NEUROCLE

DEEP LEARNING VISION SOFTWARE

MAKING
DEEP LEARNING
VISION TECHNOLOGY
MORE ACCESSIBLE

ENG

NEUROCLE

Neurocle introduces cutting-edge and efficient Auto Deep Learning Inspection Solutions, contributing to extraordinary inspection accuracy while optimizing resource utilization.

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The next level of deep learning vision inspection

Our company

Making deep learning vision technology more accessible

Neurocle is building a new vision inspection software ecosystem based on outstanding technological capabilities and R&D organizational strength.

2021

Korea ImpaCT-ech Grand Award

Gartner Cool Vendor in AI for Computer Vision

High-Growth Enterprise by the Ministry of Science and ICT for two consecutive years

2022

Top 10 Finalist in Cowen Startup Challenge, the only Asian representative

Challenge K-Startup(Minister of Culture, Sports, and Tourism Award)

2023

AI Korea Award (Minister of SMEs and Startup Award)

Three-years consecutive winner of Innovators Awards

Our technology

Deep learning vision technology

Deep learning vision technology

This technology empowers our models to perform complex judgment tasks, mirroring the cognitive functions of the human brain.

*Computer Vision: Emulating the structural aspects of human vision, this AI technology enables computers to identify and interpret objects or scenarios.

Vision inspection solution

Our focus is on developing software that utilizes deep learning vision technology to create and implement sophisticated vision inspection models. This empowers vision system integrators to enhance their quality control processes effectively.

Neurocle machine vision ecosystem

Best partners

We collaborate with major machine builders, conducting vision inspections using Neurocle's software for renowned companies both domestically and internationally.

Global business status

7+
Asia

Japan, China, Taiwan, Malaysia, Vietnam, Singapore, Thailand

13+
Europe

Germany, France, Switzerland, Ireland, Italy, Spain, Turkey, Hungary, Romania, Belgium, Luxembourg, Greece, Netherlands

Deep learning vision software: From model training to application

Project planning — Data management — Labeling — Model training — Evaluation — On-site application

No-code GUI-based software

Training the model

NEURO-T

Auto Deep Learning Vision Software

Training Method

Auto deep learning algorithm automatically optimizes the best performing deep learning architecture, hyperparameters and data augmentation.

Recommended Users

Industrial experts with rich knowledge in industrial applications

The use of auto-optimization algorithms does not require programming knowledge, making it accessible to industry professionals without deep learning expertise

NEURO-X

Deep Learning Vision Software for Experts

Training Method

Users can configure the deep lerning architectures, hyperparameters and data augmentation to optimize the model performance.

Recommended Users

Deep learning experts with rich knowledge for model optimization

Recommended for the engineers who possess knowledge in deep learning and want to experiment with various approaches.

* On-premise server : Operates in the user's local environment.
* Client-server architecture : Supports multiple users for simultaneous access.

On-site application

NEURO-R

Runtime Software Library (Runtime API)

Utilization

Real-time software library, offers APIs compatible with all models created in Neuro-T and Neuro-X for swift deployment on the manufacturing floor.

Features

Runtime API that can be seamlessly integrated with existing equipment and systems

Applies inspection models to interpret images or videos received in real-time through camera.

* Inference device :CPU, GPU, Jetson
* Supported languages: C++, C#, Python

Eight types of deep learning vision models

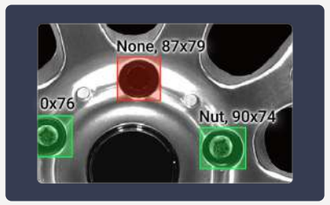
Supervised models

01 Classification

Categorizes images into normal/ defective or multiple defect classes

02 Segmentation

Detects the precise shape and location of defects at the pixel level
(able to detect multiple defects in a single image)

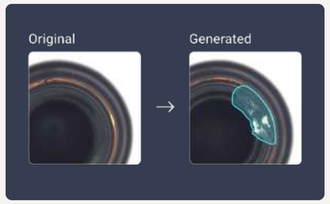


03 Object Detection

Recognizes the number of objects and identifies their positions

04 OCR

Recognizes text (English, numbers, special symbols) within an image



05 GAN

Generates artificial defect images resembling real ones

06 Rotation

Automatically rotates original images to the correct orientation

Unsupervised models

07 Anomaly Classification

Provides a basis for binary* classes in the form of a heatmap, trained solely on normal images

* Normal / Defective

08 Anomaly Segmentation

Detects defective areas at the pixel level, trained solely on normal images

The next level of DL vision: Auto deep learning algorithm

CORE TECHNOLOGY

Auto Deep Learning Algorithm finds the optimal deep learning model structure and hyperparameters to create a high-performance vision inspection model. In the case of Conventional deep learning vision inspection, the process involves constant retraining until a model that achieves the desired level of performance is created. Auto deep learning, on the other hand, allows the creation of the best model with a single click, enabling even those who are not deep learning experts to build high performance deep learning model.

