AI-BASED CLASSIFICATION OF GEMSTONE'S AUTHENTICITY AND ORIGIN

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CSEM AT A GLANCE

We are a public-private, non-profit, Swiss technology innovation center

We enable competitiveness through innovation by developing and transferring world-class technologies to industry

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LASTING CUSTOMER IMPACT THROUGH

Applied research: We develop next-generation technologies with the potential to transform industries and improve people's lives

Tech transfer: We customize and develop new products, processes, and services with our clients that address their unique needs

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THE DIGITAL "SUPER-EXPERT" PUTTING GEMSTONES UNDER THE MICROSCOPE

Determining if a gemstone is authentic and what it is worth requires years of experience and extensive specialist knowledge. CSEM has partnered with Gübelin's Gem Lab in Lucerne, CH, to finalize work on a high-performance AI authentication solution. In the future, this digital "super-expert" will work together with human experts to analyze gemstones.

WHAT DEFINES THE VALUE OF A GEMSTONE?

Origin!

sold at auction for
US$ 6,900,000

(same stones from **Madagascar**:
below US$ 1,000,000)

Bracelet with nine sapphires
from **Kashmir**

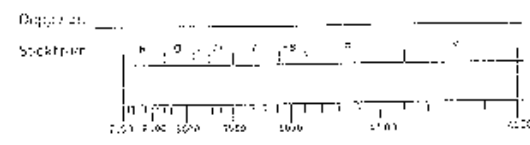# WHAT DEFINES THE VALUE OF A GEMSTONE?

Treatments!

Weight:	5.14 ct
Species:	Natural ruby
Origin:	Burma
Sold for:	**US$ 600'000**
Condition:	Untreated

Weight:	5.62 ct
Species:	Natural ruby
Origin:	Burma
Sold for:	**US$ 30'000**
Condition:	**Heated**

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Auftrag: **J.S.S. De YOUNG** (of 135) — Date due

Gegenstand: one faceted gemstone (tested in the mounting) set in a — Start date

yellow metal ring with fourteen round diamonds — Date out

Gewicht: approximately 8.5 ct — Recheck ex-

Abmessungen: approximately 12.08 × 10.60 × 7.05 form octagonal — Databank search

Schiller / Glanz: Step cut

Durchsichtigkeit: tp.

Farbe DIN 6164 HR: DL brownish green   IL greyish purple (brownish) purple

Sättigung: mid

Dunkelstufe: mid t.

Pleochroismus: in comparison to

Dichte g/cm³: n.a.   DT Hematite also

Brechzahl: c. 1.748

Stockkarte: [spectrum scale]

UV 366 nm: none (?)

UV 254 nm: none

Filter:

Chelsea Filter:

Mikroskopischer Befund: natural-looking healed fissures

light and angular growth structures

some dust particles and dust veils

some tp. to sa at one end

few rutile short rutile needles (or channels?)

Merkmale:

Spezies: NAT CHRYSOBERYL ✓   Herkunft: no origin, Sri Lanka prob.

Varietät: ALEXANDRITE ✓

Bemerkungen: Comment: Strong colour-change   no residues SL from UV/VIS/NIR spec.

Literatur Ref: EXO: 1748/38%/9 in YG ring   infrared chemistry: SL (Fe, Ga, V)

