



Machine Vision in Greece

Vassilis Spais
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Presenter



Vassilis Spais (Dipl. Eng) is a Business Development Manager with INOS Hellas S.A., fully owned subsidiary of inos Automationssoftware GmbH

I am working in pursuing opportunities in the domain of machine vision and robotics applications targeted to automotive assembly and inspection. In the past I have worked in robotics, machine learning and systems modelling, military systems, medical devices, vehicles, digital electronics, factory automation, industrial operations optimization, multidisciplinary design and engineering, information technology systems integration, green power, sensor systems, waste treatment and evolutionary multi-objective optimization. I received the Diploma in Electrical Engineering from the Aristotle University of Thessaloniki.

Outline

- 01 Greece – History and Economy
- 02 Academic Computer Vision Research in Greece
- 03 Industrial Machine Vision Activity in Greece

Greece – The Country



Greece:

History and Economy

A Long History



From prehistory to the Romans

- Cycladic civilization, Minoan civilization, Mycenaean Greece, Doric invasion
- Olympic Games 776 BC, Archaic period, Colonization of Southern Italy and France, Rise of democracy, Battle of Marathon 490 BC, Pericles, Alexander the Great, Hellenistic period, Roman era



Between East and West

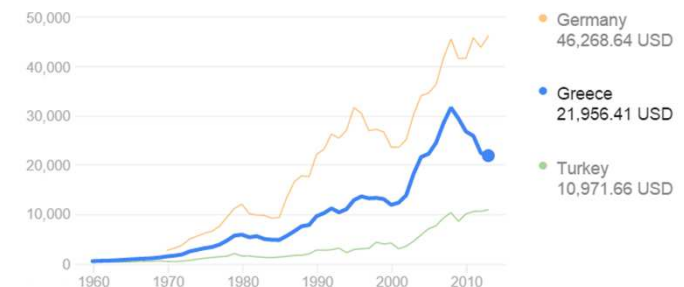
- Byzantine empire, Latin states, Ottoman empire (1453-)
- War of independence, Modern Greece 1830
- First Hellenic Republic, Otto of Greece, Constitution of 1843, Territorial enlargement, Balkan wars, WW1, Population exchange, WW2, Civil war

European Era

- Post war growth, Emigration, Textiles, chemicals, metals and construction, Military dictatorship, Absolution of monarchy, EC in 1981, Population aging (Fertility < 2.1 from 1982)
- Middle class expansion, EU transfers, De-industrialization, Immigration, Joined Euro in 2001, Globalization, 2004 Olympic Games, Overexpansion, Greek Crisis 2009

21,956.41 USD (2013)

Greece, GDP per capita



Some of the things we owe to Greece



Greece, one of the pillars of Western Civilization

- Democracy and Politics
- Philosophy and History
- Geometry and Math
- Athletics, Marathon and Olympic games
- Alexander the Great and Hellenism
- Drama and Comedy
- Public Juries
- Homer and Epic Poetry
- Scientific Terms

Greek Economy Overview (2014)



Overall Economy Structure

- **Agriculture:** 3.5%
 - **Industry:** 15.9%
 - **Services:** 80.6% (2014 est.)
- Source: CIA world fact book

Major Indicators (2014 projected)

IOBE, Foundation for Economic and Industrial Research and
www.investingreece.gov.gr

- GDP 179 billion euro, -1.84% from 2013
- The average unemployment rate in 2014 overall was approximately 26.4%, more than one percentage point lower than in 2013 (27.5%). Youth unemployment however exceeds 50%
- Total exports were 22.325 Billion €, down 3.3% from 2013 but Industrial product exports were up 2.9%
- Imports were 47.7 Billion €
- Investment was 1.3% up from 2013. However Net Foreign Direct Investment (FDI) inflows decreased by 22.9% in comparison to 2013 but was 20.9% higher than 2012

Greek Economy Exports (2014)



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Exports from Greece

Exports per 1-digit product classification in current prices (millions of €, provisional data)
January – October, 2014 and 2013

