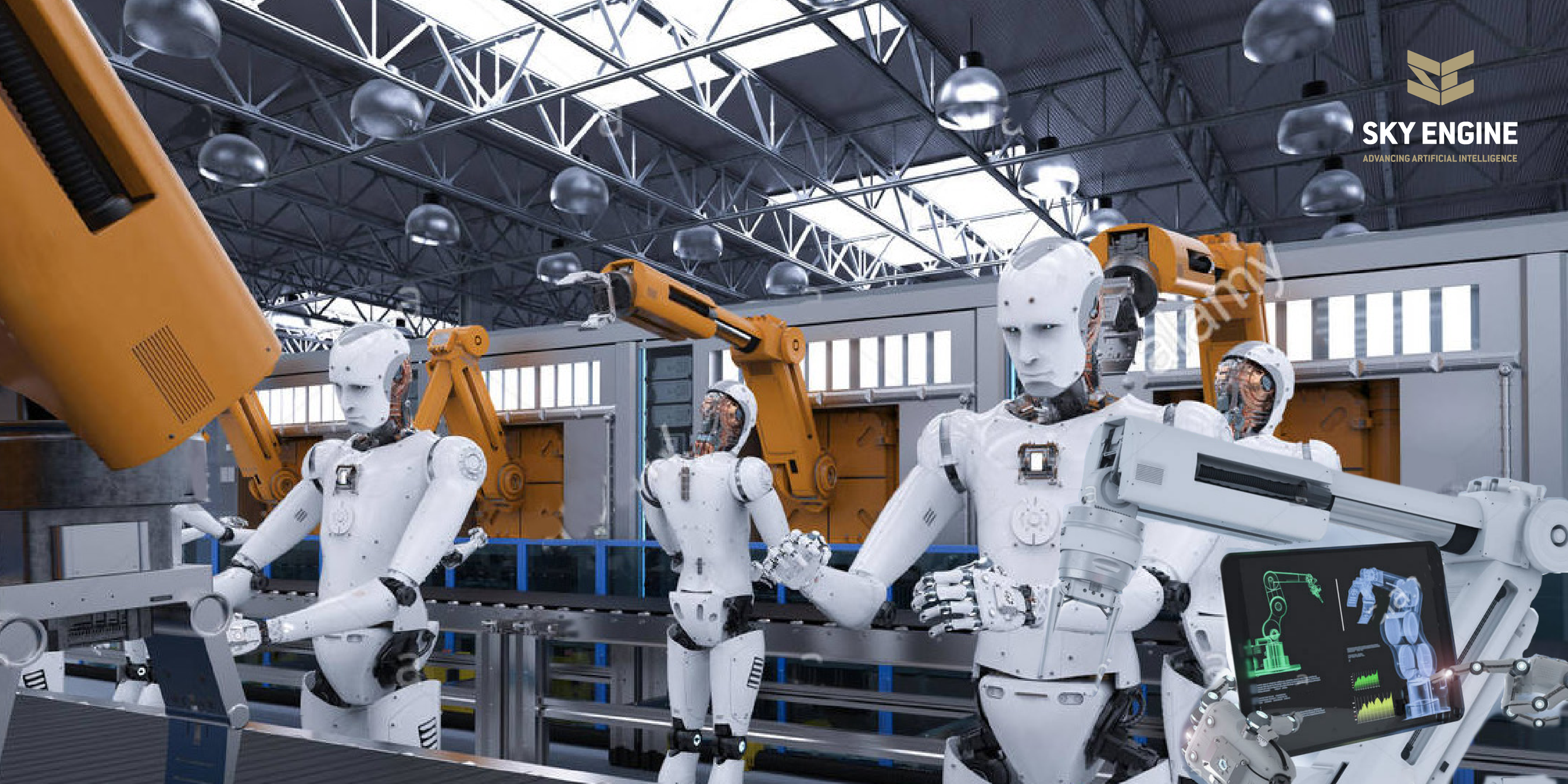SKY ENGINE
ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE
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contact@SkyEngine.AI
www.SkyEngine.AI

ADVANCING ARTIFICIAL INTELLIGENCE

INTRODUCTION

SKY ENGINE AI - Solutions in Machine Vision

SKY ENGINE — ADVANCING ARTIFICIAL INTELLIGENCE

The world's first, efficient, and feasible self-learning Artificial Intelligence (AI) solutions to improve and boost production processes in medicine, manufacturing and agriculture.

SKY ENGINE is **Advancing Artificial Intelligence** through pioneering deep learning software and hardware integration powered by imaging development. Hardware and AI integrated software have unlimited potential, and we believe it is now the driving force for the innovation in Machine Vision. Data Science and Machine Vision never stand still, and neither does SKY ENGINE.