ACdb-1798 Aldb 765

OPTICAL SPECTROSCOPY (UV, FTIR)
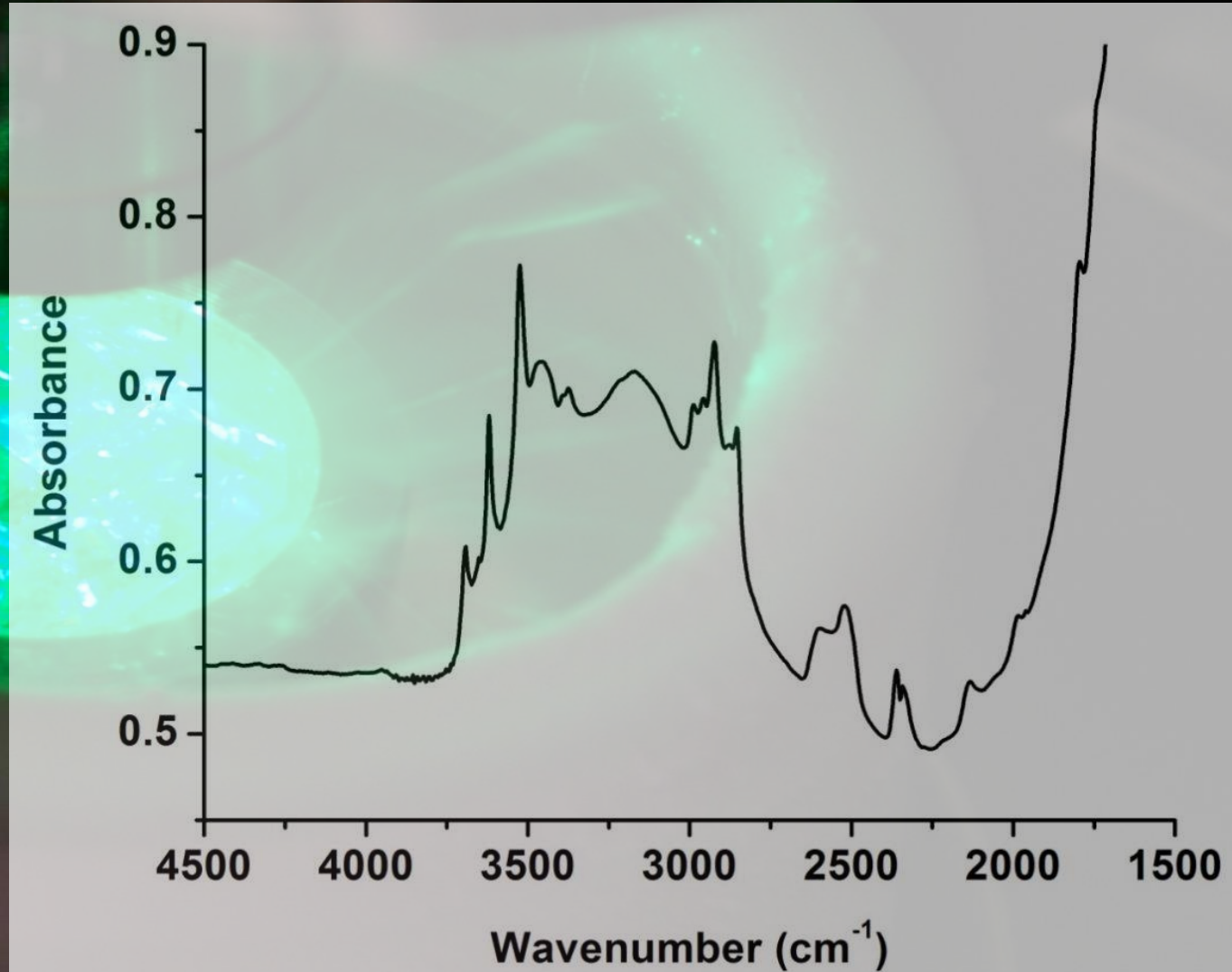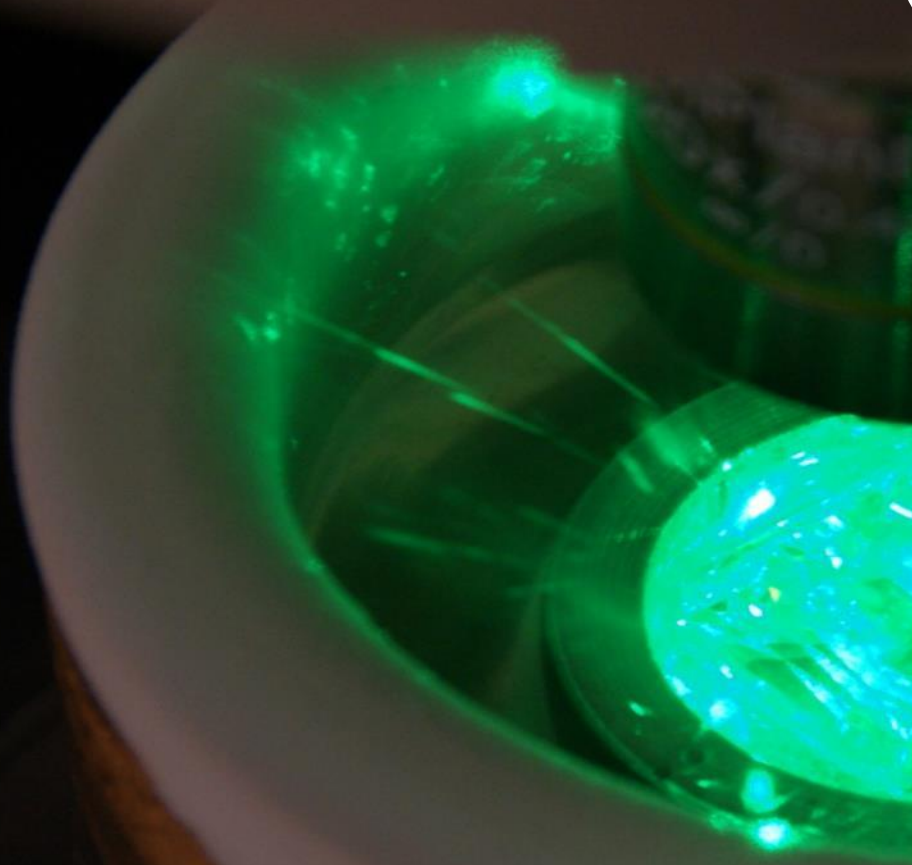