Product	Value (millions of €)		Change 2014/2013	Share of total (%)	
	2014	2013		2014	2013
Agricultural Products	3,723.4	4,021.4	-7.4%	16.7%	17.4%
Food and living animals	3,062.7	3,019.9	1.4%	13.7%	13.1%
Beverages and tobacco	461.8	479.3	-3.7%	2.1%	2.1%
Animal or natural oils and fats	198.9	522.1	-61.9%	0.9%	2.3%
Raw materials	785.4	872.6	-10.0%	3.5%	3.8%
Crude materials excluding food and fuel	785.4	872.6	-10.0%	3.5%	3.8%
Fuel	8,811.7	9,418.5	-6.4%	39.5%	40.8%
Minerals. fuel. lubricants	8,811.7	9,418.5	-6.4%	39.5%	40.8%
Industrial products	8,515.5	8,277.0	2.9%	38.1%	35.9%
Chemicals and related products	2,221.5	2,124.3	4.6%	10.0%	9.2%
Manufactured goods classified by raw materials	3,089.8	3,122.8	-1.1%	13.8%	13.5%
Machinery and transport equipment	1,775.6	1,651.7	7.5%	8.0%	7.2%
Miscellaneous manufactured products	1,428.6	1,378.3	3.7%	6.4%	6.0%
Others	489.2	497.1	-1.6%	2.2%	2.2%
Commodities and transactions not classified by category	489.2	497.1	-1.6%	2.2%	2.2%
Total exports	22,325.2	23,086.6	-3.3%	100.0%	100.0%

Sources: ELSTAT, PEA-ERC

Conclusions and Very Subjective Opinions on Current Status

- The Greek internal market is comparatively small and growth is currently negative. There is significant economic uncertainty
- Low levels of industrialization result in a small internal machine vision market
- The internal sector doing quite well is tourism (contributes 20% to the GDP); tourist arrivals are estimated at 23 million persons in 2014 up from 15 million in 2010 (Source: SETE)
- In 2014 there was **positive growth** in industrial product exports which is a **positive indicator for the machine vision market**
- Structural barriers to some types of investment still exist. Greece cannot compete with Asia on low skilled labor cost
- Investment in activities leading to the export of knowledge intensive services, software and IP is attractive

Talent is available; employing it effectively is the challenge

“There are three principal ways to lose money: wine, women, and engineers. While the first two are more pleasant, the third is by far the more certain.”

Baron Rothschild, ca. 1800

- The Greek **propensity to pursue higher education** is delivering significant numbers of qualified technical people to the Greek job market
- Foreign language literacy is relatively good – more than 70% of the population speaks English (www.investinggreece.gov.gr)
- Modern ICT infrastructure
- There is untapped potential to export services based on a **Nearshoring model**
- The high unemployment rate gives employers - willing to risk political uncertainty - significant advantages in personnel selection

An Overview



Academic Computer Vision Research in Greece

Institutions of Higher Education in Greece



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Greece is “obsessed” with Higher Education

- Greeks and their families make significant investments in education, in many cases disproportionately
- A lot of scientists and engineers emigrate (among other professionals)
- Most would like to stay or return to Greece if they can find suitable work

Sources: Wikipedia, WikiMedia

Public Universities in Greece (22) Technological Educational Institutes (15) Private “Colleges” (39)

- | | | |
|--|--|-----------------------|
| – Attika/Athens (8) | – Attika/Athens (3) | – Attika/Athens (25) |
| – Northern Greece (5) | – Northern Greece (4) | – Thessaloniki (11) |
| – Central Greece, Thessaly and Epirus (2) | – Central Greece, Thessaly and Epirus (4) | – Other locations (3) |
| – Western Greece, Ionian Islands and Peloponnese (4) | – Western Greece, Ionian Islands and Peloponnese (3) | |
| – Aegean and Crete (3) | – Aegean and Crete (1) | |

R & D Expenditure in Greece (2013)



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R&D Expenditure, national GDP (in million EUR) και R&D Intensity (R&D Expenditure as % GDP), 2011 - 2013

	2011	2012	(%) Annual change 2012-2011	2013	(%) Annual change 2013-2012
R&D Expenditure (million EUR)	1 391.2	1 337.6	↓ -3.9%	1 465.7	↑ +9.6%
GDP (million EUR)	207 752.0	194 204.0	↓ -6.5%	182 438.0	↓ -6.1%
R&D Intensity (R&D Expenditure as % GDP)	0.67%	0.69%	↑ +2.9%	0.80%	↑ +16.6%

Trends

- Overall GDP contracted as a result of the financial crisis in Greece
- Despite the economic recession, R&D investment grew in 2013 and as a result R&D intensity grew even more