Skilled deep learning engineer for optimization tasks

Industrial expert

Repeated optimization process

Understanding a definition of a project

Data collection

Hyperparameter tuning and training

Evaluating a performance of the model

Tuning parameters and retraining

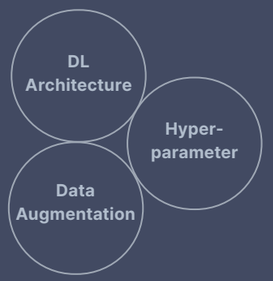
Evaluating a performance of the model

⋮

Check the result of deep learning model

Final model

Auto-optimization using auto deep learning algorithms



Check the result of deep learning model

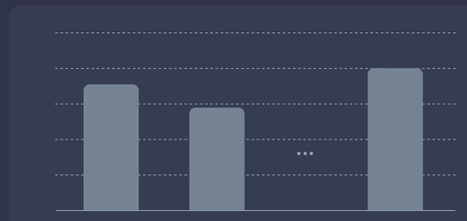
Final model

Maximize inspection accuracy, minimize resources

BENEFIT 1

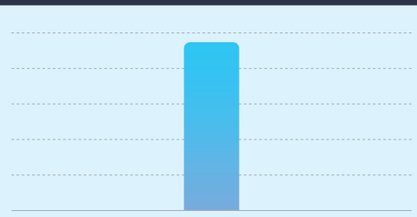
Overwhelming model performance

Conventional DL



A deep learning engineer made numerous attempts to achieve the desired performance

Auto DL



Quality management team deep learning non-expert achieved the desired performance in just one attempt

* In case of a chip breaker defect detection project (Company A).

BENEFIT 2

Minimize resources

Conventional DL

The time required for model development

4 months

Manpower

10 people

- Required repeated process of optimization of 'Training - Evaluation - Retraining'
- Required a large number of deep learning experts

Auto DL

The time required for model development

2 weeks

Manpower

One person

- Resulted optimized model with single training
- Can be handled by a single industrial expert

* In case of film detection project (company B), aiming for a 98% target inspection accuracy.

All-in-one platform for high-performance model

Manufacturers encounter various challenges in deploying vision inspections powered by deep learning. **Neurocle** provides useful features to overcome these challenges, ensuring effective and precise vision inspections.

Four key factors for high performance model training

Neurocle software addresses practical challenges that may arise in the vision inspection process associated with four conditions, creating a high-accuracy inspection model.

01 High quality and ample data

Learning-based deep learning algorithm demands both high-quality and ample data to ensure optimal performance.

Challenge	Solution from Neurocle
If the defective rate is low, it is often challenging to acquire an ample amount of data.	Neurocle offers the various useful features to address the data scarcity challenges.

02 Accurate labeling with consistency

Consistent and accurate data labeling is crucial for optimal model performance. Inaccuracies and inconsistencies in labeling can impact model effectiveness.

Challenge	Solution from Neurocle
Labeling task with consistency requires heavy resources for engineers.	Neurocle offers the various Smart Labeling features to address the labeling challenges.

03 Hyperparameter optimization

To enhance the performance of the model, finding the best combination of hyperparameters and validating them is essential. This process can be time-consuming and challenging.

Challenge	Solution from Neurocle
Difference in expertise among deep learning experts can lead to variations in model performance.	Anyone can easily optimize the models with high-performance with 'Enhancing performance' functionalities.

04 Fast inference time

To interpret images in real-time during inline processing, it is necessary to have suitable inference speed for inline production.

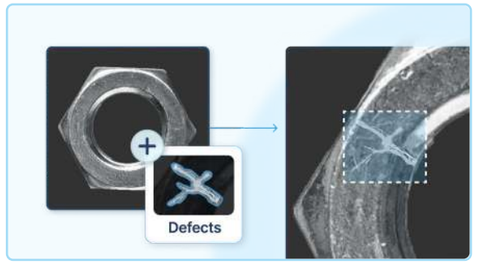
Challenge	Solution from Neurocle
It is challenging to create models meeting the required inspection speed.	Create models with fast inference speed through various optimization options and apply on-site through 'Easy integration' features.