CHEMICAL FINGERPRINTING (XRF, ICP-MS)
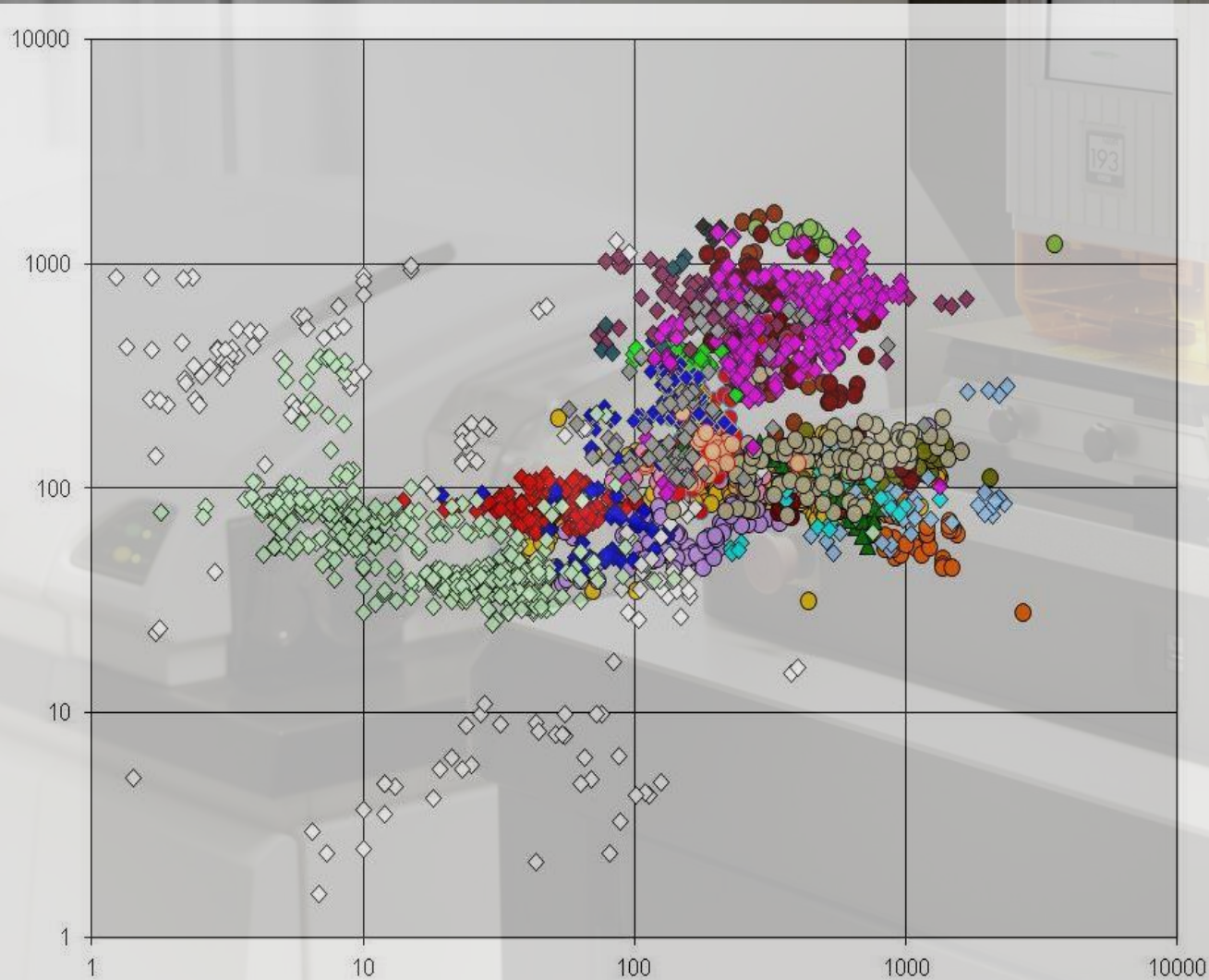
EXPERT EXPERIENCE INTO AI SOFTWARE

