Rethink Artificial Intelligence in Non-Destructive Testing

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AI

Introducing Critical Image Detection (CiD) and Single Image Detail Analysis (SiDA).

The **non-destructive testing (NDT)** industry has undergone significant changes over the years, driven by advancements in technology. One of the most impactful developments has been the integration of artificial intelligence (AI) into inspection processes. While AI has shown first impacts in automating defect detection and recognition (ADR), its potential extends far beyond this application.

NDT often relies on human evaluators to interpret complex data sets, facing today's challenges like demographic change and skilled labor shortage. To tackle these challenges the German software company, sentin, is the first company to develop a new system for AI in NDT using Critical Image Detection (CiD) and Single Image Detail Analysis (SiDA) focusing on the whole inspection workflow (like fraud/duplicate detection, IQI evaluation, documentation and report generation) and not just defect detection. This development marks a new era of efficiency with the potential to revolutionize the way inspections are performed in the future.

By streamlining the inspection process to a digital workflow and leveraging AI, these systems can generate substantial business value through time and cost savings. In this article, we will look deeper into what CiD and SiDA are, their benefits, and how they can be applied to various inspections.

What are these systems?

A two-step process for finding critical images fast (CiD) and precise (SiDA).

Critical Image Detection (CiD) and Single Image Detail Analysis (SiDA) are two innovative approaches that can be applied to image-based inspection like radiographic testing, thermographic, visual or drone inspection.

While most current discussions around AI in NDT revolve around automated defect recognition (ADR), CiD and SiDA look at the complete inspection process with all workflow steps in mind. This means the system will also do tasks like accessing image quality, evaluating IQIs, finding IDs and references for documentation.

It is a two-step process - while CiD tells which images are affected e.g. with bad image quality, SiDA tells where in the image the indications are (e.g. detector artifacts on a weld).

CONTINUE *with AI in NDT!*

Reduce down-time and prioritize the 1% of findings.

Applications of Critical image Detection (CiD) can be Fraud Detection, Image Quality Check, Defect Detection and more.

Critical Image Detection (CiD) is designed to find critical images fast by processing whole batches of images. CiD will look at all images in a dataset e.g. all images taken from a shift and run the (AI) algorithms to check them. The system then will pre-sort and prioritize images based on various indicators such as potential defects, duplicates, missing labels or references, and many more.

Often a huge fraction of parts / images inspected does not show any indications and e.g. only 1% of them is critical. The CiD system enables inspectors to look at the 1% of "critical images" showing indications first and not the 99% of "good images". Therefore, triggering repairs or rescanning faster and reducing downtimes.

Figure 1 shows an example of CiD applied to a dataset of 10 images. A few images with critical indications have been found and therefore prioritized and put to the top of the list. Two pairs of duplicates have been found, which indicates a manipulated inspection. Three images had missing IQIs and one had blemishes (bad image quality). The other four images had no findings, so that they can be put to bottom.

Some applications of CiD are:

1- **Fraud detection**: Identify and flag suspicious images that may be indicative of tampering, manipulation or duplicates of other images.
2- **Image quality check**: Ensure the image meets the required standards for analysis, so that a compliant evaluation is possible.
3- **Defect detection**: Detect potential defects or anomalies in the image, enabling evaluators to e.g. find undercut, porosities or cracks faster.

Figure 1 - Critical Image Detection example

Automate the inspection workflow and report generation.

Applications of Single Image Detail Analysis (SiDA) can be IQI Detection / Evaluation, Defect Recognition, ID and Text Recognition.

Single Image Detail Analysis (SiDA) is a system that provides detailed information about the findings, like potential defects, and their location in an image. When looking at an image in NDT there are many more things to do than finding defects. Often a lot of documentation and compliance tasks must be done before that. SiDA will automatically trigger your workflow steps to reduce the manual tasks in an inspection.

Some application of SiDA are:

1- **IQI Detection / Evaluation**: Identify Image Quality Indicators (IQIs) to ensure a compliant image quality e.g. SNR / CNR.
2- **Defect Recognition**: Recognize and classify defects based on their characteristics and severity.
3- **ID and text recognition**: Extract relevant information from the image, including IDs, labels, and other textual data.

It can output boxes, polygons, texts and more advanced data formats integrating in your digital infrastructure. This means the inspector may have the relevant double wire, SNR values, component ID (from lead letters) and defect highlighted or pre-filled in a report without a single click.

Figure 2 shows how the image is evaluated automatically (showing on the left side of the image) and the results can also automatically be processed to pre-fill a report. In this case the Identification of a weld, the double wire IQI (including SRB and an SNR measurement) as well as a defect (crack) have been detected and filled in. This workflow can save inspectors precious time and reduce mistakes when transferring inspection results.

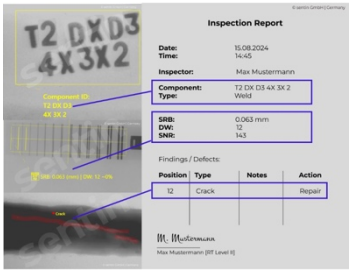

Figure 2 - Single Image Detail Analysis example

This even works for non-image data like UT or sensors

CiD and SiDA boost inspection speed and precision.

The principles of CiD and SiDA are also applicable to non-image inspections like data from ultrasonic or other sensors. The batch processing of inspection data can also find the 1% of critical items (Critical Item Detection - CID) in other methods by tweaking the algorithms for that data format. The same is possible for looking at single items in detail to tell where indications are (Single Item Detail Analysis - SIDA) e.g. in a UT Scan. This modular design allows to adapt the system to inspection specific needs.

Whether image-based or other inspections, the advantages of CID and SIDA include:

1- **Increased efficiency**: Automate routine tasks and reduce manual effort required for inspections.

2- **Improved accuracy**: Enhance the quality of inspection results by identifying critical images and defects more accurately.

3- **Reduced costs**: Minimize downtime, labor costs associated with manual inspections and maximize resource utilization.

Use the AI system today

A practical approach to AI in NDT

The introduction of CID and SIDA marks a new chapter in the history of AI in NDT. The user-centric approach boosts efficiency / accuracy and saves costs. The use of AI is not a dream of the future but is already available today. It will change the way we work in NDT and inspections.

sentin is a leading provider of digital automation and artificial intelligence for the non-destructive testing (NDT) and inspection industry. As one of the first companies specializing on Artificial Intelligence in NDT and years of experience the software company from Germany is actively pushing innovation in this industry. As the first company providing a CID and SIDA systems their international customers are entering a new era of inspections today.
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References
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