Solving data scarcity

Even with insufficient data, high-performance models can be created.

AI model to generate virtual defects

GAN Model & Generation Center

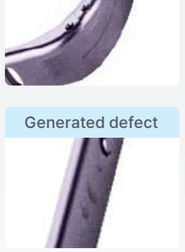


GAN Model & Generation Center tackle data scarcity in manufacturing by leveraging generated defect images for training inspection models, resulting in enhanced model performance.

GAN models are employed to train features of defects, and the Generation Center generates the corresponding defect images.

Generated defect images

Inspection for Metal Frame of Smart phone



Existing vs New model with generated defect (in performance)

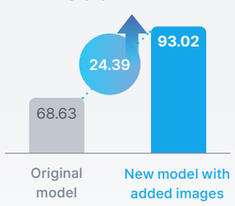
Inspection for MLCC Chipping

Utilizing generated defect images to the training dataset enables to create higher performing model when data is scarce.

Trained Images
(number of photos)

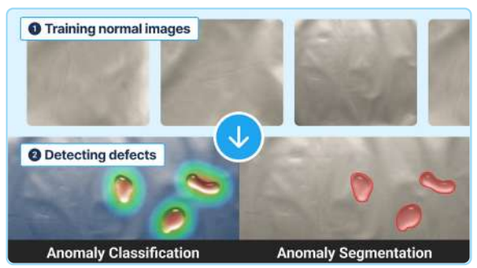
Types of defects	Original images	Added images
Body chipping	66	+50
Pin chipping	60	+50

Accuracy (%)



Unsupervised learning model trained on normal images only

Anomaly Classification & Anomaly Segmentation model



In contrast to supervised learning, which relies on labeled data, unsupervised models can learn solely from normal images.

Neurocle offers two unsupervised learning models employing the latest techniques to distinguish between normal and anomaly without the need for labeled data.

Smart labeling

Minimize labor-intensive labeling process by providing various tools.

Automate data labeling for large amount of images

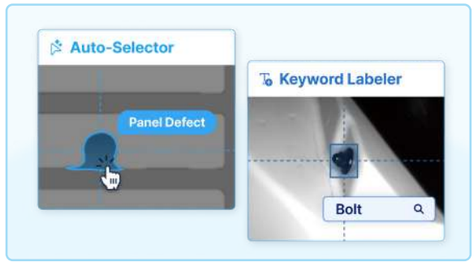
Auto-Labeling

Start by manually labeling a small set of image data and then utilize the Auto-Labeling feature to automatically suggest the labels.

This feature relies on user-labeled data in a few images, minimizing labeling efforts while maintaining high-accuracy labeling results.

Automated labeling without the need for training

AI-Based labeling tools



Auto-Selector

The areas based on objects with similar characteristics are labeled automatically. This eliminates the need for manual labeling for individual images.

Keyword Labeler

By inputting short keywords, the parts that correspond to specific keywords are automatically labeled.

Smart labeling features

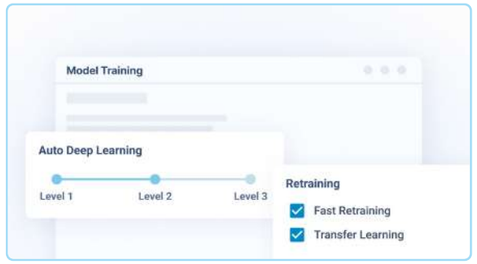
Criteria / feature	Auto-Labeling	Auto-Selector	Keyword Labeler
Supported model	All models	Segmentation, Anomaly Segmentation, GAN	Object Detection, Segmentation, Anomaly Segmentation, GAN
Auto labeling range	Minimum : Single image Maximum : Entire image	Single image	Minimum : Single image Maximum : Entire image
Labeling criteria	As defined by users	Features in image	Keywords

Enhancing performance

Maximize model performance with various features for model training and validation even without deep learning expertise.