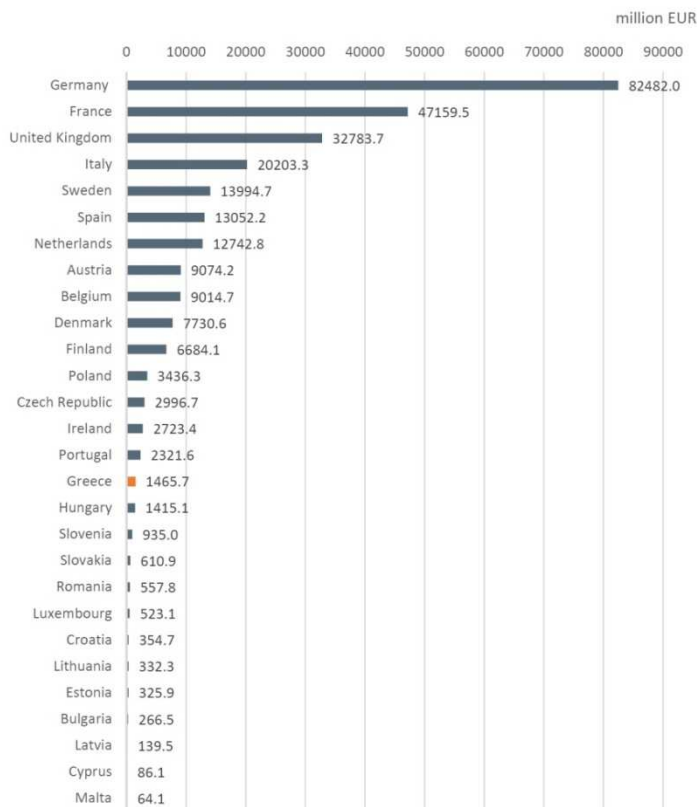
Source: Greek National Documentation Centre, R&D expenditure and Personnel in Greece in 2013 – Main Indicators

Relative R & D Expenditure in Greece (2013)

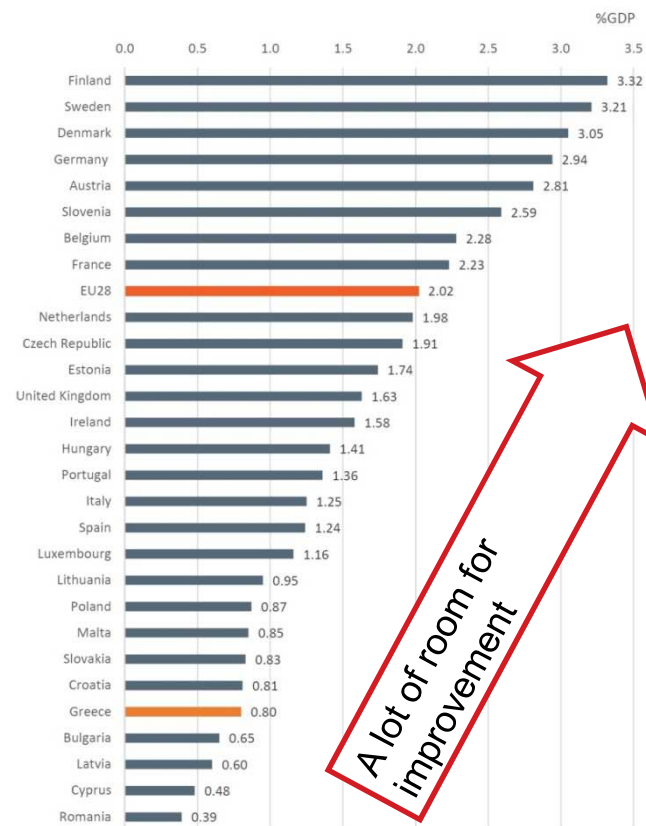


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R&D Expenditure (in million EUR) in Greece and in other EU28 Member States, 2013



R&D intensity (R&D Expenditure as %GDP) in Greece and in other EU28 Member States, 2013



Source: Greek National Documentation Centre, R&D expenditure and Personnel in Greece in 2013 – Main Indicators

- In 2013 Greece ranked 16th in the EU in absolute terms
- In relative terms with respect to GDP, Greece ranks low (24th of 28) and the Greek R&D intensity was 0.8 compared to 2.02 for the EU as a whole and 3.32 for the top performing Finland