ULTRA-FAST COMPUTING + **SKY ENGINE AI DEEP LEARNING powered by IMAGING** + **MACHINE VISION**
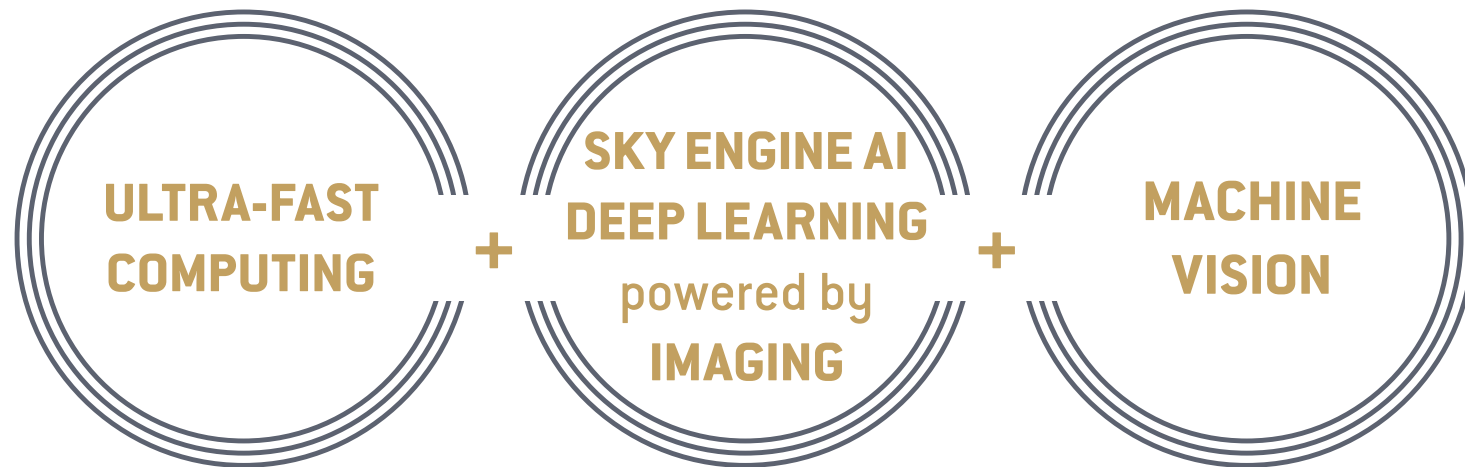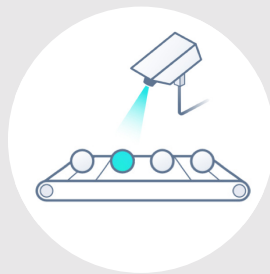
SKY ENGINE Integrated Solutions

SKY ENGINE optimized imaging using very first ray-tracing renderer of synthetic imaging in hyperspectral range

Unique deep neural networks and GPU ultra-fast computing provides cutting-edge machine learning

Integrated Machine Vision solutions tailored to real-time analysis on few samples for super high Quality Control accuracy

Inspection results and performance analysis enables production boost and business transformation

Key Partners

IBM
Multinational information technology company

NVIDIA
Leading world GPU provider

Adobe
Multimedia and creativity software company

Microsoft
Leading information technology company worldwide

INDUSTRIES

SKY ENGINE AI - Applicable Industries

SKY ENGINE — ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE provides integrated solutions in several industries: medicine, manufacturing and agriculture. We enable Smart Manufacturing, Precision Agriculture, and Intelligent Medicine.

**Smart Manufacturing**   **Precision Agriculture**   **Intelligent Medicine**

SKY ENGINE Applications in Machine Vision

SKY ENGINE solutions are available for electronic components inspection such as PCB, mobile device elements including motherboards, etc. Applications in agriculture for food safety: yield defects, weed identification and chemicals used i.e. fertilizers, pesticides. In medicine for automatic lesion recognition in the medical imaging (endoscopy, X-rays).

Manufacturing
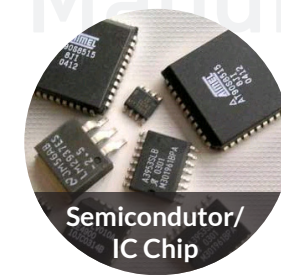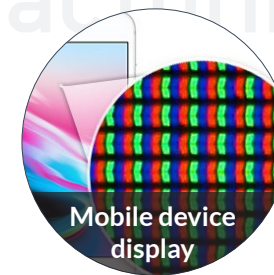
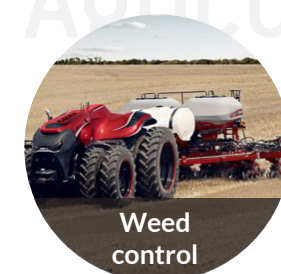Semicondutor/ IC Chip | Mobile device display | Automotive parts | Solar panel cells | PCB
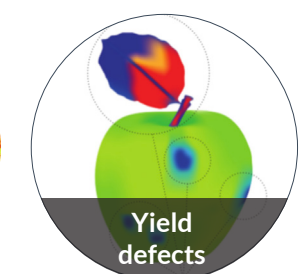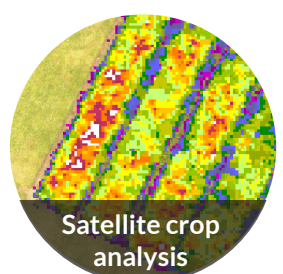
Agriculture

