Machine vision in the Czech Republic

Václav Hlaváč

Czech Technical University in Prague

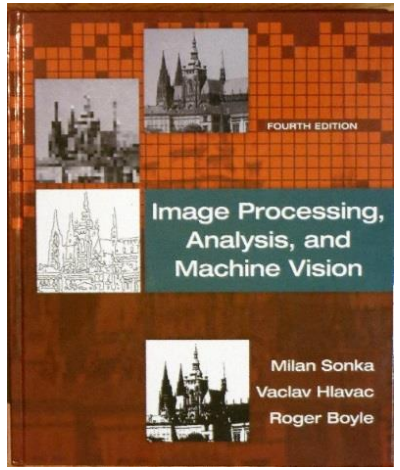
Czech Institute of Informatics, Cybernetics and Robotics

166 36 Prague 6, Jugoslávských partyzánů 1580/3, Czech Republic

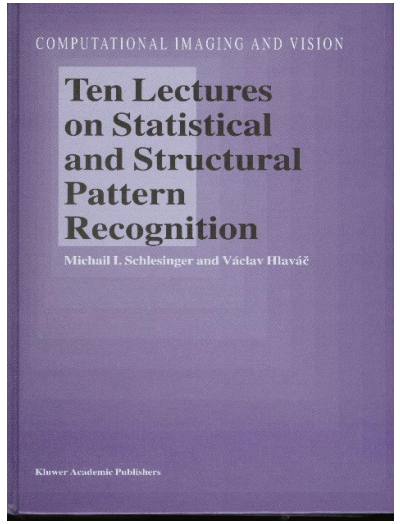
vaclav.hlavac@cvut.cz, http://people.ciirc.cvut.cz/hlavac/

About the speaker - Václav Hlaváč

- Born 1956, male, Ph.D. 1987
  Prof. of the Engineering Cybernetics 1998
- Head of the Center for Machine Perception at Faculty of Electrical Engineering since 1996
- Co-founder of CIIRC in 2013, leads its Robotics and Machine Perception dept.
- Interest: autonomous robotics, computer vision, machine learning.
- Responsible for the study branch Robotics at the Faculty of EE ČVUT.



