Deagle

Developing Ideas.

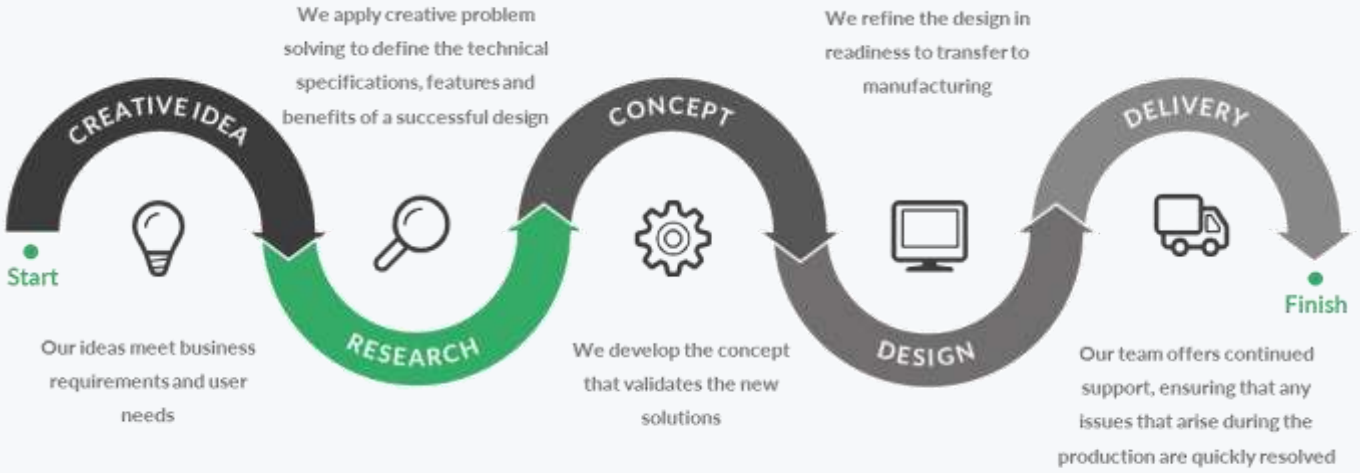
AI in Aircraft Maintenance

deagle.it

DEAGLE

Digital, sustainable, global.

Deagle is an Innovative Start-up founded by a team of managers and engineers, combining their experience in high technology fields



DEAGLE

Digital, sustainable, global.

AEROSPACE

Engineering

Certification & Prototype

Manufacturing & Integration

INDUSTRIAL INNOVATION

Research and development

Pre-industrialization

Automation

Artificial Intelligence

Product support

RENEWABLE ENERGY

Eco Friendly

Innovative

Flexible solution

ARTIFICIAL INTELLIGENCE PLATFORM

Deagle is able to merge the high potentiality tools based on Artificial Intelligence in many fields of application varying from **medical sector products to industrial applications**, whose technical background is firmly owned by Deagle team.

Deagle uses cutting edge **machine learning** and **artificial intelligence** to rapidly and repeatedly deliver customer insights and advantages from his own data, to have the predictive power needed to drive change and innovation. developing customized platform of data analytics, based on his property AI engines,

Requirements → Design → Develop → Testing → Deployment

This leads to:

- increase resilience;
- speed up recovery procedures;
- reduce exposure risk due to security systems;
- decrease the impact of critical events;
- respond quickly to any kind of thread;
- turn critical situations into new opportunities

ARTIFICIAL INTELLIGENCE: PAST EXPERIENCE

IN STORE ANALYTICS

HOLMeS: Medical Disease Prediction

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-support medical decision
-integrate the platform with nano-device
-collaborate and interact with health organizations
-active health monitoring

HORUS project – Bando 2 Meditech

The HORUS project aims to develop a technological solution capable of identifying and validating new aircraft fuselage **inspection** procedures.