Customized model optimization and retraining options

Training methods

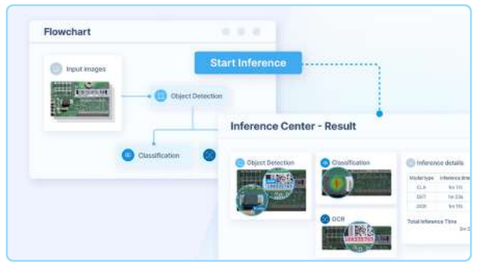


Users can adjust the optimization level based on their training environment. If retraining is needed, users can select between two methods based on data acquisition situations.

Retraining methods		
Features	Fast Retraining	Transfer Learning
Specifications	Fast Retraining retrains the entire dataset using information from a previously optimized model, resulting in a well-balanced, high-performance model achieved quickly.	Transfer Learning is utilized in data-rich scenarios, involving the reuse of a pre-trained model for a different inspection purpose in a similar context.
Recommended usage	When dealing with a moderate volume of newly acquired field images, Fast Retraining is highly effective for new model's rapid enhancement.	If an already satisfactory pre-trained model exists, Transfer Learning enables continuous improvement of model performance over time.

Project design and model validation

Flowchart & Inference Center



Flowchart

Flowchart enables users to easily combine multiple deep learning models into a personalized model and visualize complex flows in an orderly fashion.

Inference Center

Anticipate model performance during POC before deploying them in industrial settings. Conduct simulation in environments closely resembling real-world conditions to reduce inspection trial and error.

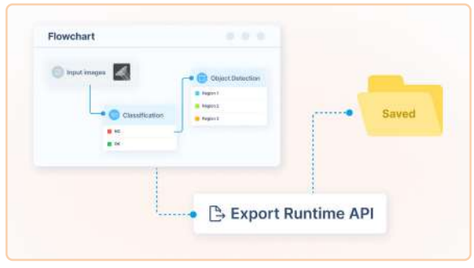
Seamless integration

Neuro-R facilitates seamless real-time inference with minimized programming efforts.

Fast inference time

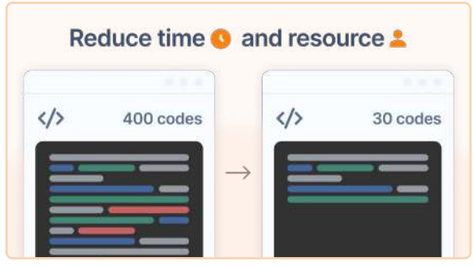
Create models with fast inference speed by using various optimization options. Models can inferenced at a suitable speed even where fast processing time is important.

Multi-Model export



Extract Flowchart models created in the Inference Center into a single file. By calling models with just one API, programming efforts are significantly reduced.

High level API module



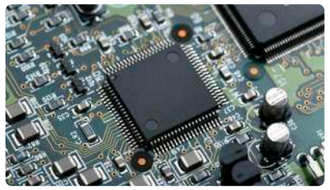
Support easy library integration through modular API design. Neuro-R's modularized example code requires minimal programming efforts, typically around 30 lines, streamlining the integration process.

Application

Deep learning vision inspection solution ensures high performance in all in-line applications

Industry specific application cases

Electronics



Accurately detects defects in small electronic components.

Example

- LED panel inspection
- Soldering bubble detection in PCB board
- Surface inspection for FPCB / MLCC
- Speaker mesh inspection

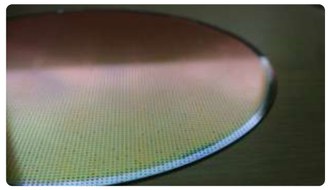
Battery

Improves battery yield with precised detection.

Example

- Pouch type battery inspection
- Cylindrical battery cap inspection
- Battery X-ray inspection
- Battery CT inspection

Semiconductor



Accurately recognizes irregular defects, replacing visual and AOI inspections.

Example

- Wafer notch detection
- Wafer surface inspection
- Wire bond defect inspection
- Integrated circuit leads inspection

Display

Improves display quality through precise panel inspection.

Example

- Bear glass inspection
- OLED mask inspection
- Pattern defect inspection
- Panel damage inspection

Automotive

Enhances production speed which has been automated early on.

Example

- Assembly detection
- Automotive parts and tire inspection
- VIN Number recognition
- Sunroof primer recognition

Metal

Detects machining and welding that are hard to inspect with the naked eye.

Example

- Steel surface inspection
- Press products surface detection
- Steel plates edge detection in rolling process
- Color-coated steel plates inspection

Pharmaceutical

Minimize undetected rates in pharmaceutical industries with strict regulations.