Selected Labs and Projects



Academic Computer Vision Research in Greece

Computational Vision and Robotics Laboratory, FORTH, UOC



<http://www.ics.forth.gr/cvrl/>

– **Perceptual capabilities:**

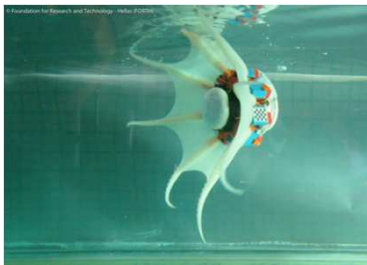
- What is the maximum information that a robot can extract by sensing its environment? More importantly, what is the actual information that a robot needs to extract from its environment in order to exhibit certain desired and possibly intelligent behaviors?

– **Robot behaviors and sensory-motor coordination:**

- How should perceptual capabilities and control strategies be combined to obtain the desired robot behaviors? How should the characteristics of the environment and the mechanical properties of a robot be taken into account in this process?

– **Learning:**

- How can a robot acquire skills in a developmental manner, through interaction with its environment? How can a robot accumulate experience, thus improving its acquired skills?



– **Prof. Panos Trahanias**

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Computer Vision, Speech Communication & Signal Processing Group, NTUA

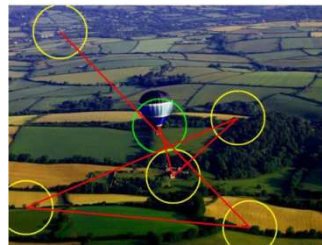
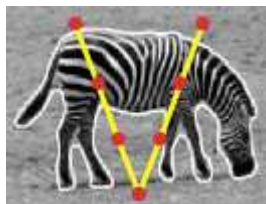
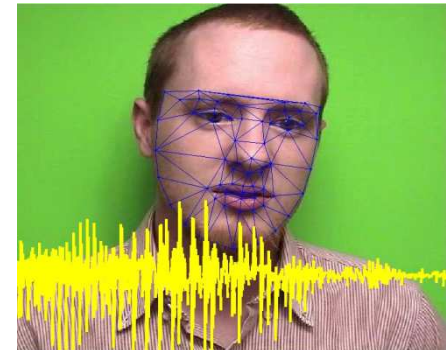


<http://cvsp.cs.ntua.gr/>

The **Computer Vision, Speech Communication & Signal Processing Group** was established in 1999 by Prof. Petros Maragos at the National Technical University of Athens.

Research areas of interest are:

- Computer Vision and Image Processing
- Computer Sound Processing and Speech Communication
- Pattern Recognition and Machine Learning
- Multimodal Information Processing and Fusion
- General Signal Processing and Nonlinear Systems Analysis
- Applications in artificial intelligence, biomedicine, multimedia, human-computer/robot interaction, virtual reality, digital arts, cultural heritage, intelligent computer/communication networks, satellite remote sensing, environment, and econometrics.



Prof. Petros Maragos

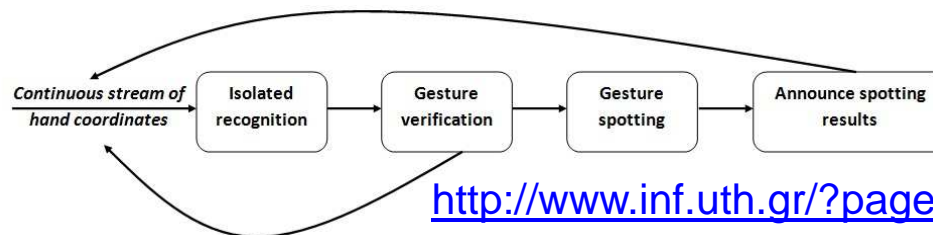
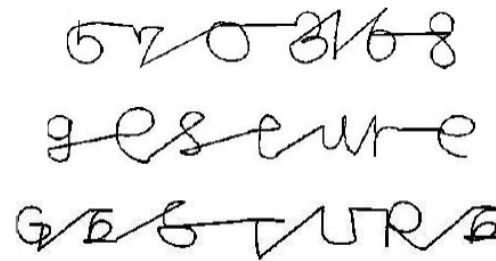
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Zografou campus, Athens 15773, Greece.
ECE Building 2.1.24, Tel: +30-210-7722360