Gemstone

Light microscope → Expert report

Optical Spectrometer FTIR / UV-Vis → Optical spectrum

Chemical Spectrometer EDXF / ICP MS → Chemical spectrum

Multimodal Classification

Origin

real / fake

(un-) treated

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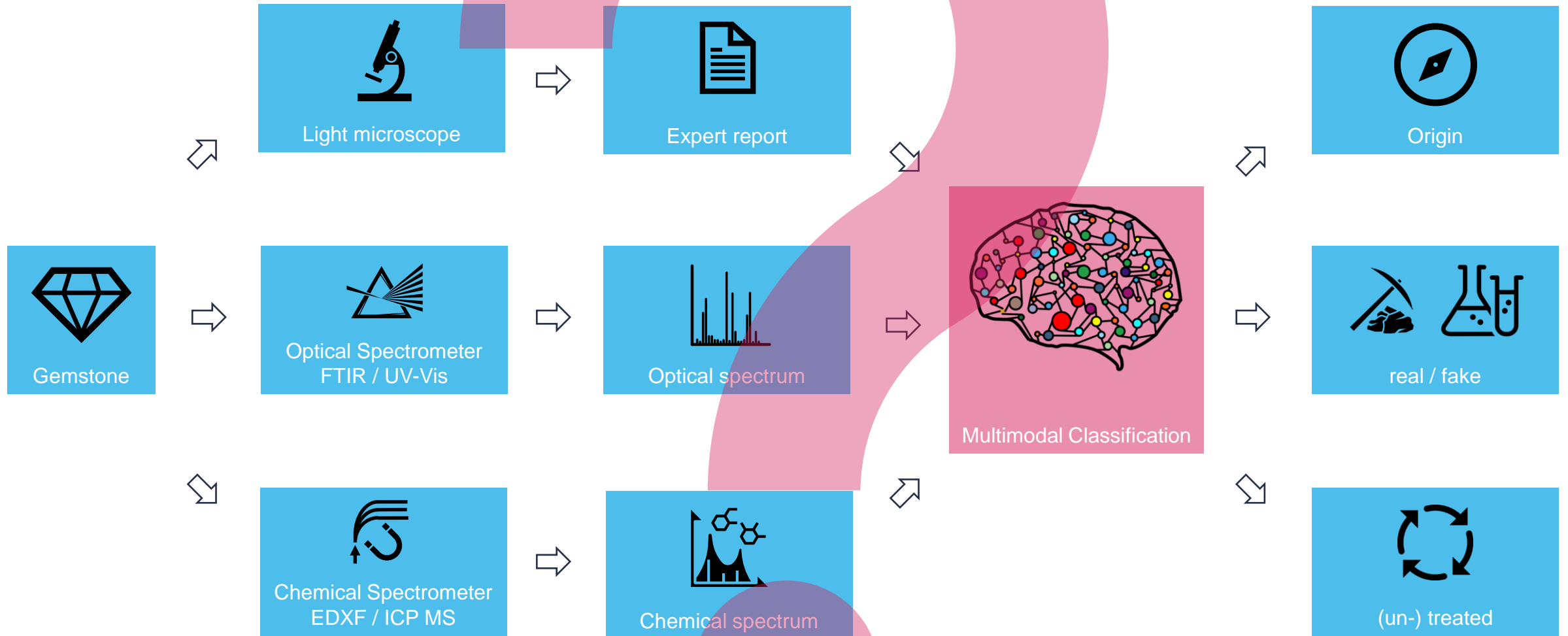
A FLEXIBLE DEEP LEARNING ASSISTIVE SOLUTION