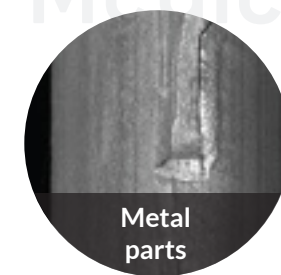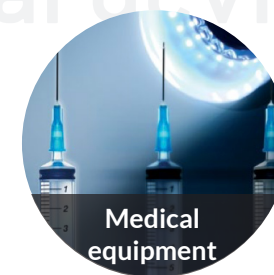Weed control | Crop protection | Agriculture analytics | Yield defects | Satellite crop analysis
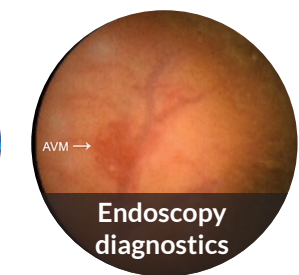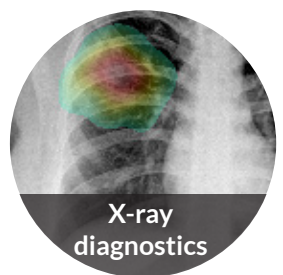
Medical devices

Metal parts | Medical equipment | Drugs discovery | Endoscopy diagnostics | X-ray diagnostics

CASE STUDY / Manufacturing

Electronic devices Printed Circuit Board quality control

SKY ENGINE
ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE is delivering Machine Vision manufacturing solutions to monitor, track, and trace critical data to ensure quality while maximizing productivity using automated electronics assemblies.

Smart self-learning AI for manufacturing industry ensure high inspection accuracy
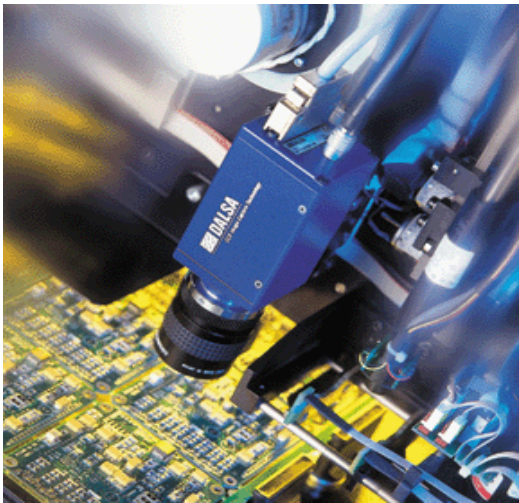
Industry leaders within electronics and semiconductor manufacturing need to enable lean manufacturing, assure quality, and optimize efficient use of resources. SKY ENGINE provides tremendous improvement in accuracy coupling synthetic data generation of diverse industrial images with development of deep learning algorithms specialized in manufacturing industries.

To survive and prosper in today's economy, leading manufacturers must assemble high quality products at the lowest possible cost. The total cost of production must take into account the complete product life cycle including warranty, recalls, and repairs.

$430 Million spent by Sony
to replace faulty batteries in OEM laptops

$1 Billion to extend warranty by Microsoft
for Xbox 360 due to undetected hardware failure

SKY ENGINE solutions: Machine vision system coupled with SKY ENGINE AI and imaging for accurate and automatic defects labeling and recognition to enable self-learning during inspection.

Conventional Machine Vision	SKY ENGINE self-learning AI

No ability to analyze complex images

Irregular images cannot be easily and quickly assessed as it's difficult to manually define defect features and label them.

Low Accuracy

Slight deviation from defined defect criteria leads to reduced inspection accuracy as it is very difficult to recognize defects.

High entry barrier to Inspection Automation

Machine Learning requires large amount of data, unavailable when production task changes hindering adoption process.

Complex image analysis

Our deep learning powered by imaging enables analysis of images in broad spectral range (visible, NIR, SWIR, X-rays).
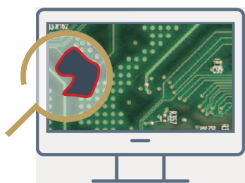
Ultra High Accuracy

SKY ENGINE AI is using first ray-tracing renderer to generate large amount of data for deep learning model training unlocking accuracy.
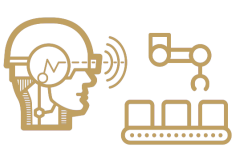
Very low entry barrier to Inspection Automation

Training is using huge amount of labelled data that we generate and image recognition requires only few images with SKY ENGINE AI.

HOW IT WORKS

Smart defects recognition in electronic components

SKY ENGINE
ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE built an automated AI visual inspection system for optimizing quality inspection in manufacturing operations. Our solution automatically detects and classifies defects in objects.