1st 1993
2nd 1998
3rd 2007
4th 2015



2002

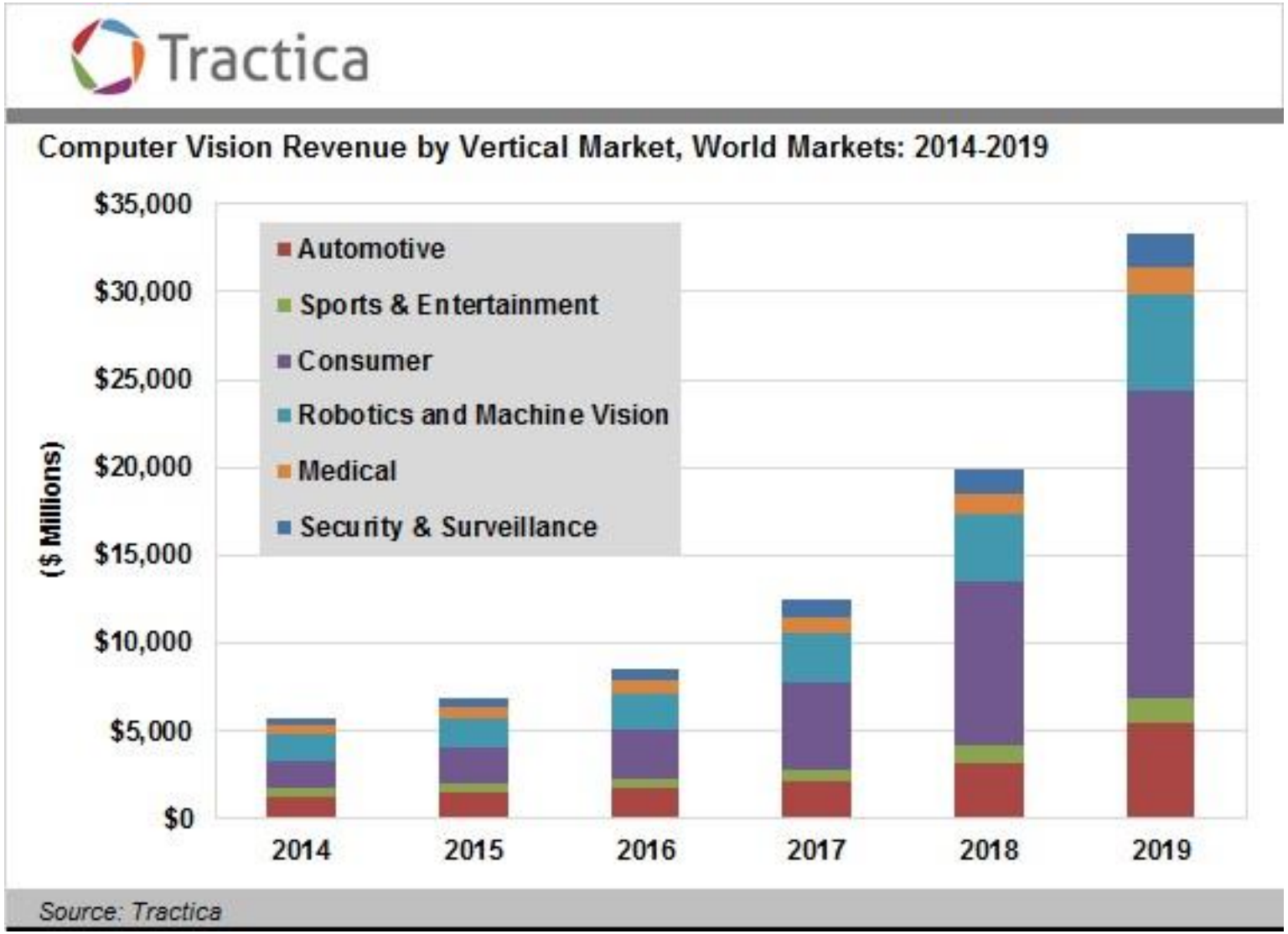
2015 World bank data

- Manufacturing, value added (% of GDP)

Israel, Italy, USA	Japan	Germany	Czech Republic	China	South Korea
12%	19%	23%	27%	28%	30%

- Global manufacturing output
  - 55% China, Germany, Japan, USA (combined)
  - 45% The rest of the world
- Manufacturing sector contributing to Global Domestic Product
  - 1970: 25%
  - 2015: 15%