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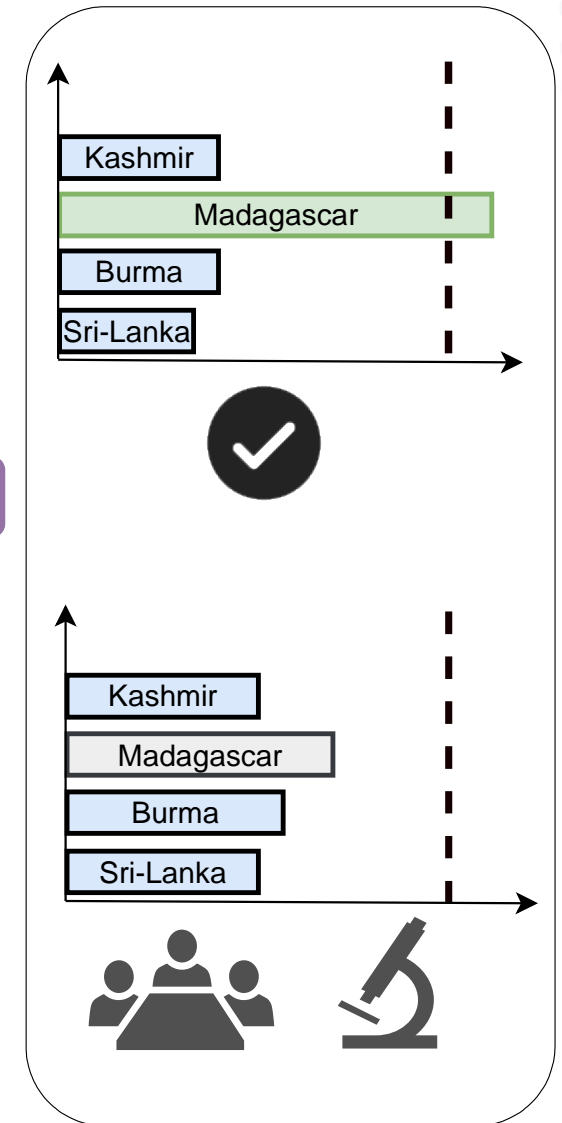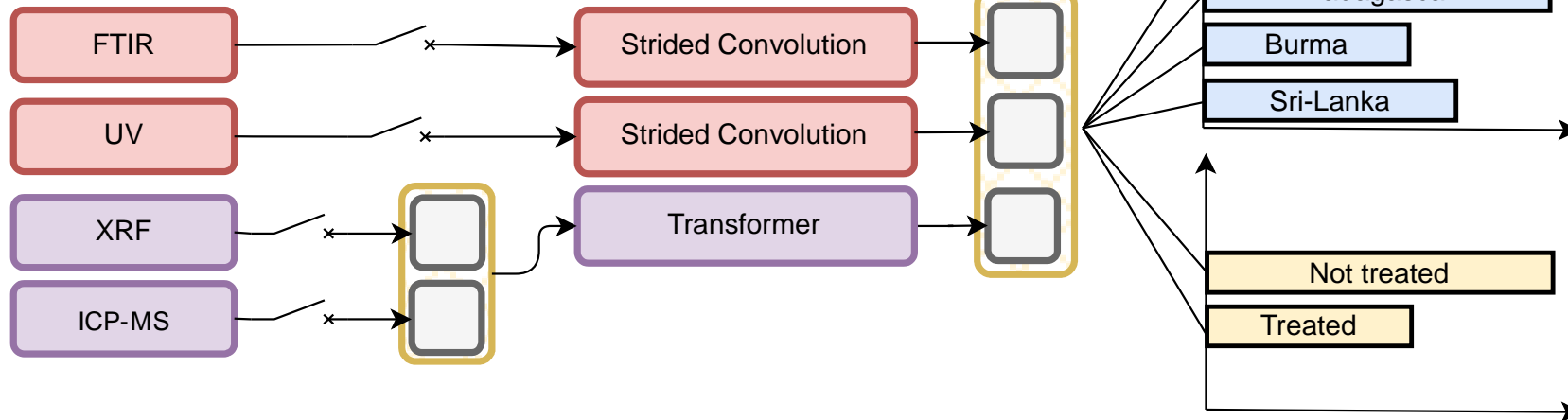
BUILDING A GEMSTONE SUPER-EXPERT

R&D

Español Français
By Serge Maillard
MARCH 2021

Far greater volumes of gemstones, evaluated automatically? This is the promise offered by Swiss jewellery house Gübelin, which has joined forces with CSEM to develop a revolutionary data processing tool using artificial intelligence and machine learning. This new technology also opens up some exciting prospects for the watchmaking industry.


