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Image Recognition Based Surface Defect Detection

Detecting Surface Defects by Using Machine Vision

A closed-loop quality management and the achievement of a zero defect manufacturing are still main drivers for being competitive in the steel and aluminium production. Whether an occurrence on the surface is marked as a defect or not, is mainly decided manually doing a visual evaluation, which is why testing and quality control are expensive and form up a significant percentage of the total production cost. Increased automation in the decision making process for existing defects would result in significant time and cost savings.

Machine Learning for Image Segmentation

Machine Vision technology is the set of methods used to automatically extract information from an image. Its models are capable of analyzing very complex pictures with many details and subtle differences. Based on complex input image data from production in the form of a steel surface image, the model precisely segments the picture showing the locations of probable defects. This is the basis to make precise and automated decisions on the material quality.

Benefits of the Automated Defect Detection

- Much faster & more precise than any human being
- Improve quality of final products
- Reduce production cost
- Improve efficiency

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Neural Network as preferred model

For detecting defects on steel surfaces PSI uses a Convolutional Neural Network (CNN) architecture. Due to the available computational capabilities using Graphical Processor Units (GPU) those extensive architectures can process a huge amount of production image data. This results in significant predictive capabilities to make a precise decision based on complex image data.

Finding defects - fast and precise

Models for surface-defect detection find defects much faster and more precise than any human being. To solve a defect problem PSI uses a composite approach consisting of two models. The first one – a classifier – is capable of detecting whether there is a defect, and which defect type, or not. If a defect was detected then the image is passed to the second model – a segmentator – which detects the position of the defect.

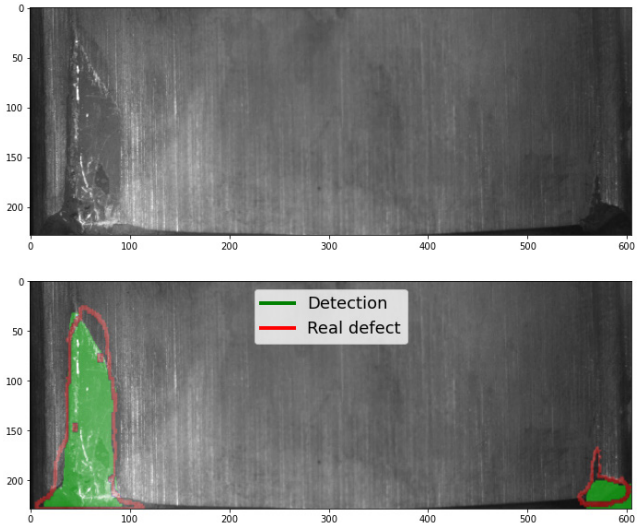
How to get started?

Within a proof of concept PSI experts prepare, train and validate the model to ensure a robust and reliable prediction. The customer needs to deliver the images and the categorization of the images. During implementation the customer will learn how to train/retrain the model and by the end of the project the customer can manage the model on his own.

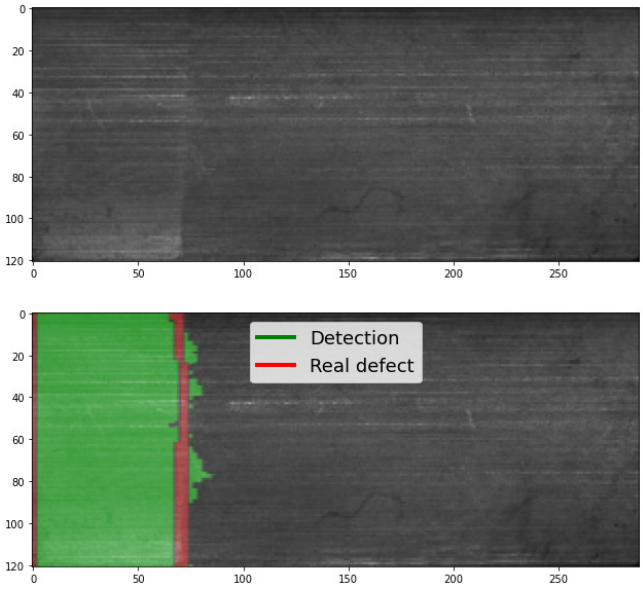
More areas to benefit from

Other fields for the automated image detection in the steel/aluminium production process are:

- identify scrap type from truck or wagon pictures before unloading
- identify the scrap grip contents while preparing baskets
- unblock material decisions
- identify complex plate pile topology and many more



Steel defect detection result – fray defect



Steel defect detection result – uneven defect

FACTS & FIGURES:

+ The quality score of the model is excellent (0.95-0.97) in terms of accuracy, precision and recall.
+ Within a fraction of a second (0,7 ms) hundreds of steel surface pictures are analyzed and determined.
+ Just a minimum of 10.000 images are needed to get started and train the model properly.
+ Any type of imaging as for e.g. a normal photo, x-ray, ultrasound image, infrared image, 3d image can be the subject of this technology.

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