Tractica, computer vision market analysis

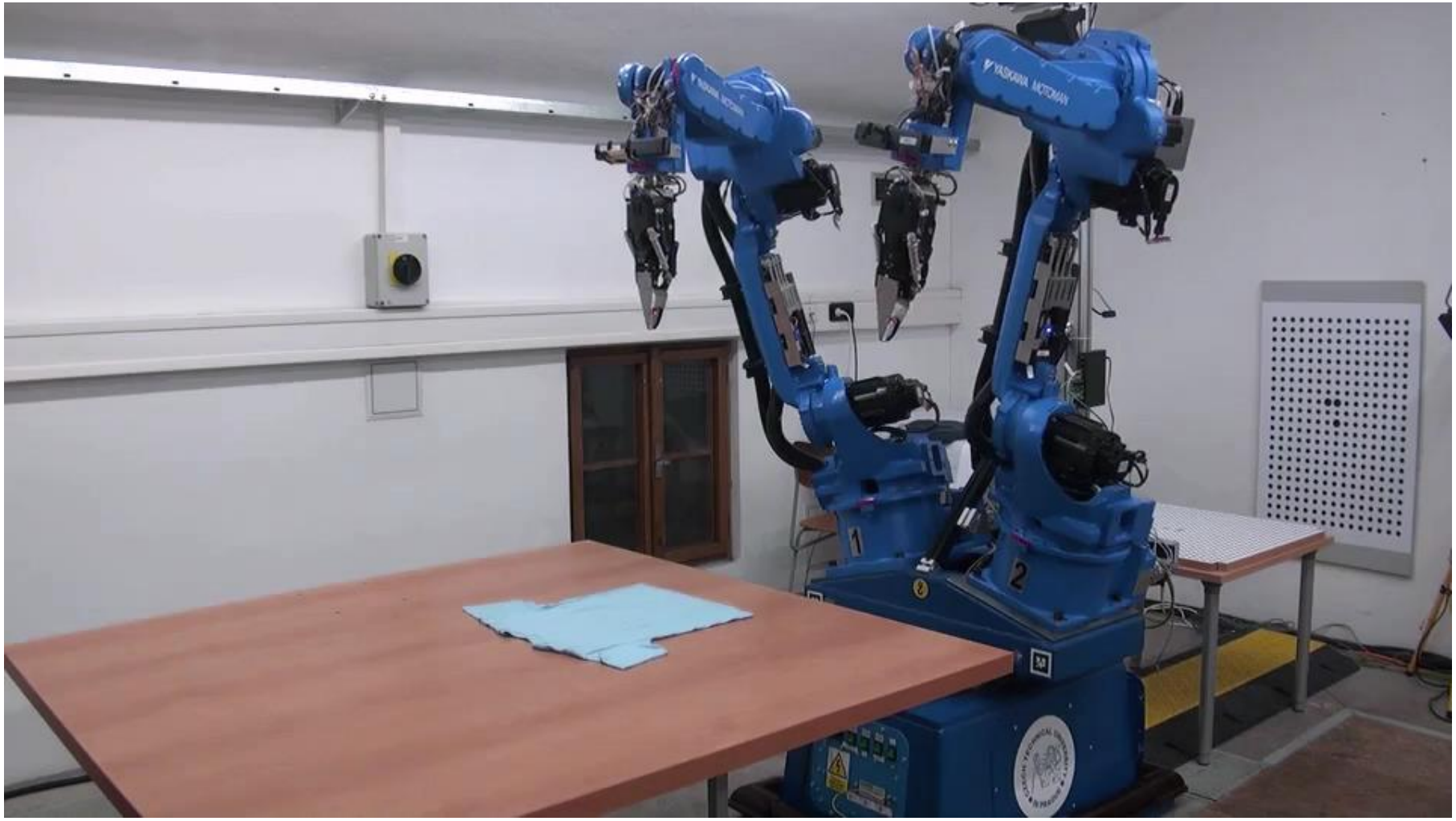


Industry 4.0 as a chance

DFKI – CIIRC ČVUT agreement on Industry 4.0 signed at our university on August 25, 2016

Project CloPeMa

Clothes Perception and Manipulation, EC funded, 2012-2015, continued by RadioRoSo in 2016



Project TRADR

Long-Term Human-Robot Teaming for Robot Assisted Disaster Response,
EC funded, 2014-2017, video from Amatrice mission on Sept 1, 2016

Project UP-Drive

- Automated Urban Parking and Driving.
  EC funded, 2016-2019.
- Coordinator Volkswagen Research, Wolfsburg, Germany.
- UP-Drive contributes to a selfdriving car.
- The first test scenario is “valet parking”, i.e. the car should drive autonomously in the urban environment in low speed (up to 30 km/h), explore it to find a parking spot, park there. Later, if called, it should drive to the position, where the human left the car.
- CIIRC team contributes to perception and scene understanding in the UP-Drive project

