Utilise AI for NDT Inspection

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Abstract

Everyone is talking about machine learning (ML), deep learning (DL), and artificial intelligence (AI). In the consumer space it is used in many applications for our daily activities and conveniences. This technology marks a step change in productivities in virtually all areas of our lives. In this article we leverage the technology for Non-Destructive Testing (NDT) inspection. Today, virtually all manufactured products are inspected manually from visual (surface) to ultrasonic (internal) in quality control processes. NDT is one challenge and opportunity that could leverage AI for efficiency and productivity, and the potential of innovation in the manufacturing processes. In this presentation we will present real-world inspections achieved, including a customer case in wind turbine blade manufacturing.
Utilise AI for NDT Inspection

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Fast Fujitsu Facts
Using the power of technology to shape the future of business and society.

- Fujitsu is the world’s 5th largest IT Services Provider and No.1 in Japan
- The Fujitsu Group operates in 154 countries ensuring a globally consistent service with 30,000 Channel Partners selling Fujitsu portfolio globally
- Fujitsu has been chosen for inclusion in the Dow Jones Sustainability World Index for the 17th time
- Fujitsu has spent $1.6 billion annually on research and development worldwide
- Fujitsu has over 80 years experience in the IT industry and developed Japan’s first computer in 1954, the FACOM 100

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What is possible with AI?

Artificial Intelligence: Hollywood version vs immediate potential

- Hollywood version of AI
- A better definition of AI: computational ability to achieve real-world goals typically associated with human intelligence
  - Sensing and Recognition
  - Knowledge Processing
  - Decision Support
  - Data-driven intelligence!

Revolutionizing quality control processes through AI in the 4th industrial era

accurate agile consistent efficient...
Industry 3.0 product quality inspections

- Automated optical / X-ray inspection (AOI) or (AXI)
  - Automated visual inspection system commonly found in electronics manufacturing
  - Principle is to compare a reference image, deviation from the set specifications is either rejected or to be inspected by an inspector

- Others such as UT is out of scope for automation

Production fully automated except QC

- Quality control inspections requiring intelligent judgement

Production fully automated except QC

Inspection can take up 50% plus of workforce
How Artificial Intelligence enables a new generation of automated Quality Control

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Automated Optical Inspection (AOI)</th>
<th>Artificial Intelligence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learns from images instead of programmed rules</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Fast adaptation to changing specifications / product variation</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Replicates worker judgement</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Highlights anything unexpected</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Easily applied to more complex image types (i.e. ultrasound)</td>
<td>✗</td>
<td>✓</td>
</tr>
<tr>
<td>Classifies type of defect</td>
<td>✗</td>
<td>✓</td>
</tr>
</tbody>
</table>

Measurable Defects
- Placement
- Angle
- Width

Complex Defects
- Scratch
- Jagged Edge
- Curvature
- Discoloration

Quality Control in Circuit Board Manufacture

Previous Automated Optical Inspection (AOI) system for Quality Control was highlighting 7000+ images for inspection – far too many per day.

Inspection of images is a manual process, taking key resource away from other duties.

Machine Learning applied quickly through training from images of defects.

Leveraging AI machine learning has proven to achieve an 85% workload reduction.
Applying AI for Wind Turbine Manufacture

- Ultrasonic quality inspection generates massive amount of blade scan data for Quality Control
- Scan data evaluation process now completely automated
- High gains in time efficiency, enabling skilled operators to focus on the important part of the data
- Cuts inspection times for windmill turbine blades from six hours to just one and a half hours

‘By adopting Fujitsu’s ground-breaking AI technology it takes only a quarter of the time previously required to perform an inspection’ Kenneth Lee Kaser, Head of SCM, Siemens Wind Power

Summary and Remarks

- Applying AI machine learning to real-world product inspections
  - Achieved workload reduction of 75% to 85%

- AI for NDT is the next generation to support automated inspections
  - Taking quality control to the next level

- We are at the start of the journey
  - Many challenges ahead e.g. standardisation, digital transformation, R&D, etc.
  - New innovations and business opportunities