<http://cvsp.cs.ntua.gr/maragos>

Low complexity hand gesture recognition

Stergios Poularakis, 2014. Supervisor: Ass. Prof. Ioannis Katsavounidis

- Real-time gesture detection, verification and recognition of digits and letters based on Tree-based Fast Nearest Neighbor



http://www.inf.uth.gr/?page_id=2127&lang=en



UNIVERSITY OF
THESSALY



<http://robotics.pme.duth.gr>

- Vision for robotics and automation
 - 3D perception, motion estimation, mapping
 - Fusion of video signal with other sensors
 - Object and action recognition
 - Place recognition and semantic mapping
- Applications in
 - Mobile robotics
 - Aerial vehicles
 - Space robotics



over 10 years of applied funded research

Research units

- Image and Signal Processing
- Computer & Cognitive Vision
- Pattern Recognition and Machine Learning
- Human Computer Interaction
- Virtual and Augmented Reality
- Artificial Intelligence
- Security and Surveillance
- Biomedical Applications
- Environment, Geoscience and Remote Sensing
- Communications and Networking
- Multimedia, Database and Information Systems
- Social Media Analysis
- e-Government
- Cultural and Educational Technology
- Integrated Commercial Solutions

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An Overview



Industrial Machine Vision Activity in Greece

Greek Internal Market Size and Structure



Major Customers

- Food, Packaging and Logistics are the major industrial MV automation customers
- The tourism and hospitality sector is relatively unexplored
 - People counting / management
 - Security
- The public sector faces extreme capital shortages
 - Traffic
 - Security
- Pharmaceuticals are at this time conservative in their investment plans

Internal Market Size

- Difficult to estimate from raw statistical data
- Based on heuristic estimates (analogy, multipliers) and industry participant estimates, the **current internal** Greek machine vision market is estimated below 5 million Euros annually

Exports

- Greek exports of machine vision products and services are currently larger than the internal market and are probably in the range of 10 million Euros annually

Major Issues Impacting Greek MV Market Vendors



Challenges

- De-industrialization and bad overall economic situation
- No new (or very few) production line constructions
- Unwillingness to pay for production line improvements, especially software (unlike business software)
- Operators in industry often have low levels of skill. A lack of technically skilled people for middle level positions able to support MV applications in the field
- A lot of production cells or lines are purchased on a turn key basis with in country vendors limited to providing support

Opportunities

- Educational system and Greek family propensity for education deliver significant numbers of engineers
- Good Information and Communications Technology infrastructure, i.e. Internet and Mobile Telephony System penetration and stability, availability of data centers

A Sampling of Companies



Industrial Machine Vision Activity in Greece



Fully owned subsidiary of of inos Automationssoftware GmbH, Grenzebach group

- INOS develops software for robot guidance, metrology and quality control in the automotive industry
- Software development and engineering services in Greece
- Customers worldwide: Europe, USA, Brazil, Mexico, China
- Pure export organization – has no internal market within Greece

Products

G-Gauge: Absolute measurement inline, Gap & Flush

G-Guide: BestFit for doors, hoods, fenders, roofs, glass screens, glass modules, cockpit and front-end modules

G-Guide: For paintshop

G-Guide: Deracking, Depalletizing

G-Verify: Absence, Presence and Component Detection

G-Analyzer: Process analysis via statistical process control

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Machine Vision Experts



Robovision was founded in April 2004 in order to provide high quality industrial machine vision services, representing in Greece and Cyprus the worldwide leading company in machine vision Cognex. Among the wide range of products provided are the following:



In-Sight sensors



Checker sensors



PC Vision



Dataman ID Readers

Over the last 11 years Robovision has developed its expertise by specializing in machine vision systems. Robovision is a Cognex ASP (Automation Solution Provider). This allows to provide turn key solutions and act as a distributor as well. Robovision provides services on the highest level and grants immediate support under any circumstances.

