DEUTSCH is the ideal partner for a complete solution. We have more than 75 years of experience in the design and construction of inspection systems and also develop and produce in-house our own inspection media for magnetic particle inspection. The experts in our application laboratory will be happy to assist you with any questions you may have about automated, AI-based detection of MT indications.

Contact
Dr. rer. nat. Helge Rast
Head of Applications Laboratory
Phone: +49 202 7192 273
E-Mail: rast@karldeutsch.de

Example of a conventional DEUTROMAT magnetic particle inspection system with viewing booth

A selection of FLUXA test agents that are developed and produced in-house

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KARL DEUTSCH Pruef- und Messgeraetebau GmbH + Co KG
Otto-Hausmann-Ring 101 · 42115 Wuppertal · Germany
Phone +49 202 7192 0 · Fax +49 202 7192 123
info@karldeutsch.de · www.karldeutsch.de

KARL DEUTSCH