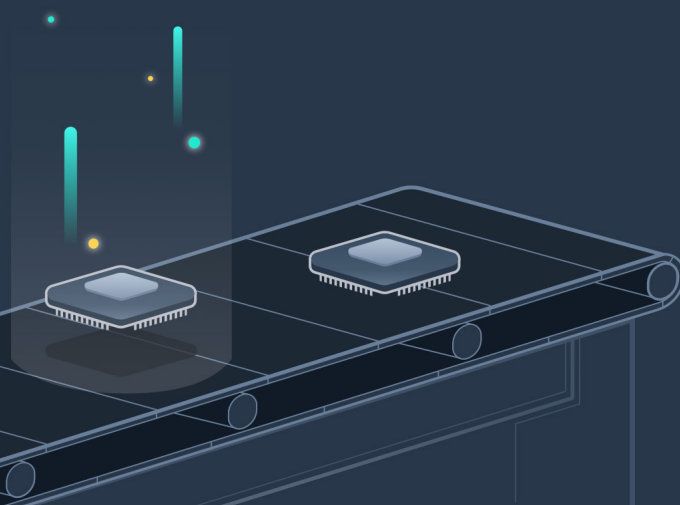## Silicon cracks in PCB automatically and precisely detected

Silicon wafers accumulate residual stress during the growth, sawing, grinding, etching, and polishing process. Cracks may appear during these processes, and if undetected can be rendered as unusable in subsequent manufacturing stages. Therefore, inspecting a raw material substrate for impurities before processing and detecting defects is critical to keep the manufacturing costs down.

Intelligent vision ensures defects detection with high accuracy
infrared imaging detects cracks inside silicon substrate

Silicon is transparent to infrared light. As a result, smart cameras, operating in the SWIR (Short Wave Infra Red) wavelength band, allow to see through semiconductor silicon substrates.

The ability to see **30x faster** than a human with high accuracy through these materials offers great benefit to the manufacturing process as all the defects can be highlighted: **400** objects/minute.

Our solution includes adaptive deep machine learning with new models **2-3 weeks** training on few samples to enable real-time defects recognition.
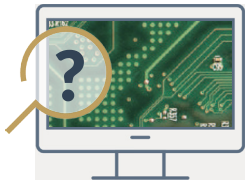
SKY ENGINE AI defects recognition system overview

SKY ENGINE AI dedicated Deep Learning
neural network processing and model training

Few output images required
used for new model network training

Defects recognition
using smart cameras
on assembly line

input images
to deep neural network

images acquired for
real-time defects recognition

3D modeling of the object
and labeled images rendering

New deep neural network modeling minimize amount of data
required by machine vision system for learning of new tasks

CASE STUDY / Agriculture

Crop protection for food safety - Optimize every plant

SKY ENGINE
ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE is providing the next generation of smart agriculture solutions.
We are introducing edge technology, enabling a world in which every plant counts.

Smart farm machines to manage crops at a plant-level for Precision Agriculture

Today, the best practice is to treat all plants as if they have the same needs.
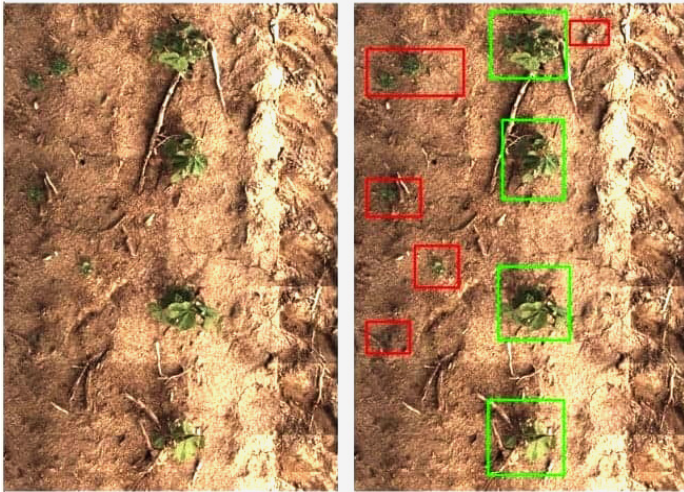SKY ENGINE shifts this paradigm, empowering growers to make every individual plant count at scale.

Using computer vision and artificial intelligence, our smart machines can detect, identify, and make management decisions about every single plant in the field.

Unlocked herbicide options to fight resistant weeds when not spraying crops .

90% lower herbicide costs
when selectively applying herbicide to weeds only

2,5 Billion potential reduction
in global herbicide use (lbs)
with sustainable weed control

SKY ENGINE solutions: precisely spraying herbicides only where needed, and with exactly what's needed.
Smart machines give farmers a new way to control and prevent herbicide-resistant weeds.

Precisely and automatically recognized plants (green)
and weeds (red) using SKY ENGINE AI for herbicide spraying

Optimizing weed control in a world of herbicide resistance
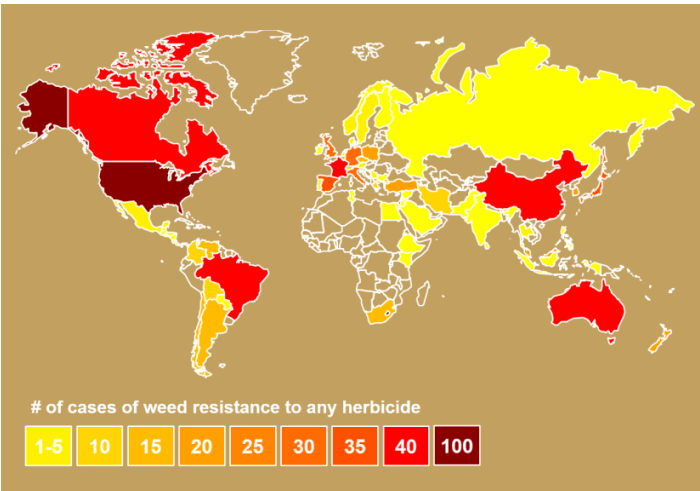
With the rise of herbicide-tolerant weeds, there are fewer and fewer effective solutions. Farmers around the world need a new way to address the weed control challenge.

