

# Machine Vision in Croatia

EMVA CONFERENCE / DUBROVNIK, JUNE 2018.

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#### **BEAUTIES OF CROATIA**





Photo source: http://www.istriasun.com

Photo source: https://www.adriagate.com



1244 islands

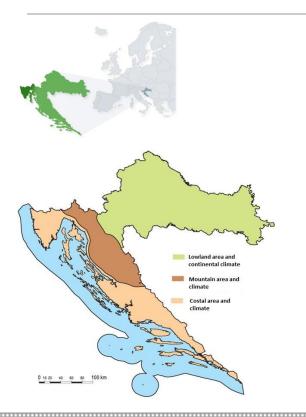
Protected natural beauties

Very well indented coast

- Located along sea side, in continental part and in mountain area
- Ancient cities and fortresses
  - Walls of Ston, Walls of Dubrovnik
- 10 UNESCO heritage sites
  - Natural, historical, cultural and architectural heritage



### **REPUBLIC OF CROATIA**



- Located in the heart of Europe
  - On the crossroad between:
    - Central Europe and Mediterranean
    - Eastern and Western Europe
- Member of EU since 2013.
- Capital: Zagreb
- Borders with Italy, Slovenia, Hungary, Bosnia and Herzegovina, Montenegro and Serbia
  - 2370 km of land boundaries
  - 6278 km of sea coast (including islands)
- Surface
  - Land: 56594 km<sup>2</sup>, Sea: 31067 km<sup>2</sup>
  - 4.28 millions of inhabitants (Croats 90.42%)

Data Source: Croatian Bureau of Statistics



### **IMPORTANT FACTS ABOUT CROATIA**

- Homeland of tie
  - Worn by 600 millions around the world, every day
- Famous inventors
  - Nikola Tesla, Faust Vrančić, Slavoljub E. Penkala
- Sport legends
  - Goran Ivanišević, Kostelić family, Dražen Petrović, Toni Kukoč, Davor Šuker, ...
- Nobel Prize winners
  - Lavoslav Ružička, Vladimir Prelog



Photo source: http://www.croatia.org

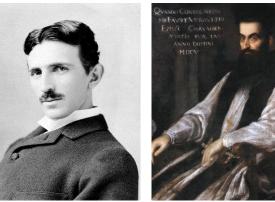


Photo source: https://hr.wikipedia.org

Photo source: http://www.enciklopedija.hr

Photo source: Google



12.06.2018

# **INSTITUTIONS AND EDUCATION – PILLARS OF DEVELOPMENT**

- Ruđer Bošković Institute
  - Leading scientific institute in the natural and biomedical sciences
- Public universities
  - University of Zagreb
  - University of Split
  - Josip Juraj Strossmayer University of Osijek
  - Juraj Dobrila University of Pula
  - University of Rijeka
  - University North
  - University of Zadar
  - University of Dubrovnik
- Private universities
  - Dubrovnik International University
  - University VERN
  - Croatian Catholic University

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and Computing in Zagreb

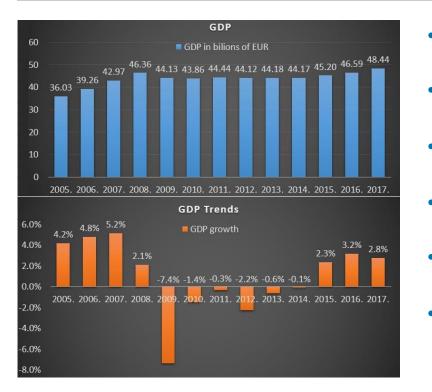
FER – Faculty of Electrical Engineering

Interesting faculties for Machine Vision

- FOI Faculty of Organization and Informatics in Varaždin
- FSB Faculty of Mechanical Engineering and Naval Architecture in Zagreb
- PMF Faculty of Natural Science and Mathematics in Zagreb



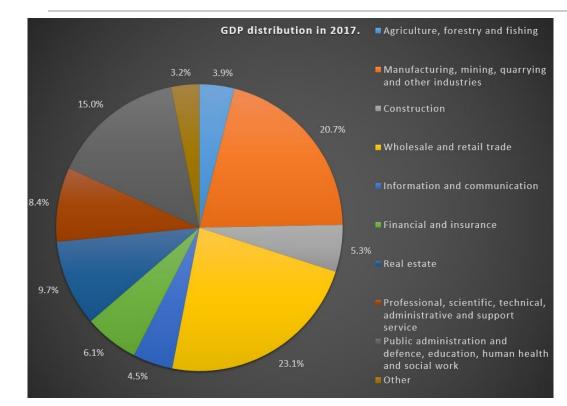
# CROATIAN ECONOMY – PATH TO STABILITY



- Economic growth started in 1995., after finishing the war
- GDP
  - 24 billions € in 2000. → 48 billions € in 2017
- 2008. 2015. effects of global economy crisis
  - in 2015. return to positive growth
- Results of 2008. were barely outmatched in 2016.
- Small but continuous growth over last 3 years
  - Period of stability
- GDP per capita in 2017.: 11300 €
  - Data Source: Croatian Bureau of Statistics