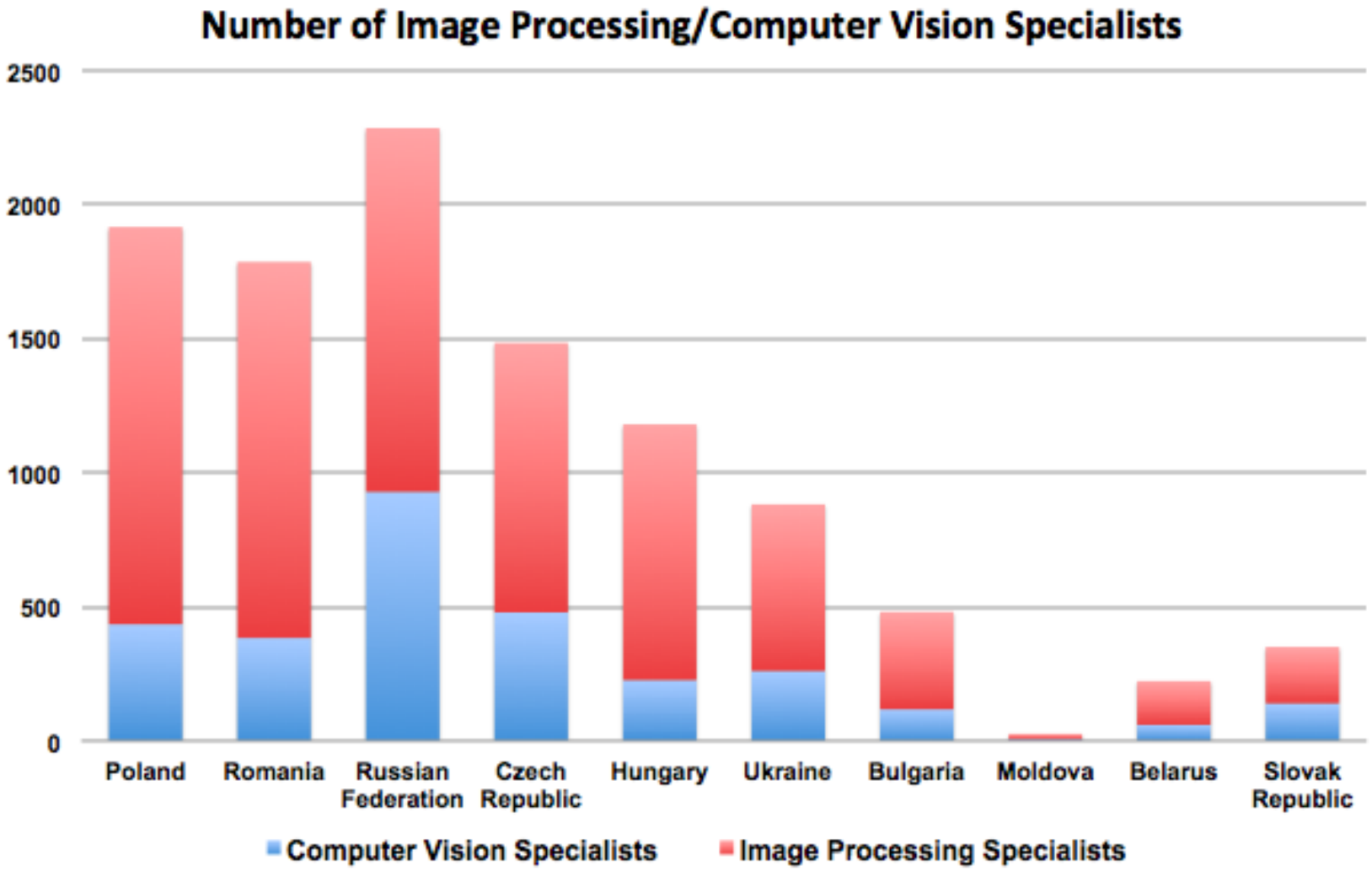
Computer vision academics, main groups

- Czech Technical University in Prague
  - Faculty of Electrical Engineering - Jiří Matas, Tomáš Svoboda, Boris Flach
  - Czech Institute for Informatics, Robotics and Cybernetics - Václav Hlaváč, Tomáš Pajdla
- Masaryk University Brno, Faculty of Informatics – Michal Kozubek
- University of Technology Brno, Faculty of Electrical Engineering and Communication technologies – Karel Horák
- Technical University Ostrava, Faculty of Electrical Engineering and Informatics – Eduard Sojka
- Technical University Liberec, Faculty of Mechatronics – Petr Tůma
- Czech Academy of Sciences, UTIA – Jan Flusser, Filip Šroubek

Principal theoretical contributions

- 1990
  Jan Flusser – moment invariants, discovered mistake in Hu's invariants, series of contributions on the topic
- 1995
  Tomáš Pajdla (Václav Hlaváč as Ph.D. supervisor) – epipolar geometry and reconstruction for omnidirectional cameras
- 2002
  Štěpán Obdržálek, Jiří Matas, Ondřej Chum, Tomáš Pajdla – maximally stable extremal regions

Labor force in computer vision



Source:
Eastern European Computer Vision Conference 2016

CV industrial scene in the Czech Republic

R&D divisions of global companies

- Honeywell Research Labs in Prague
- Honeywell Development Center in Brno
- Valeo R&D Center in Prague

Local companies, see next slides

Czech CV companies (a)

