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ABSTRACT

PRESENTATION

PAPER

Olaia Antero is a researcher in the area of digitalization technologies in the Artificial Vision Research Line of the LORTEK, a member of the Basque Research and Technology Alliance (BRTA).

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AUTOMATIC DETECTION BASED ON DEEP LEARNING OF SMALL CRACKS IN INDUCTION THERMOGRAPHY USING IMAGES FROM FEM SIMULATION MODELS

In induction thermography, the work samples are heated while capturing the process with an infrared thermal camera. Then, the obtained recording undergoes Fourier transform analysis to obtain a phase image, where the surface cracks are enhanced. In this study, small cracks have been considered, specifically in the order of the millimetre or smaller. This type of small cracks present a pattern called "butterfly pattern", which is especially helpful for the posterior automatic defect detection.

In this paper, an automated defect detection method is introduced for the detection of butterfly pattern cracks, using images of simulated cracks. The aim is to verify the possibility of developing robust detection models in cases of reduced amount of available real images. To do so, a three-step pipeline is proposed, consisting of:

1. creation of datasets
2. training of detection models
3. defect detection.

For the creation of datasets, mainly images obtained after the processing of FEM simulations of the induction heating process were employed. To have more variability, the simulation images were transformed using data augmentation techniques and then combined different images into one. The obtained images were used to train generative models, such as pix2pix or SPADE. These generative models can generate synthetic images from gt masks. In this study, the masks were automatically created to have a similar distribution of cracks found in real samples. This approach ensures that the generated synthetic images are as similar as possible to real images.

Using the synthetic images, object detection and segmentation models were trained; YOLO for object detection and U-Net for segmentation.

The evaluation of the mentioned models was carried out in images with real cracks. The aim is to verify the feasibility of the models trained mainly with synthetic images for the detection of real cracks. Results validate this approach.