Main: 13th Ad. Korai str, 57010 Filyro, Thessaloniki
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info@robovision.gr www.robovision.gr

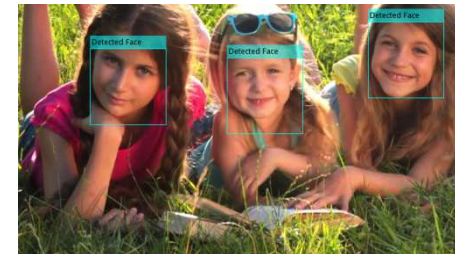
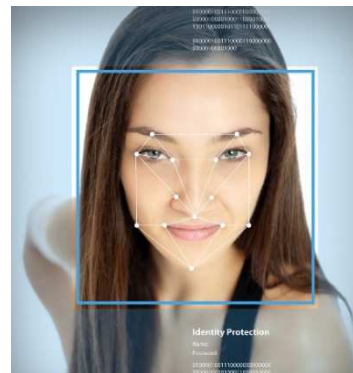
Irida Labs



Software and IP vendor

- Video Stabilisation
- Rolling Shutter Distortion Correction
- Face Detection
- Face Recognition
- Low Light Enhancement
- Targets most mobile processor cores

www.iridalabs.gr



unibrain

- Unibrain is a dynamic company, active in the design, development and support of innovative hardware, software and firmware products for the industrial and consumer electronics markets.
- A global leader in the development of FireWire hardware and software solutions, offering a complete line of FireWire products for a wide range of applications.

- Also recognized as a leader in high-performance digital media players for the OEM (Original Equipment Manufacturing) market. Over the last 5 years, we have closed OEM agreements with Iomega, MacPower, Logitech, Packard Bell, Lacie, Philips and Intralot.
- Headquarters and Development in Greece, Sales via Unibrain Inc. - San Ramon - California

Unibrain S.A. (Europe/Asia)
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www.unibrain.com



QUBBER



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QUBBER Machine Vision Technology

Goal

Development & manufacture of industrial standard machine vision systems that are:

- Powerful
- Flexible
- Reliable &
- With high cost-performance rate

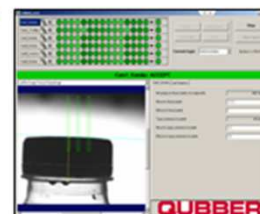
Foundation:	2005
Staff:	5
Management:	Sotiris Bekos
Head office:	Volos, Greece
Web site:	www.qubber.gr
Quality management system:	ISO 9001:2008

Our customers



Products

- Customized solutions
- Standard systems



Orama Solutions



DIMITRA STOIMENIDOU "Orama Solutions"
IROS KONSTANTOPOULOU 51, 56625, SYKIES,
THESSALONIKI, GREECE
Tel: +30 2311 274 568, +30 697 800 5997
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Orama solutions is a recently founded company in Greece , dealing with industrial automation using machine vision technology. Although we launched our company a few months ago we have 3 installation for this year and we have a lot of project awaiting. Despite that orama solutions is a new company our technicians are well experienced in machine vision technology with a lot of installations around Greece. We mainly work with food and beverage , pharmaceutical and recycle companies. We managed to qualify in an innovation competition in Greece launching our first vision software product.



Machine Vision System Integrator

- Consulting in image processing and image analysis
- Distribution and systems integration for image processing and industrial vision systems
- Custom design and manufacturing (hardware and software) of image processing and image analysis systems
- Distribution and systems integration for biometric iris recognition access control systems
- Gauging
- Assembly Verification
- Robot Guidance
- Quality Control
- Identification
- Mark Inspection
- Optical Character Recognition (OCR)
- Optical Character Verification (OCV)
- Bar Code
- Data Matrix
- Biometric Iris Access Control Systems



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Digital Image Systems



Medical and Machine Vision System Distributor

Machine Vision System Integrator and Custom Solutions Provider

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- medical imaging - medical printing
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- telemedicine and tele-pathology
- document image processing
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- behavior analysis – kinetics
- law enforcement - forensic inspection
- biomedical reagents



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sales@dis-imaging.gr, support@dis-imaging.gr

<http://www.dis-imaging.gr/>

Solid Iris Technologies



Rendering Engine Developer

- Thea Render (commercial) <https://www.thearender.com/site/>
 - Thea Render (Studio)
 - Thea for 3dsMax, Blender, Cinema4D, Rhino, Sketch-Up
 - Thea SDK
- Kerkythea (freeware) <http://www.kerkythea.net/cms/>



ajax
Created by SandroS using Kerkythea



Carapicuiba House 02
Created by SandroS usingThea

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SPECTRA tech



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- Security systems
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Thank you. Questions?

<http://www.inos-automation.de/>