The solution is based on image processing technology, and the idea behind the project is to use **automatic** devices for **visual inspections** in a process that drastically reduces the time to complete such tasks.

meditech COMPETENCE CENTER

PON IMPRESE E COMPETITIVITÀ INIZIATIVA PMI 2014-20
Riaccendiamo lo sviluppo

UNIONE EUROPEA
Fondo europeo di sviluppo regionale

Deagle — Leader – AI, Engineering, Automation

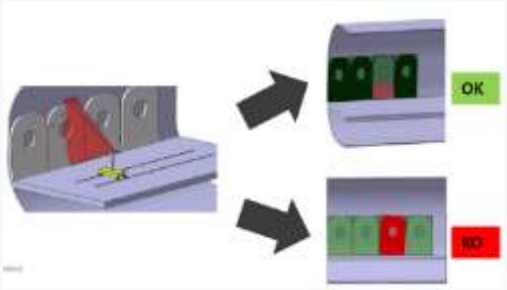
Atitech BEYOND FLIGHT — Industrial Partner– Aircraft Maintenance

ARIA — Partner – Experimental measurement, Engineering

Other Actors

meditech COMPETENCE CENTER

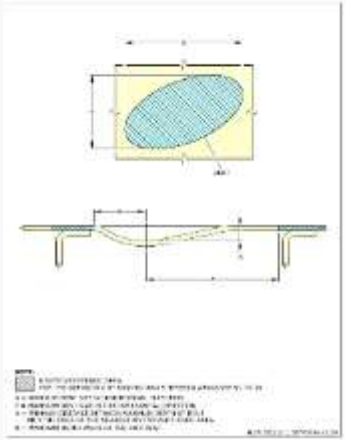
HORUS project - Objectives

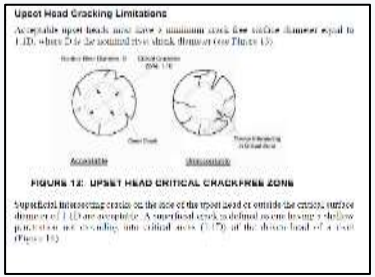


Before HORUS	After HORUS
standard approach for quality/maintenance management	automatic quality/maintenance evaluation system
visual inspection of the aircraft by expert technicians	automatic aircraft verification
general, not specific, requirements for image processing	ability to define image processing requirements to improve industrial production
very preliminary application of image processing to resolve manufacturing nonconformities	HW identification and SW development for image processing systems aimed at production assistance

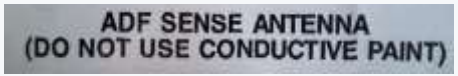
HORUS project - Requirements

- Definition of requirements for each type of defect
  - ✓ absence of rivet
  - ✓ scratches
  - ✓ writings/decals missing or damaged
  - ✓ dents



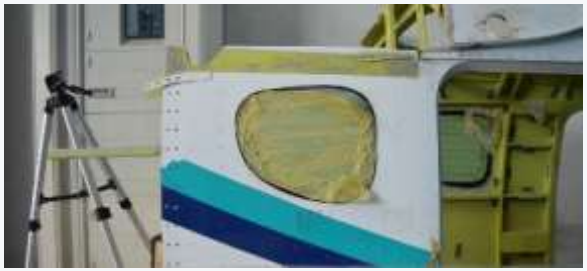


- Selection of typical components to carry out inspections and calibration of the system



HORUS project – Experimental environment

Image acquisition phase of defects making use of the collaboration of **Meditech (CESMA),** whose laboratory hosts a full-scale fuselage section of an A320, as well as an almost intact fuselage of an AG P2006 aircraft, on which it was possible to reproduce typical defects



HORUS project – Acquisition campaign

- The acquisition equipment for this first phase is a Nikon 3200 **digital reflex camera**, Pixel 24M, 23.2x15.4mm2 CMOS sensor, which gives the opportunity to acquire images with different technical characteristics (focal length, aperture, artificial light from flash or not , shutter speed,..) to identify the limits and ideal operating range for the recognition software.