# **ECONOMY STRUCTURE – MISS BALANCE**



**Q**smartek

visior

- Tourism strongest component
  - Approx. 20% of GDP
  - Croatia is leader in nautical tourism
- Strong industries
  - Food industry
  - Chemical and Oil
  - Machines and Equipment
  - ICT
  - Auto industry
  - Energetics
  - Pharmacy
  - Textile industry

Data Source: Croatian Bureau of Statistics



# PRESERVED NATURAL RESOURCES – DEPOSIT FOR THE FUTURE

- Moderate utilization of resources resulted in rich reserves
- Agricultural land
  - 1.5 million ha is utilized, 2.7 million ha is available
  - Large fields of Slavonia
- Forests
  - 2.7 million ha (47% of total land area)
- Fresh water
  - 27330 m<sup>3</sup> per inhabitant, leader in EU
- Oil, gas
  - Pannonian, Dinarides and Adriatic basins
- Renewable energy sources
  - Island of Hvar has 65% of sunshine yearly
  - Regions near seaside have wind potential of over 300 W/m<sup>2</sup>
- Stone from island of Brač
  - Many famous buildings are made of it

#### Data Source: Croatian Bureau of Statistics, Eurostat



### **SMARTEK**

**Q**smartek



- 2001 Foundation of Smartek d.o.o.
- Started in one room of family house
- Focused on Machine Vision and building quality products
- Worked with many distributors in China and Europe
- Resources were strained, focus was no longer engineering
- Strategically changed in 2011 to focus on one distributor FRAMOS
- Partnership allowed for successful execution of strategy
- Merged with FRAMOS in 2013

### WHO IS FRAMOS?

**Q**smartek

vision



- Founded in 1981
- Family owned
- Employees 150+
- 50M revenue
- Fulfilment, buffer-stock or consignment stock possible
- Quality Certification DIN EN 9001
- The only global imaging partner from sensor to system
- Development of our own technologies
- Team of 40 engineers
- Reliable Partner Network

FRAMOS

#### WHO WE ARE NOW

- 15 years of experience in Machine Vision
- 25 employees
- Total 950m<sup>2</sup> containing:
  - Development / Production
- ISO9001 certified
- Passionate about what we do
- Core values and culture remain the same
- Same company, new possibilities







#### MAKING MACHINES TO SEE AND THINK!

- Specialists in flexible camera and strobe controller solutions
- State of the art standard portfolio, ready to be customized
  - From form factor over IOs to special algorithms
- "twentynine" industrial camera platform with latest CMOS image sensors
  - Small 29x29mm footprint, enhanced processing capabilities, GigE Vision & USB3 Vision
- High Performance LED Strobe Controllers
  - Unbeaten power, efficiency and stability, full control for a wide range of applications
- Fully tailor made solutions for deep integration

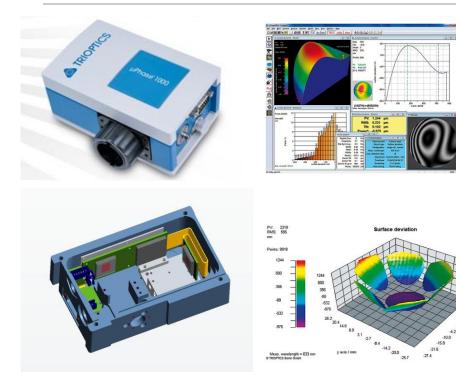








#### **INTERFEROMETRY SYSTEM**



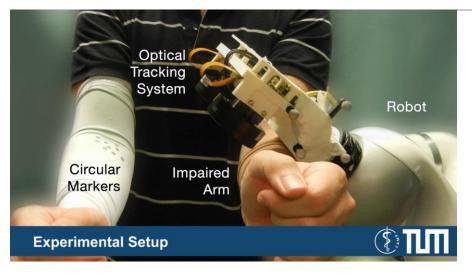
- Dual camera system developed for TRIOPTICS Berlin GmbH
- Precise measurement of surface deviation and wave front aberration
- Controlling DC motor and piezo actuator
- Processing data from two global shutter image sensors, incremental encoder and external signals