$25 Billion spent each year

3 billion pounds of herbicides

250 species of resistant weeds

Over reliance on a handful of chemicals is fueling the evolution of herbicide tolerant weeds, making traditional broadcast-sprays less effective at weed control.

# of cases of weed resistance to any herbicide
| 1-5 | 10 | 15 | 20 | 25 | 30 | 35 | 40 | 100 |

HOW IT WORKS

Intelligent weed control

SKY ENGINE
ADVANCING ARTIFICIAL INTELLIGENCE

Precision Agriculture requires accurate AI systems designed by SKY ENGINE AI.
AI crop identification with smart, optimized herbicide and pesticide spraying enable safe food.
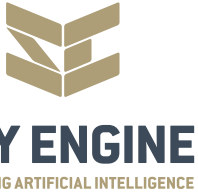
Scan and AI analyse single crops
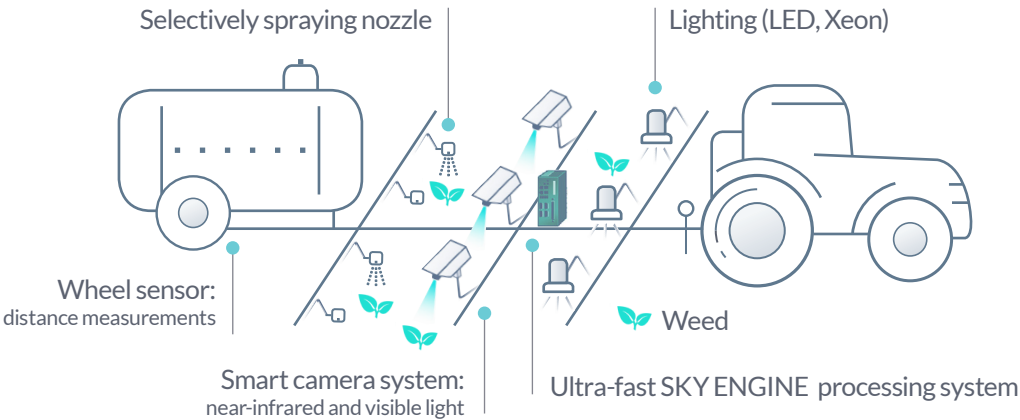and determine the appropriate treatment for each

SKY ENGINE intelligent models using machine vision and machine learning that can distinguish subtle differences between plants and weeds of many species and sizes.

Our plants imaging and 3D rendering is coupled with deep machine learning. It has ability to recognize differences between plants in the conditions that would challenge the human eye.

SKY ENGINE Automated AI weeding system overview

Selectively spraying nozzle

Lighting (LED, Xeon)

Wheel sensor:
distance measurements

Weed

Smart camera system:
near-infrared and visible light

Ultra-fast SKY ENGINE processing system

Autonomous prototype visualization

Smart Spray only weeds with high accuracy
as robotic nozzles target weeds in real time as the machine passes

With great accuracy and precision we can apply herbicide only to weeds, avoiding chemical application on plants or on areas without weeds.

Precise application allows growers to reduce chemical usage by an order of magnitude, and unlocks the ability to use herbicide alternatives to effectively control weeds that would otherwise be resistant.

SKY ENGINE solution includes an additional set of cameras and the ability to automatically check its work as it operates.

We are able to constantly gather data on the tens of thousands of plants in each field, so our software can continue improving in service to the growers.

CASE STUDY / Agriculture

Crop protection for food safety - Analyse plant health and reduce chemicals use

SKY ENGINE

ADVANCING ARTIFICIAL INTELLIGENCE

SKY ENGINE is providing the next generation of smart agriculture solutions.
We are introducing edge technology, enabling a world in which every plant counts.

Precise farming to reduce amount of chemicals: pesticides, fertilizers, herbicides

Today, the best practice is to treat all plants as if they have the same needs.
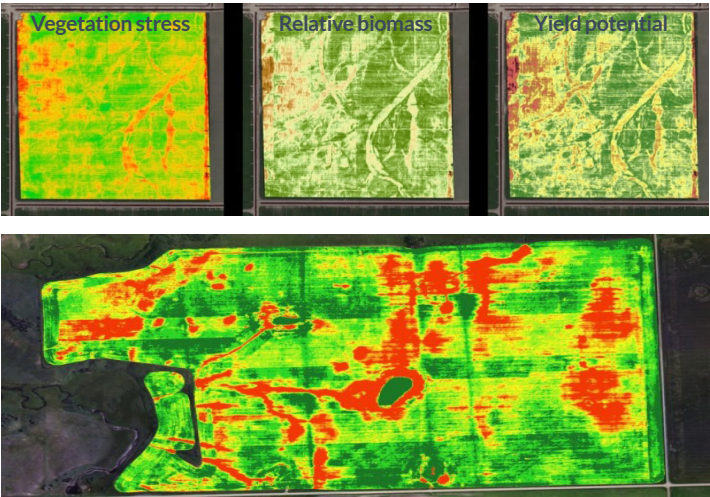SKY ENGINE changes this paradigm, empowering growers to make every individual plant count at scale.