NOME FOTO	SOGGETTO	DISTANZA (CAMERA-TARGET)	LUNGHEZZA FOCALE	ILLUMINAZIONE
foto_0001.JPG	Pannello rivettato, fusoliera	30 cm	18 mm	NO flash
foto_0002.JPG	Pannello rivettato, fusoliera	30 cm	18 mm	flash
foto_0003.JPG	Pannello rivettato, fusoliera	30 cm	18 mm	Luce naturale
foto_0004.JPG	Pannello rivettato, fusoliera	80 cm	55 mm	NO flash
foto_0005.JPG	Pannello rivettato, fusoliera	80 cm	55 mm	flash
foto_0006.JPG	Pannello rivettato, fusoliera	80 cm	55 mm	Luce naturale
foto_0007.JPG	Pannello rivettato, fusoliera	80 cm	18 mm	NO flash
foto_0008.JPG	Pannello rivettato, fusoliera	80 cm	18 mm	flash
foto_0009.JPG	Pannello rivettato, fusoliera	80 cm	18 mm	Luce naturale

Rivet

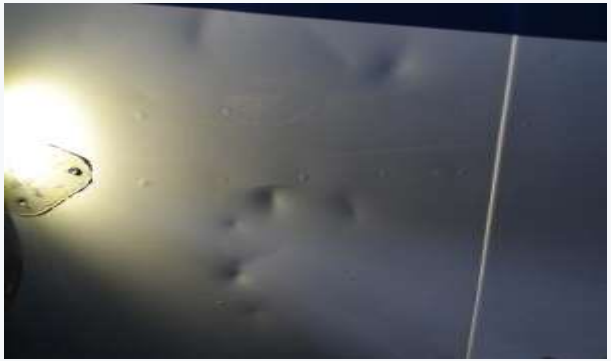
Missing Rivet

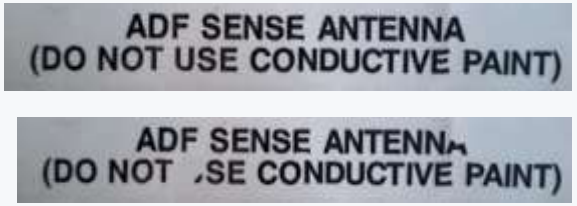
- In the next phase, the acquisition system will be degraded to make it suitable for **commercial application** and to be easily transported by an automatic system in the aircraft fuselage, therefore the actual software training campaign will be repeated and in-depth based on images from a smartphone or Go-Pro like instrument.

HORUS project – Typical defects

Scratch

Dents





Labels

Missing Rivets

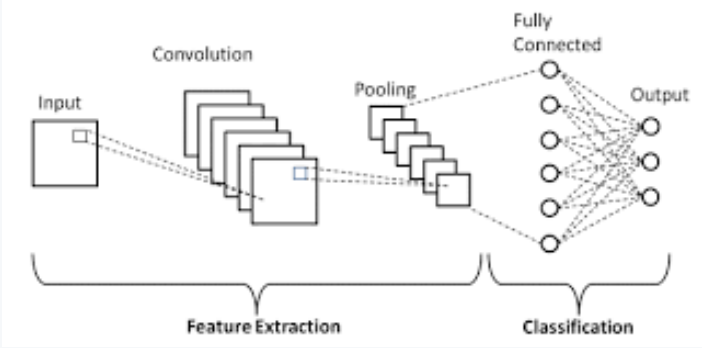
HORUS project – Algorithms development

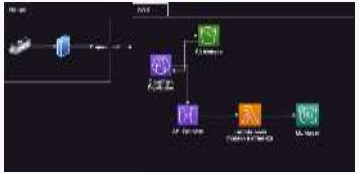
Architecture: LeNet model, by mixing convolutional layers with pooling up to fully connected layer linked to neurons for class prediction.

Training: Model has been trained with Grid Search method, by using 100 epochs to find the optimal iperparameters and monitoring the accuracy of classification, the loss function and other relevant parameters for image classification. Adam has been used as optimizer.

