Cognex + Suarez Lab
Deep Learning Inspection Solution for Machine Vision
Company overview

SUALAB

offers a fast, accurate, and easy
deep learning-based machine vision solution
in areas where the inspection is difficult
based on rule-based technology

Business field

Based on our competitiveness
in deep learning inspection,
SUALAB provides various customized
services according
to customer requirements
Company history

SUALAB has observed a rapid qualitative and quantitative growth since the launch of its first version of SuaKIT in 2017

Main milestones

- **2013**
  - Company established

- **2015**
  - Attracted seed investment _83,000 USD

- **2016**
  - Commercialization of deep learning-based vision inspection library “SuaKIT”
  - Attracted Series A _1.7 million USD

- **2017**
  - China branch established
  - Expanded into the Japanese market
  - Attracted Series B _8.6 million USD
  - Expanded into the Southeast Asia market

- **2018**
  - SuaKIT 2.0 released
  - Expanded into the European market
  - Expanded into the US market

- **2019**
  - Attracted Series C _15.8 million USD
  - SuaKIT 2.3 released
  - Has been acquired by Cognex

Honors and awards

- **2015.02** Grand Prix in “Be the Rocket, Session 1” hosted by Seoul National University Technology Holdings
- **2016.05** Selected as one of “2016 Global Top 8 Start-ups” by AIA
- **2017.04** Grand Prix in "2017 Innovators Awards" hosted by Vision Systems Design
- **2017.09** Digital Innovation prize in "Innovation Awards" hosted by the Korean-German Chamber of Commerce and Industry
- **2017.12** Excellent Startup Team minister prize in “2017 TIPS Awards” hosted by Small and Medium Venture Business Department in Korea
- **2018.04** Silver prize in "2018 Innovators Awards" hosted by Vision Systems Design
- **2018.12** Grand Prix in Machine Vision section in “2018 Industry Awards Korea” hosted by Industry News
- **2019.06** Grand Prix in "2019 Korea Small and Medium Business Startup Awards" hosted by the Small and Medium Venture Business Department
- **2019.09** Grand Prix in AI Technology and its innovation section in "2019 Smart Factory Award Korea" by Industry News and FA Journal
Our customers

Top-tier manufacturers, including Samsung, LG, Hanwha, SK, and so on
Affiliates of top-tier manufacturers in electronics, automotive, and advanced materials industries
Top-tier affiliates’ vendors and equipment suppliers

Global services

Customers get more than software when they purchase from Cognex. They get a company focused exclusively on machine vision, with the most comprehensive application experience. Add direct, high-quality worldwide service and support, and it’s easy to see why Cognex is the machine vision company that industries rely on.

Technical Support
Product Training
Hardware Programs
Product Lifecycle

When it comes to protecting your machine vision investment, Cognex understands that responsive, expert service is an expectation all customers should have. Cognex serves an international customer base from offices located throughout the Americas, Europe, and Asia and through a global network of highly-trained partners, system integrators, and distributors.

From development to deployment, Cognex is there to help you get your vision systems up and running as fast as possible. Whether you’re considering machine vision for the first time or are already an expert user, Cognex global services provide the expertise to help your organization succeed.

cognex.com/support/Cognex-services
Advantages of SuaKIT

**Improvements in production efficiency**
- Reduces workloads of human inspectors, allowing optimized resource allocation
- Minimizes "overkill" and "underkill" rates with higher accuracy, improves takt time and enlarges production capacity

**Quality improvement**
- Enhances quality control by changing inspection method from partial sampling inspection due to the limitations of the existing visual inspection to total inspection
- Improves the inspection quality by inspecting with consistent criteria and conditions, rather than the random judgment from human inspectors

**Increased detection rates**
- Images with complex and atypical patterns are hard to inspect with an existing rule-based method that manually sets the characteristic values of the defects one by one
- SuaKIT’s deep learning method can analyze and learn images’ characteristics by itself regardless of their complexity

**Easy development**
- SuaKIT’s deep learning method can inspect by labeling images and controlling a few parameters, unlike the conventional method that requires repeated manual ROI setting and wide parameter control upon every image change

**Cost reduction**
- High detection rates of SuaKIT reduces the necessity of investment in inspection H/W
Why SUALAB?

With our own methodology, technical support, and R&D capabilities, SUALAB offers a deep learning solution in mass production environments.

1. **Differentiated features and methodologies for the successful introduction of a deep learning-based solution into manufacturing processes**

   - SUALAB provides useful differentiated features that can address a wide range of variables in inspection environments

     - A methodology to reduce training time to respond to the inspection of products with short life cycles
     - A methodology to learn with only normal images in an environment where defects are hard to find
     - A methodology to automatically classify the “ambiguous decision-boundary data”
     - A methodology to quickly combine and learn the “images acquired under various optical conditions”
     - A methodology to visualize a deep learning algorithm’s internal analysis process that is usually not revealed, as in a black box

2. **Customized technical support services**

   - Operates a dedicated team of experts to create deep learning networks optimized for each application
   - Offers a range of solutions to tackle customers’ biggest inspection challenges

   "SUALAB solved the problems that were seemingly unsolvable, by delving into various aspects, including deep learning methodologies"