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SKY ENGINE solutions: precisely spraying herbicides only where needed, and with exactly what's needed.
Smart machines give farmers a new way to control and prevent herbicide-resistant weeds.

Top: 1) Vegetation stress map of areas with decreased pigment absorption of sunlight and cell wall constriction; 2) Relative biomass map of areas with thin crop density; 3) Yield potential map combines crop health and biomass info.
Bottom: NDVI map - Normalized Difference Vegetation Index.

Food safety and environmental health on fruits and flower farms
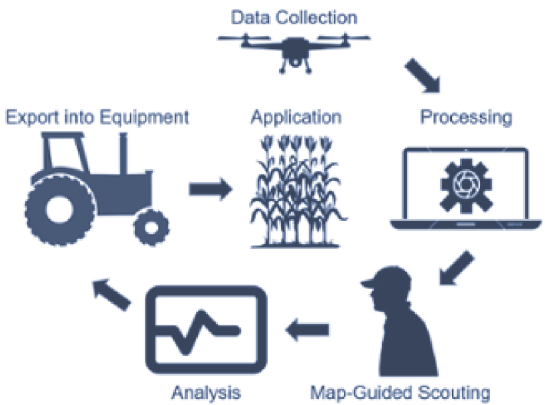
With the rise of herbicide-tolerant weeds, there are fewer and fewer effective solutions. Farmers around the world need a new way to address the weed control challenge.

10 Years to change type of plant

3 billion pounds of herbicides

250 species of resistant weeds

Over reliance on a handful of chemicals is fueling the evolution of herbicide tolerant weeds, making traditional broadcast-sprays less effective at weed control.

HOW IT WORKS

Rapid crop analytics

SKY ENGINE

ADVANCING ARTIFICIAL INTELLIGENCE

Precision Agriculture requires accurate AI systems designed by SKY ENGINE.
AI crop identification with smart, optimized herbicide and pesticide spraying enable safe food.
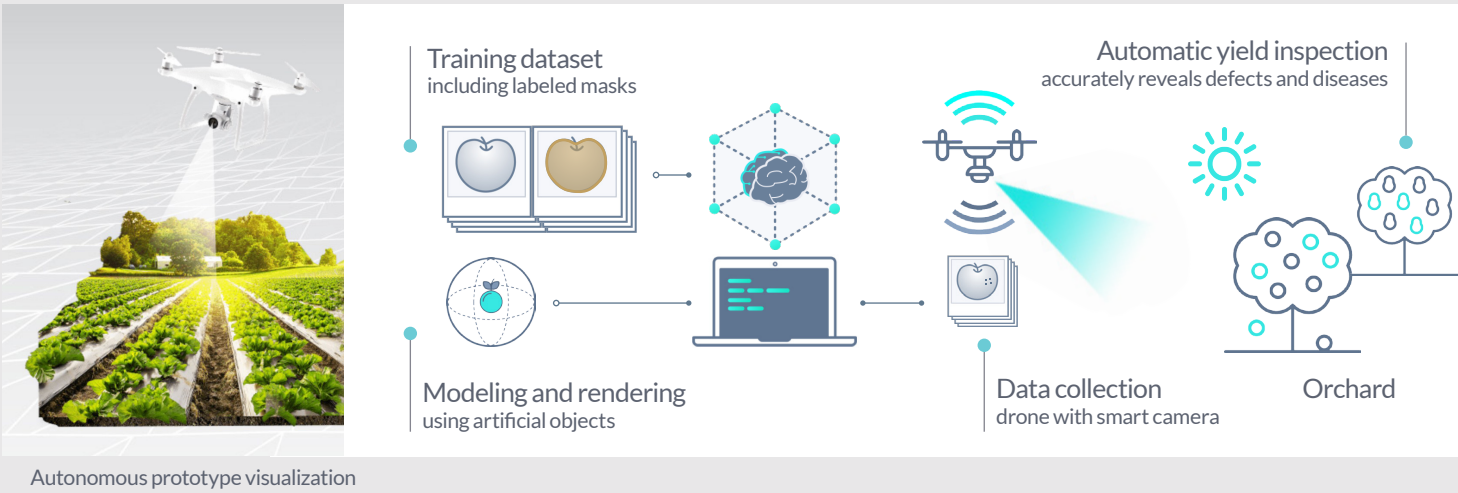
Scan and AI evaluate every fruit
and determine the status of each and chemicals used

SKY ENGINE provides automatic yield inspection, counting, classification and reveals defects also undetectable for human sight: discoloration, mold, ripeness, misshapes, bruising, pestes & disease.

SKY ENGINE hyperspectral imaging and synthetic rendering with AI engine allows analysis of crops to reduce the amount of chemicals and to enable safe food.

SKY ENGINE Automated AI crops analytics overview

Training dataset
including labeled masks

Automatic yield inspection
accurately reveals defects and diseases

Modeling and rendering
using artificial objects

Data collection
drone with smart camera

Orchard

Autonomous prototype visualization

Precisely Detect different types of defects and chemicals
to greatly reduce amount of required pesticides, fertilizers

Rapid crops analytics enable informed decision process and fast reaction to the changing crop conditions providing efficient costs planning.