DECEMBER 13, 2022

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GEMTELLIGENCE: ARTIFICIAL INTELLIGENCE IS A GEM'S BEST FRIEND
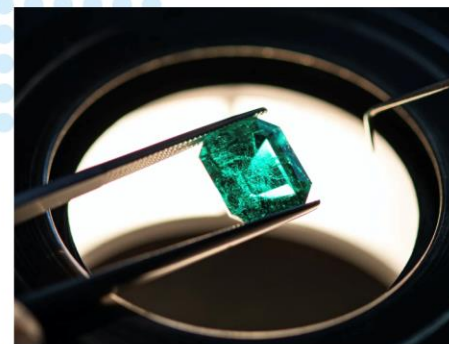
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FAKE OR FORTUNE: UNCOVERING THE VALUE OF GEMSTONES

The gemstone industry is a treasure trove of sparkling allure and brilliant worth, making gemstones a unique and valuable investment. To understand gemstones' financial value, experts must first accurately identify and authenticate them. Professional gemstone authentication is a long-established process, and it can take up to six years to train a gemologist in the trade's intricacies, including determining a gemstone's type, origin, or possible treatment.

Today, the **Gübelin Gem Lab** uses Gemtelligence, the artificial intelligence (AI) technology it developed in collaboration with CSEM in its authentication processes to complement its human experts. Gemtelligence uses deep learning models trained on multiple data sets to help Gübelin's experts determine gemstones' identity,

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PERFECT QUALITY!

source: www.siemens.com
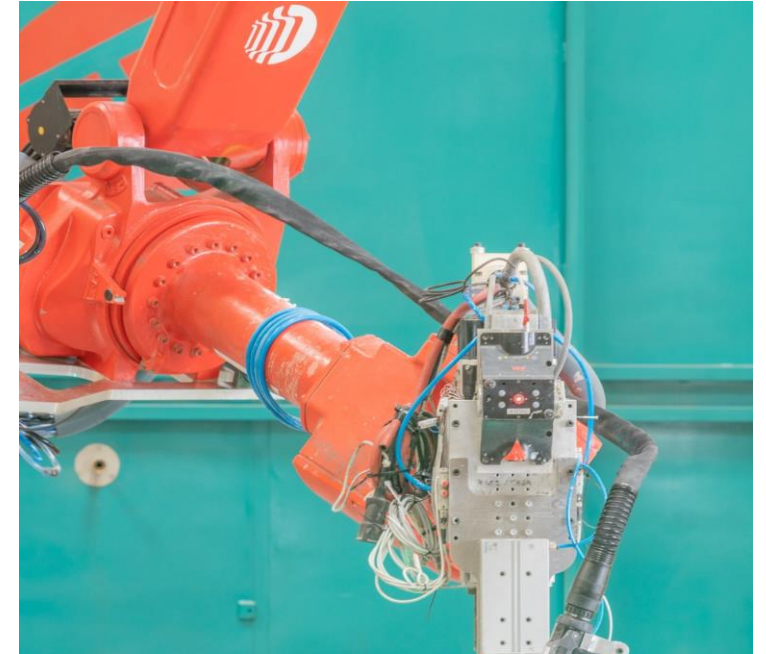
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DEEP LEARNING FOR INDUSTRY
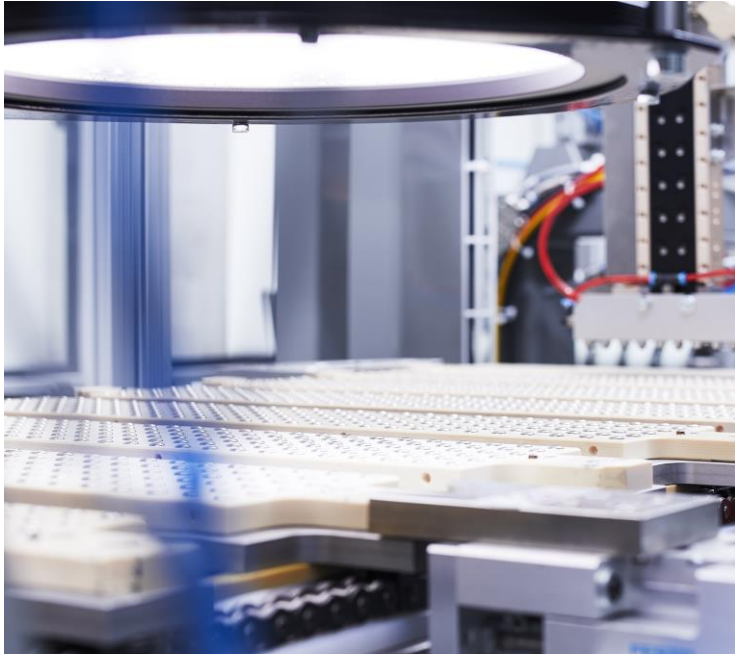
Quality & Process Control