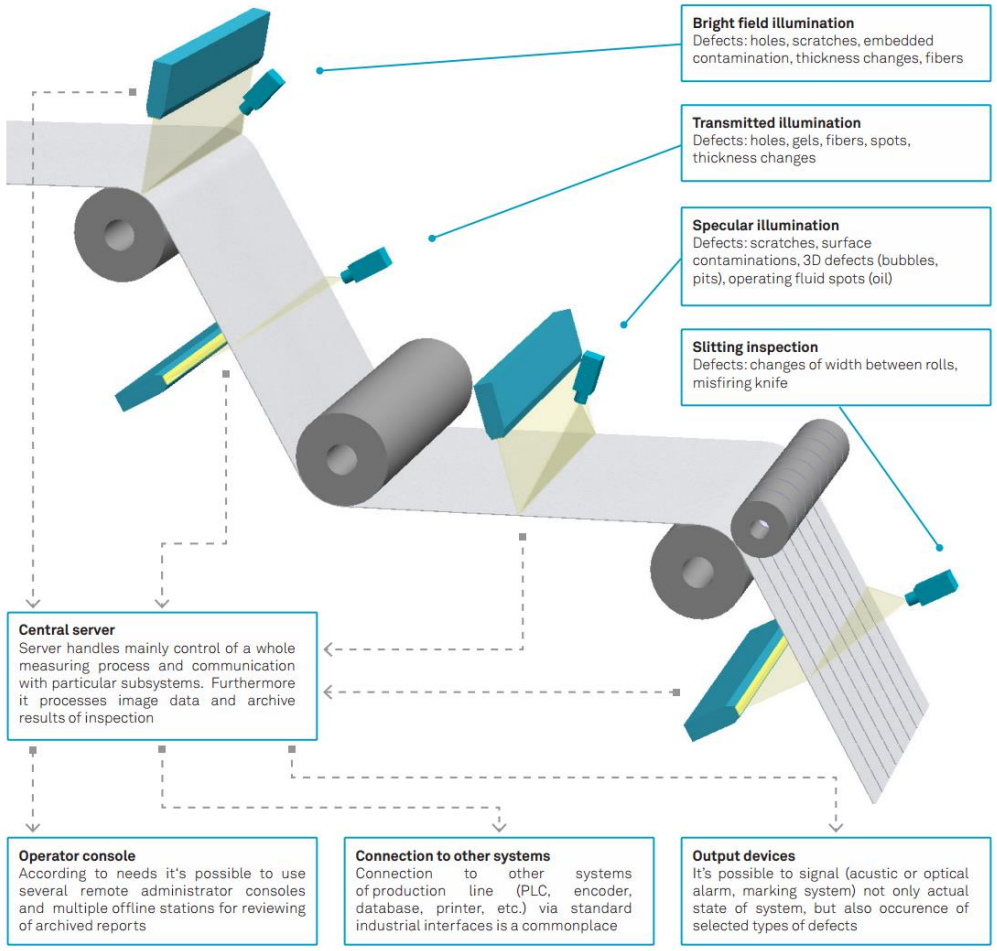
Camea s.r.o. Brno, est. 1995, ≈ 80 employees, based on the own R&D

- http://www.camea.cz
- Intelligent transportation, car speed measurements (most of Czech market, pattern recognition part subcontracted from Eyedea Recognition s.r.o.) trucks weight measurement while driving
- Industrial applications
- (Non-woven) fabric inspection, line cameras, speed 2000 m/min, i.e. 120 km/h, defect size 0,1 mm^2 , 5 meters width.
- Bottle inspection
- Label inspection, e.g. on trains in full speed