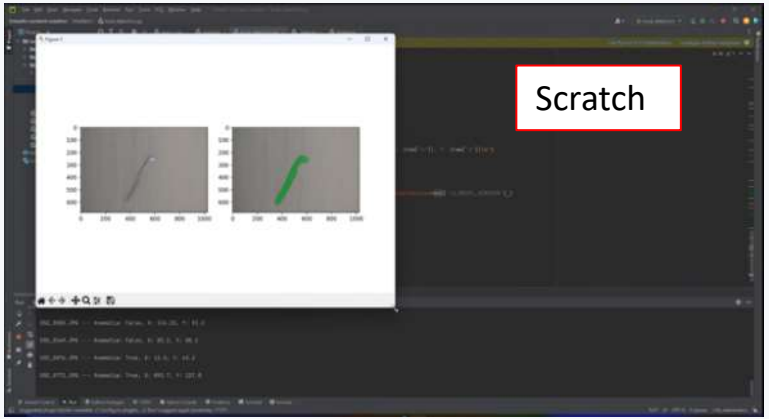
Development Pipeline: Python script has been used to get images from dataset, store in a buffer memory, make a shuffle of images categories to avoid memory of the sequence of defects.

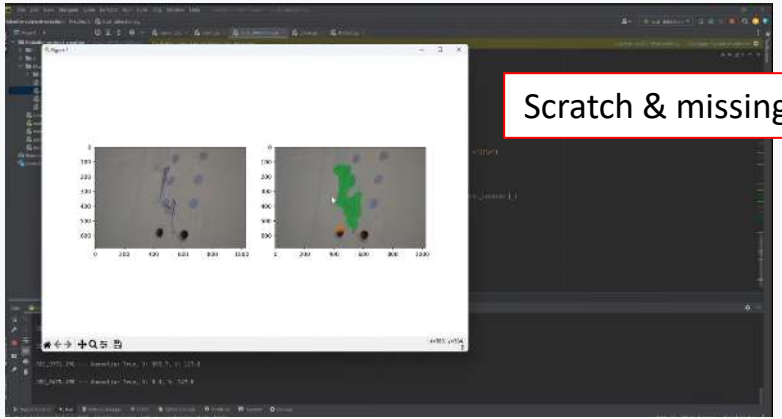
Production Pipeline: edge server to prepare images and transmit to backend through API to reduce progressing latency

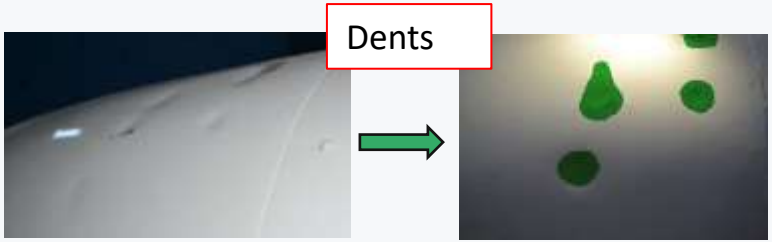




HORUS project - Identification of defects



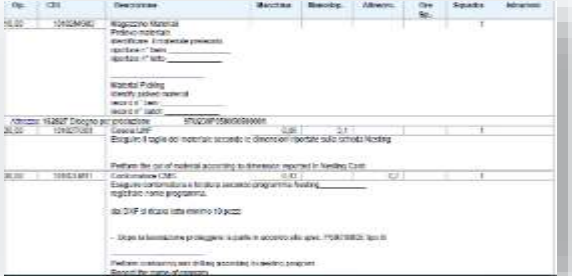




NEXT STEPS

- ***Video acquisition and image extraction*** *for spatial referencing and defects recognition.*
  - ✓ Analysis on distorted/blurry photos has shown a good capability of defect detection

- ***Issuing of technical disposition and router card***
  - ✓ *Training* on existing technical disposition on aeronautical parts (in-service defects)
  - ✓ *Correlation* between technical disposition and structured-text repair/rework/scrap route cards



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