Stress Corrosion Crack (SCC) identification using deep learning

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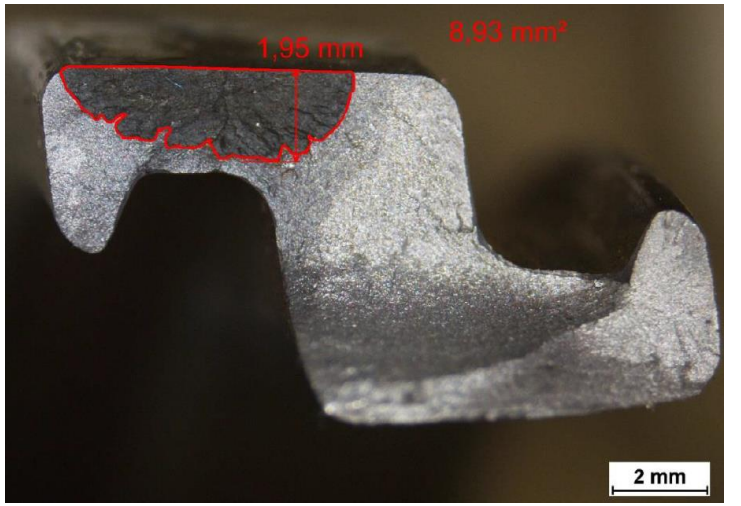

DIGITALHOUSE

Group ID: 02

Business Problem

During service, corrosive gases present in the production fluids, can penetrate to reach the metallic wires building aggressive environments. All this, associated with the residual stresses of the flexible pipeline manufacturing and service process, triggers one of the most dangerous forms of corrosion Stress Corrosion Cracking (SCC) in which may harm the efficiency and causing the fracture of flexible pipe.

In order to access the level of damage to the wires, several dissection from field samples have done has resulted in a substantial number of macrographs depicting cracks and defects (as result of the corrosive environment) in the armor and pressure wires. However, currently, these images are processed manually, which is a time-consuming process taking many hours and is subject to errors. It is important to point out that all these information of crack area and length are used for the flexible pipe lifetime projection.

AI Solution

Developing a convolutional neural network (CNN) which is a type of Deep Neural Network that is commonly used in computer vision tasks such as image classification, object detection and segmentation. To achieve this, the UNet architecture was implemented using Keras to have image segmentation based on several imagens from past projects to train the model from different images of two different metallic wires shapes (and pressure wires). After doing this, the model will be able to perform semantic segmentation on input images to label each pixel to detect the cracks and extract its measures (crack area and its length).

Business Value

Automating the SCC identification using deep learning can provide several benefits, including:

- Saving time of technicians and engineers. This frees up engineers to focus on more complex tasks that require their unique experience and skills;
- Possibility to generate even more data with no backlog limit for technicians/engineers (needing only a human oversight, as per recent AI Center of Excellence guideline).
- Path to industrialization by removing the subjective criteria, leading to standardization;
- Data-driven decision making.

TechnipFMC

ROI Impact & Estimative

- 80.5h could be saved over 1k macrographs taken since 2017;
- LCTMAT takes around 5 min to have the crack localization and its area and length, totalizing 83.3h (1k macrographs).
- ROI = **96,7%** , Furthermore, there are several positive qualitative impacts not measured by the ROI such as standardization, reliability and possibility to increase the database providing more data for the projects.