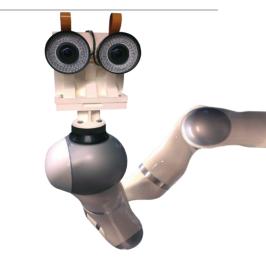
USB3.0 interface

Photo source: http://www.trioptics-berlin.com



#### **COOPERATIVE ROBOTICS**



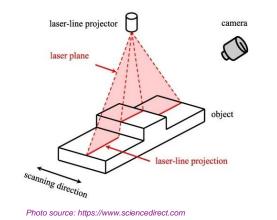


- After stroke: 80% hemiparesis
- Re-education of movements by training
- Patient participation very important
- Previus systems: Up and down, Joystick

Photo source: Framos

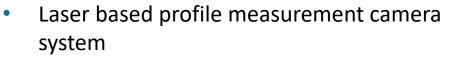


# **PROFILE MEASUREMENT SYSTEM**

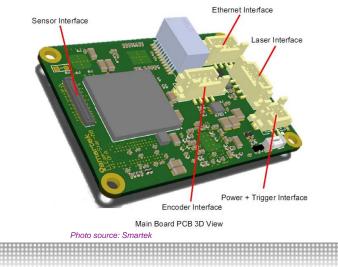


- Controlling laser projector
- Processing data from Sony global shutter image sensor, incremental encoder and external signals
- Gigabit Ethernet interface

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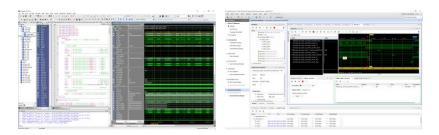


 Measuring profile dimensions of extruded, roll-formed and other continuous profiles



# SLVS-EC RX IP CORE – NEXT GENERATION

- High resolution, high framerate sensors
- Benefits:
  - Easier design of image sensor board
    - Reduced number of lanes
    - No skew adjustment between lanes
  - Longer transmission distance
  - Lower pin count for same bandwidth
  - Error detection (CRC) and correction (ECC)
- Deliverables:
  - SLVS-EC RX IP Core
  - Evaluation Kit with Sony IMX421



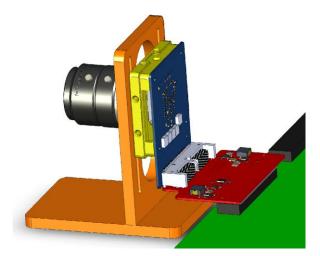
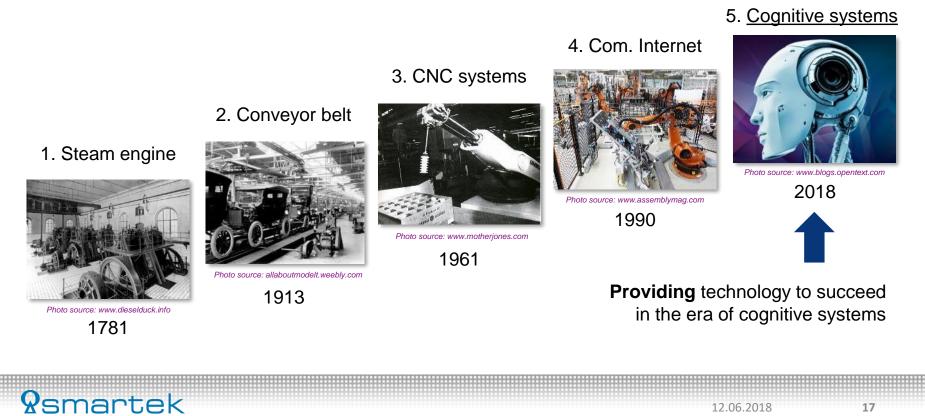


Photo source: Smartek



### FUTURE FOR MACHINE VISION



vision

# **CROATIA'S FUTURE IN MACHINE VISION**

- Smartek shaping the embedded vision hub in Croatia
- Sustainable, responsible development and growth
- Focusing on R&D, customization, smart solutions and know how
- Avoiding extreme mass production
  - Preserving nature for time to come
  - Keeping excellence
- Heritage as basis for develop the future
  - Foundations sited in institutions, universities and experience of large companies formerly leading in the field of electronic
- Improvement of education to become leading edge
- Strong passion to seek solution for challenging problems and being ahead
  - High quality engineers, respected worldwide
- Full synergy to raise optimism of society is about to happen



Thank you!

Damir Dolar CEO Smartek damir.dolar@smartekvision.com +385(0) 98 923 0943