2D/3D inline inspection
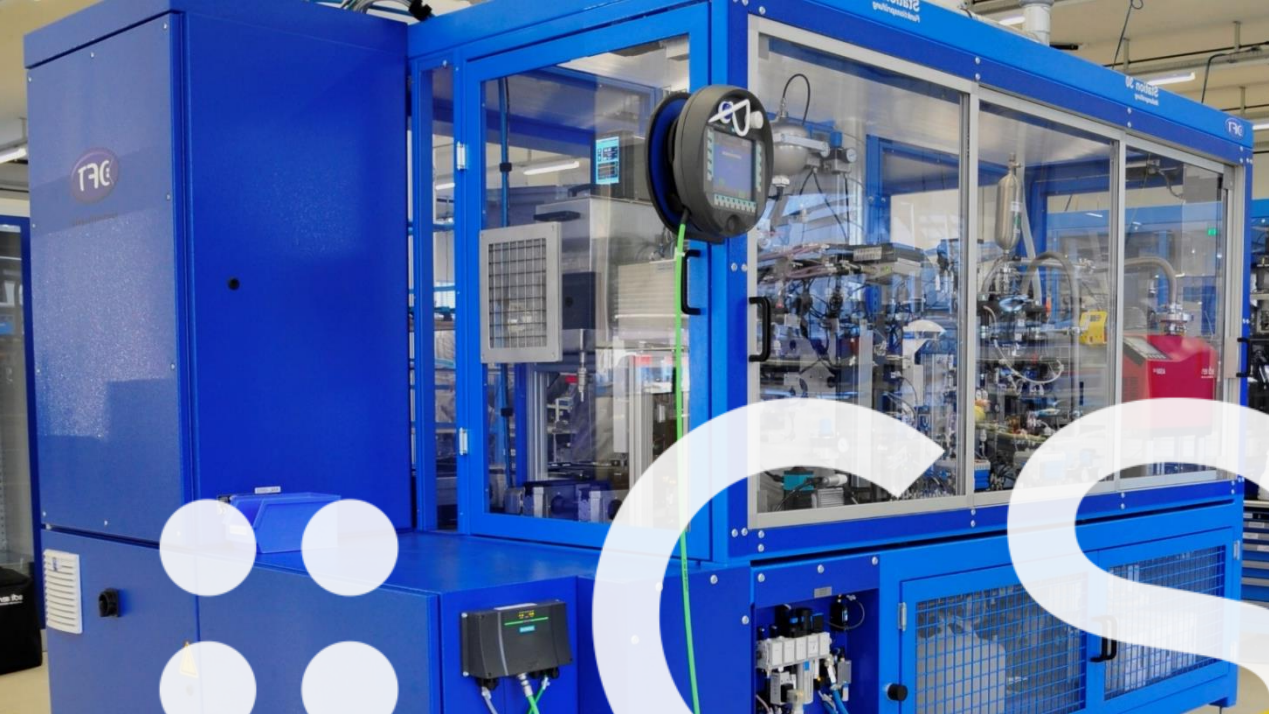
Multimodal data

Data driven optimization

Predictive Analytics

Machine health monitoring

Predictive quality

Complex system modelling

Cognitive Robotics

Smart human-robot interaction

From sensing to awareness

Agile, customized production

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FACING THE CHALLENGES OF OUR TIME

Photo by Pilatus Aircraft Ltd

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