Example

- Pill surface defect inspection
- Medical kit inspection
- Syringe rubber parts defect inspection
- Catheter laser punching detection

Bio & Healthcare

Detect anomalies that are difficult to identify with the naked eye.

Example

- Number of microorganism detection
- Cell detection inside of organs
- Virus infection classification
- Contact lens inspection

Food & Beverage

Provide fresh products to consumers by detecting contaminants.

Example

- Ramen quality classification
- Dumpling number counting
- Tofu contaminant detection
- Beverage foreign object detection

Packaging

Ensure best packaging quality through checking the package condition.

Example

- Glass bottle exterior defect inspection
- Package sealing detection
- Label alignment inspection
- Container printing defect inspection

Logistics

Maximize distribution speed by automating goods sorting and label tracking.

Example

- Container text identification
- Invoice identification and product classification
- Pallet damage classification
- Conveyor belt inspection

Agriculture

Make improvement in yield and reduce costs by minimizing personnel management.

Example

- Crop disease infection classification
- Ripeness Classification
- Animals abnormalities detection
- Forest damage and fire detection

Select lineup according to needs

Neuro-T Essential

Compact design with essential functions for vision inspection

- Support auto deep learning training
- Six types of deep Learning models*
- Smart labeling features
- Pre-trained OCR

Neuro-T Pro

Equipped with all features for optimal model performance.

- Support auto deep learning training
- Eight types of deep learning models*
- Inference Center, Generation Center
- Multi-model export

* Neuro-T Pro includes all the features of Essential.
* Deep learning models: (Essential) Classification, Segmentation, Object Detection, OCR, Rotation, Anomaly Classification
(Pro) Models supported by Essential lineup, GAN, Anomaly Segmentation

Lineup & license

Product	Lineup Type	License Type	Number of Accounts	Max. Number of GPU
Neuro-T	Essential	Basic	1	1
	Pro	Standard	3	2
		Team*	5	4
Neuro-X	Essential	Basic	1	1
	Pro	Standard	3	2
		Team*	5	4
Neuro-R	Embedded	Embedded	N/A	1
	PC	Single		1
		Double		2
		Multi		4

* Please contact us with any requirement of license beyond the team license (additional user accounts and number of GPUs).

Software update policy

Software Update Policy Upon purchasing version 4 of our software, the subsequent minor version updates will be provided at no additional cost until the next major release.

Required Specification for Version 4.0

Product	Category		Minimum	Recommended
Neuro-T Neuro-X	Server	OS	Windows 10 64-bit, Windows 11 64-bit	
		RAM	32GB or higher	64GB or higher
		CPU	Number of Cores: 4 or higher Number of Threads: 6 or higher	1 GPU: i7 or higher Multi GPU: i9 or higher
		GPU	12GB or higher (NVIDIA RTX 3080, RTX 3090)	NVIDIA RTX 4080 NVIDIA RTX 4090
		CUDA Compute Capability	7.0 or higher	
	Client	Browser	Chrome, Microsoft Edge	
Neuro-R	PC	OS	Windows 10 64-bit, Windows 11 64-bit Linux Ubuntu 18.04, 20.04 amd64	
		CPU	CPU Evaluation available	
		GPU	4GB or higher	NVIDIA RTX 4080 NVIDIA RTX 4090
		CUDA Compute Capability	7.0 or higher	
		Development Environment	Visual Studio 2017 or higher	Visual Studio 2019
	Embedded	Available Platform	Jetson™ AGX Orin series, Jetson™ Xavier NX series, Jetson™ AGX Xavier Series	
		OS	Jetpack v5.1.2 (Linux Ubuntu 20.04 arm64)	

* Additional SSD is recommended for the DB folder storage.

FAQ

Q1 What is the minimum size that can be detected by a model?

The minimum size mostly depends on the resolution of the camera used to collect the dataset. However, the smallest object that our software can detect is a 3×3 pixel object.

Q2 What are the supported image file formats? Is there a limit to the number or size of images?

Neuro-T & Neuro-X support .jpg (.jpeg), .png, .bmp, .tif (.tiff), .dcm (.dicom) formats. There isn't a limit to the number of images that can be uploaded to the software, but we recommend no more than 100,000 images per project, and a maximum size of 64MB per image file

Q3 Can I use a previous labeling data?

Neuro-T and Neuro-X allow you to import labeling data made from another platform or software. You may import labeling data in JSON files or masked image files (.png, .jpg, .bmp).

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