Precise application allows growers to reduce chemical usage by an order of magnitude, and unlocks the ability to use herbicide alternatives to effectively control weeds that would otherwise be resistant.

SKY ENGINE solution includes an additional set of cameras and the ability to automatically check its work as it operates.

We are able to constantly gather data on the tens of thousands of plants in each field, so our software can continue improving in service to the growers.

molds   bruising
discoloration   pests
disease
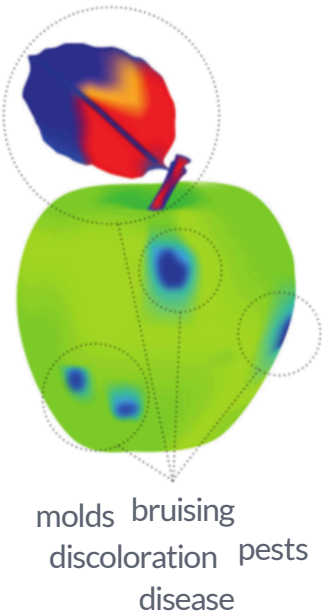
CASE STUDY / Medical devices

Cancer detection powered by SKY ENGINE AI

SKY ENGINE is delveloping state-of-the-art endoscopic imaging for automatic, real-time diagnostics to visually detect pre-malignant lesions and early cancers in the gastrointestinal (GI) tract.

Intelligent lesion differentiation using capsule endoscopy imaging

Currently, the detection and diagnosis of early GI cancer depends upon the accurate interpretation of visual data presented to the physician during gastrointestinal tract cancer screening using endoscopy equipment.

Most studies* suggest that the community of endoscopists does not reach levels of accuracy of recognition and characterization of tumours after resection, that meet the guidelines for high confidence optical diagnosis.

*) American Society for Gastrointestinal Endoscopy PIVI (Preservation and Incorporation of Valuable Endoscopic Innovations)

Increased detection accuracy leads to costs reduction.

$1 Billion cost savings
on the diagnosis and treatment (US alone)

25-40% miss rate for adenoma
as detection is still sub-optimal

SKY ENGINE solutions: Environment of ever increasing amounts of data lends itself to the use of deep learning techniques where the subjectivity in, for example, optical biopsy assessment by endoscopists can be circumvented by computer based automated tools.
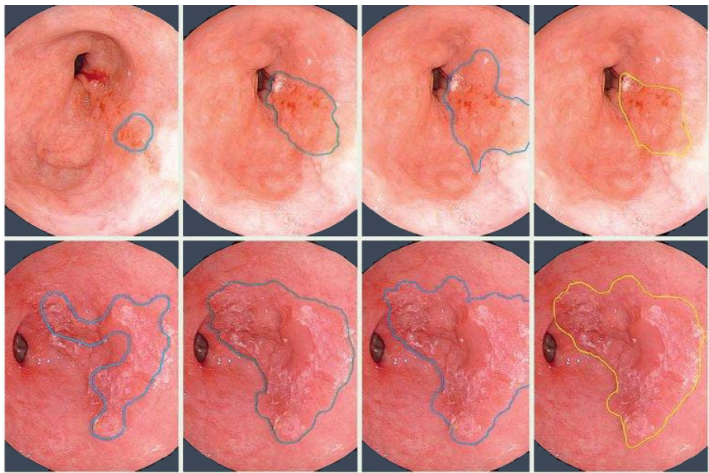
Automated detection of early neoplastic lesions in Barett's esophagus (malignant region is outlined).

SKY ENGINE Artificial intelligence helps in predicting the need for additional surgery after endoscopic resection of T1 colorectal cancer**
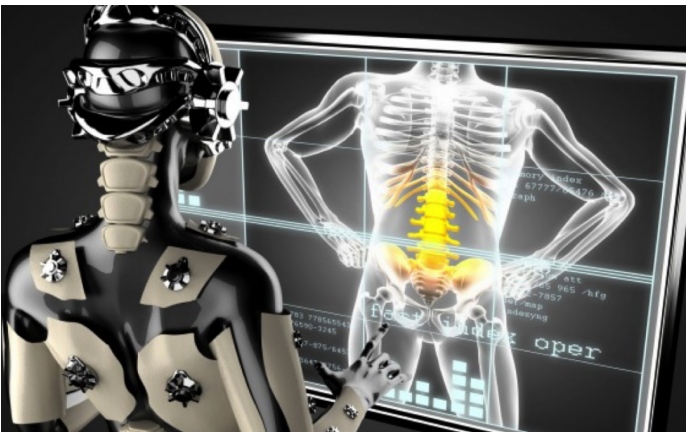
Decisions concerning additional surgery after endoscopic resection of T1 colorectal cancer (CRC) are difficult because preoperative prediction of lymph node metastasis (LNM) is problematic.

Compared with current guidelines, artificial intelligence significantly reduced unnecessary additional surgery after endoscopic resection of T1 CRC without missing LNM positivity.