UIC code reader – train identification system

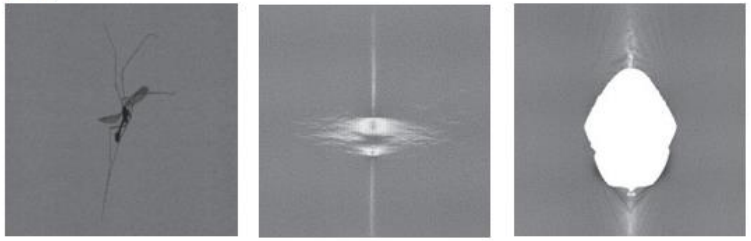
UniscanDETECTOR

continuous strip inspection



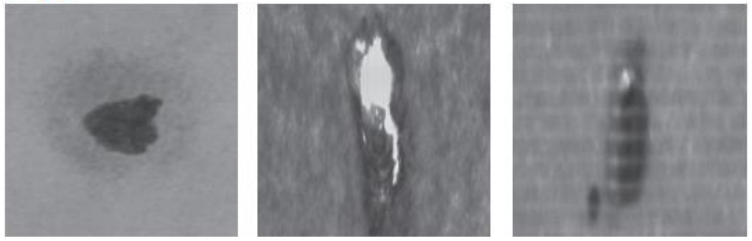
Examples of defects

Foil

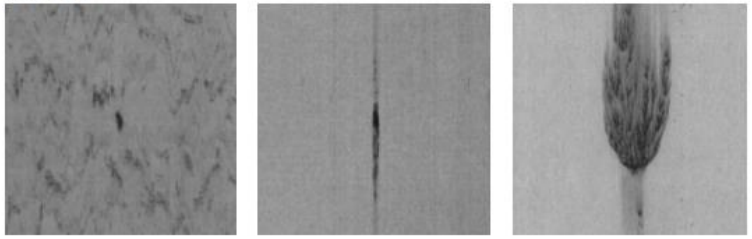


Non-woven fabric

Paper



Metal

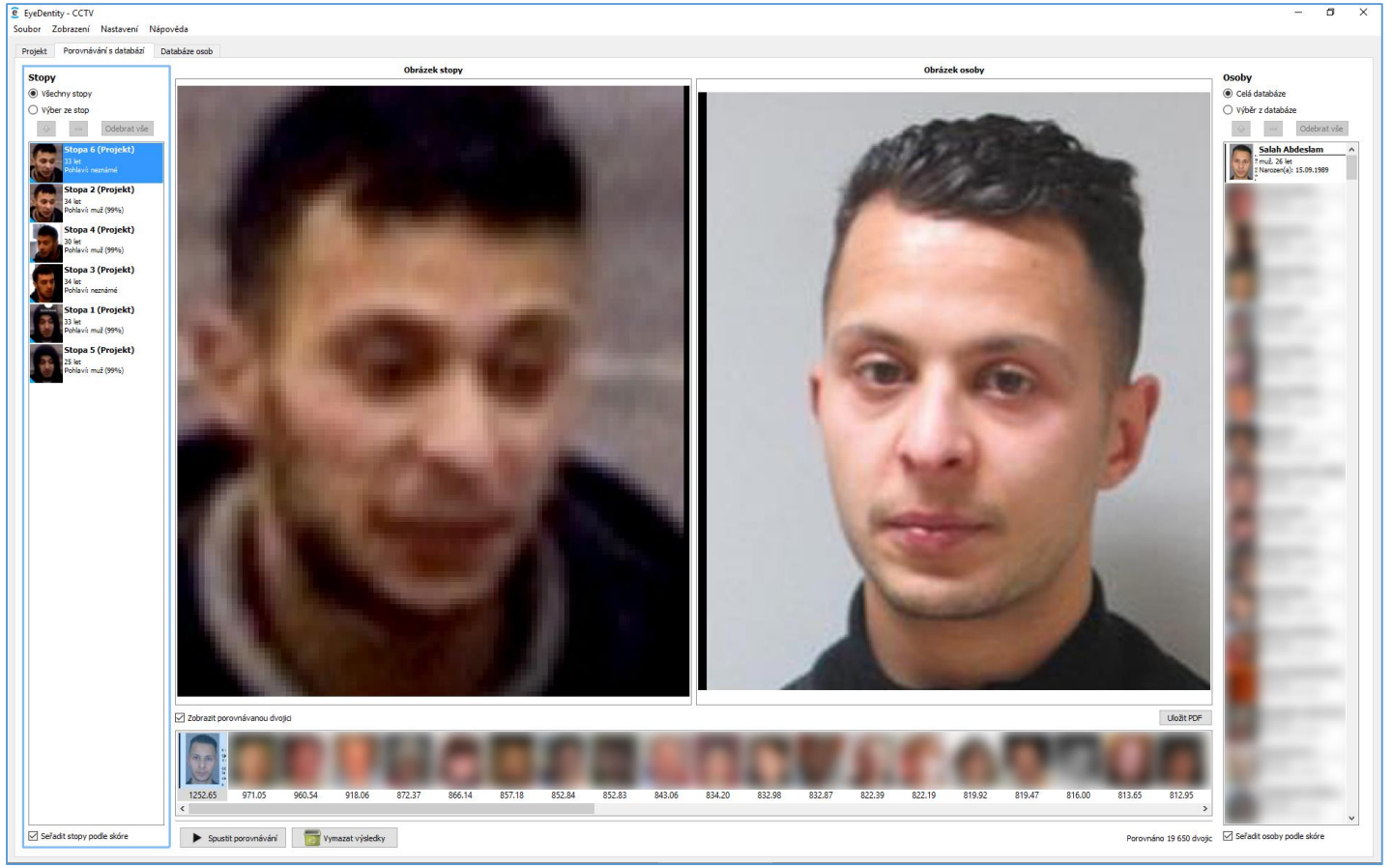


Czech CV companies (b)

Eyedea Recogniton s.r.o., Prague, spin-out of ČVUT, est. 2006

- http://www.eyedea.cz
- Human face detector, gender, age estimator
- Eye motion analysis
- Car make and model recognition
- Car number plate reading.
- Image data anonymization
- Video matching

Object detection and recognition
Machine learning and big data



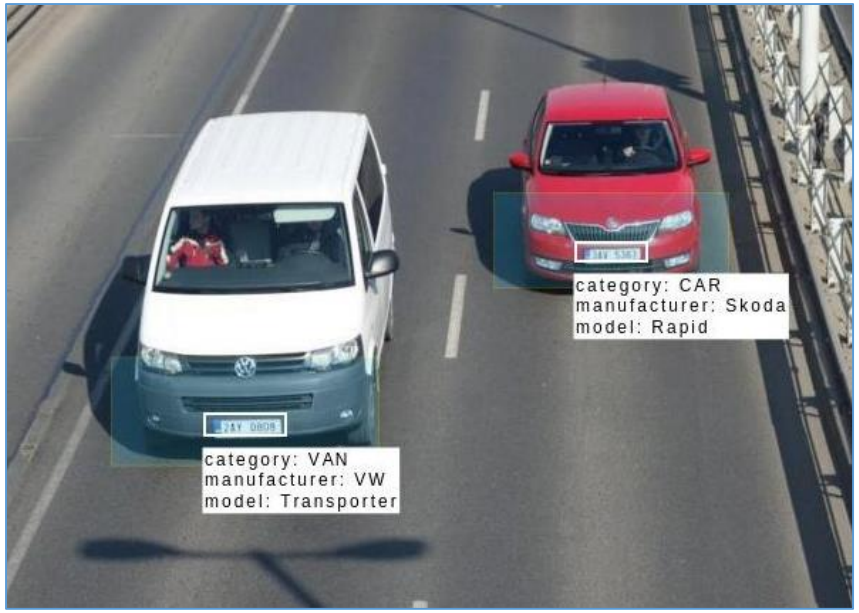
EYEDENTITY

- Forensic software for face recognition in photos and videos.
- Used also by **EUROPOL** and **Police of the Czech Republic.**

AWARDS

13 May 2015
Our face detector achieved the highest detection rate on the challenging MALF dataset, beating Apple, Google and Microsoft.

9 March 2015
Eyedea face detector achieved the second highest detection rate on FDDB benchmark.



Vehicle Make and Model Recognition

MMR Software recognizes:

- 70 Makes : Citroen, Audi, Volvo, Scania, …
- 500 Models : VW Golf, Renault Megane, ….
- 5 Categories : Car, Van, Bus, Light Truck, Heavy Truck, MTB
- Color
- Both from frontal and rear view.

www.eyedea.cz

Czech CV companies (c)

ATEsystem s.r.o., est. 2013

- http://www.atesystem.cz
- Industrial inspection

Workswell s.r.o.

- https://www.workswell-thermal-camera.com/
- Infrared cameras, services also on drones

Czech CV companies (d)

ELCOM, a.s., Ostrava, est. 1990

- http://www.elcom.cz
- Relevant is its Division of Virtual Instrumentation
- Vision inspection in industry

Kinalisoft s.r.o., Brno, est. 2006

- http://www.kinalisoft.eu
- Computer vision applications in different areas

Thank you for the attention.

Questions?