   - A manager of an electronic components company

3. **The continuous R & D and commercialization**

   - Operates the largest deep learning R & D center in Asia
   - Deep learning R&D to solve inherent problems in the machine vision field
   - Major version updates every 3-6 months to reflect the VoC
Main features and learning methodology

SuaKIT Key functions

**Detection**
Detect different objects with different classes in a single image

**Classification**
Group images by multiple predetermined classes

**Segmentation**
Accurately finds position/area/shape of defects in the images

SuaKIT’s deep learning architectures

**Single Image Analysis**
Learns each image and detects defectives

**Image Comparison**
Learns and detects defects by concentrating on the differences between a set of two images

**Multi Image Analysis**
Analyzes the relationship among multiple images to train at once for defect detection

**One Class Learning**
Trains only OK images and detect defects without NOK images
Main application cases

SuaKIT is introduced into surface inspection of advanced materials and key components for mobile, semiconductor, electronics, and automotive industries.

In addition, SuaKIT can also be widely used in all areas of manufacturing where humans can inspect products visually, including construction materials, food and beverage, packaging, and textiles.

The exterior inspection of the automobile bearing

Challenges

- Regardless of the importance of minimizing the "underkill" rate, the existing machine vision equipment misjudges defective items, resulting in re-inspection by human inspectors.
- Additional costs are generated due to the repetitive inspections, causing inefficiency.

Expected advantages with SUALAB’s solution

- Increases accuracy and reduces defect leakage rates.
- Reduces human errors and workloads.
The exterior inspection of the Solar EL Panel

Challenges
- The non-standardized and irregular patterns of the solar panels cause the need for human inspection
- Requires additional human inspection after the existing inspection

Expected advantages with SUALAB’s solution
- Enhances the classification ability regarding ambiguous images, and reduces the inspectors’ workloads

Exterior inspection of semiconductor components (Driver IC)

Challenges
- Conventional inspection equipment recognizes all ambiguous defective types as defects
- This causes an overkill, resulting in a re-inspection and increased tact time

Expected advantages with SUALAB’s solution
- Successfully reduces the overkill rate by over 90% through the deep learning inspection
- Improves production capacity and reduced inspectors’ workloads
Main application cases

Display TFT surface inspection

Challenges

- Images of ‘Open’, ‘Short’, and ‘Particle’ defects in displays are ambiguous to define the criteria
- These types of defects that are hard to detect with the existing machine vision methods need to be re-inspected by human inspectors

Expected advantages with SUALAB’s solution

- Replaces all or parts of the human inspection with the deep learning and reduces the workloads of the inspectors

Exterior inspection of smartphone and case

Challenges

- Relies on 100% visual inspection due to the limitations of the existing machine vision inspection methods
- Inconsistency in speed and accuracy due to different levels of proficiency among human inspectors

Expected advantages with SUALAB’s solution

- Accurately detects all types of defects that are humanly detectable
- Inspects up to 3 times faster than human inspectors
  * Provides all optical equipment for polyhedron inspection
## SuaKIT Specification

<table>
<thead>
<tr>
<th></th>
<th>Minimum supported specifications</th>
<th>Recommended specifications</th>
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<tbody>
<tr>
<td><strong>Operating system</strong></td>
<td>Windows 7 64bit / Windows 10 64bit / Windows 2012 R2 / Windows Server 2016</td>
<td>※ The 32-bit operating system is not supported Ubuntu 16.04 LTS (Runtime only)</td>
</tr>
<tr>
<td><strong>CPU</strong></td>
<td>Intel® Core™ i5 or higher</td>
<td>Intel® Core™ i7 or higher</td>
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<tr>
<td><strong>RAM</strong></td>
<td>16GB (more than 8 GB of free memory)</td>
<td>32GB or more</td>
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<tr>
<td><strong>GPU</strong></td>
<td></td>
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<tr>
<td>GTX</td>
<td>NVIDIA® GeForce® GTX 980 (More than 4 GB of free memory)</td>
<td>NVIDIA® GeForce® GTX 1080</td>
</tr>
<tr>
<td>RTX</td>
<td>NVIDIA® GeForce® RTX 2070</td>
<td>NVIDIA® GeForce® RTX 2080 Ti</td>
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※ Requires updating NVIDIA Graphic Driver to the latest version

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<tr>
<th>Development environment</th>
<th>Visual studio 2010</th>
<th>Visual studio 2017</th>
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<tr>
<td><strong>Resolution</strong></td>
<td>Full HD (1920*1080) or above</td>
<td>※ Developer kit only</td>
</tr>
<tr>
<td><strong>Required storage capacity for installation</strong></td>
<td>8 GB or more free space (SSD recommended)</td>
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<tr>
<td><strong>Media</strong></td>
<td>Installation disc (USB) and digital download</td>
<td></td>
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<tr>
<td><strong>Security</strong></td>
<td>Only available when a dongle key is plugged in</td>
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### FAQ

**Q** How many image data per class should be added for training?

**A** It depends on the complexity of the image, but initially, around 100 images by defective type are needed.

**Q** How long will it take to train a network?

**A** It depends on the number of images to be trained, but it takes about 20 minutes based on 1,000 images (1024x1024)

**Q** What is the image data processing speed in inspection process?

**A** SuaKIT can process about 20 images (1024x1024) per one second based on Segmentation / Geforce GTX-1080Ti in real-time.