**) Ichimasa et al. Endoscopy. 2018 Mar;50(3):230-240.

HOW IT WORKS

Real-time cancer diagnostics

Intelligent Medicine is supported in the fight against GI cancer by applying SKY ENGINE AI, with its recent deep learning techniques, which will be a game changer in medical image analysis.
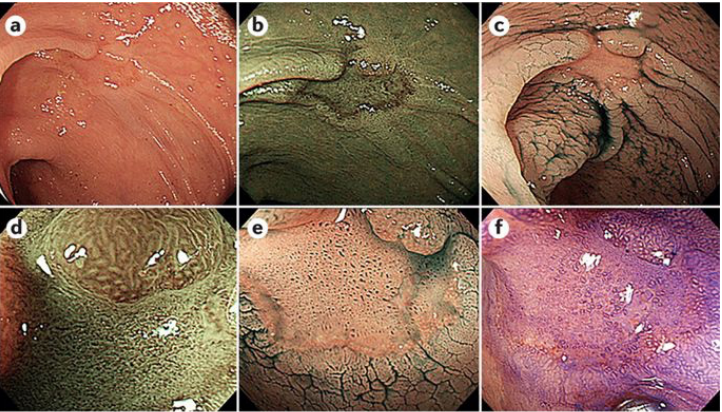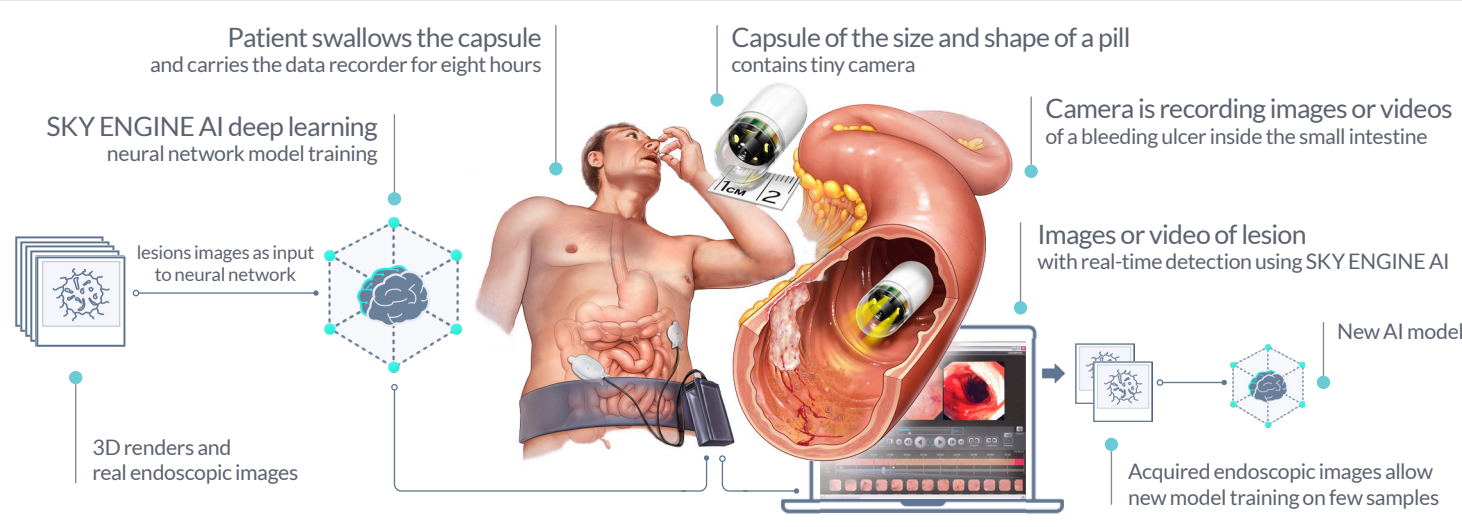
Deep Learning training on IEE data
IEE - Image Enhanced Endoscopy

SKY ENGINE enables neural networks training on IEE data, so any modality of Optical Biopsy can be supported:

- Chromoendoscopy
- Virtual chromoendoscopy: NBI, iScan, FICE, Spies, BLI, LCI
- Magnification endoscopy
- Confocal laser endoscopy: probe based or scope based
- Endocytoscopy (EC)
- HD scopes
- OCT/VLE
- Molecular Imaging

SKY ENGINE Automated AI disease detection system

Patient swallows the capsule and carries the data recorder for eight hours

Capsule of the size and shape of a pill contains tiny camera

SKY ENGINE AI deep learning neural network model training

Camera is recording images or videos of a bleeding ulcer inside the small intestine

lesions images as input to neural network

Images or video of lesion with real-time detection using SKY ENGINE AI

New AI model

3D renders and real endoscopic images

Acquired endoscopic images allow new model training on few samples

Detect & Mark disease with top precision
as SKY ENGINE AI neural network models are trained with self-generated big data

Accuracy of automatic lesion detection depends on the amount of data used for training of the deep learning model.

Precise recognition of malignant tissue allows to reduce follow-up diagnostics and treatment costs.

SKY ENGINE solution includes very-first self-learning AI system to generate large amount of training data. Image recognition can be cloud-based and data quickly available for Physician.

SKY ENGINE assistance in diagnosis can expand the availability of the endoscopy procedure to the general population.