Autonomous mobility

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Faculty of Information Technology

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BRNO UNIVERSITY OF TECHNOLOGY
FACULTY OF INFORMATION TECHNOLOGY

BRNO UNIVERSITY OF TECHNOLOGY

- 1899 founded
- 8 faculties
- 18,000 students
- 1,500 PhD students

- Faculty of Civil Engineering
- Faculty of Mechanical Engineering
- Faculty of Electrical Engineering and Communication
- Faculty of Architecture
- Faculty of Chemistry
- Faculty of Business and Management
- Faculty of Fine Arts
- Faculty of Information Technology
- Institute of Forensic Engineering
- Centre of Sports Activities
- Central European Institute of Technology
- SIX Research Centre

FACULTY OF INFORMATION TECHNOLOGY

- Founded 2002
- Center of excellence in research
- Member of CyberSecurity DIH
- AI education tradition
  - 1982 - Robotics
  - 1988 - Fundamentals of AI
  - 1998 - Neural networks

WORKING WITH BEST

- Leading global companies
- Well-known universities
- World-class R&D centers and institutes
- National and International scientific projects

STRATEGIC R&D AREAS

- Information Technologies
- Artificial Intelligence
- Cybersecurity
- Cyberphysical Systems
- High Performance Computing

Key Research Groups

Language Processing
(Doc. Dr. Cernocky)

Evolvable Hardware
(Prof. Sekanina)

Accelerated Network Technologies
(Dr. Korenek)

Automated Analysis and Verification
(Prof. Vojnar)

Big Data / Knowledge Technology
(Dr. Smrz)

Computer Vision and Graphics
(Prof. Zemcik, Prof. Herout)

Supercomputing Technologies
(Dr. Jaros)

Computational Photography
(Dr. Cadik)

Human-Machine Interaction & Robotics
(Dr. Beran, Dr. Rozman)

Security Technology R&D
(Prof. Drahansky)

AUTONOMOUS MOBILITY @ FIT BUT

WHAT WE DO

AUTONOMOUS TECHNOLOGIES

- AGV, Autonomous driving, Mobile robots
- Navigation and 3D mapping (SLAM/ PTAM)
- Vision technologies
- Data fusion, Sensors data processing
- User Interface

BIG DATA

- Deep & Machine learning
- Big-data, data mining, knowledge gathering

SECURITY

AND MANY MORE

INNOVATIVE PROJECTS

H2020 5G-ERA

ARTIN

roboauto

COGNITECHNA

Open Source MANO

FIT

BRING AUTO

- 5G Networks technology for autonomous driving
- Enhanced Robot Autonomy
- Selfdriving vehicle in operation
- Training of deep neural network
- Cloud Native (CN) approach, standardised APIs, integration of ROS with OSM

LiDAR

Odometry Estimation from Velodyne LiDAR Point Cloud Scans

- A novel method of odometry
- Change in pose and orientation of the scanning device over time
- Deals with the sparsity and the quantity of data points
- Estimation a precise transformation aligning the two Velodyne scans (Collar Line Segments)

NANORADAR

T A
Č R

An innovative nanoradar sensor for autonomous driving of trucks

- Radar technology

  (2 autonomous driving functions)
- Mechanical design
- HW and SW aspects
- Automation and control
- Machine learning
- Signal processing
- Validation and testing

USER INTERFACE

ŠKODA

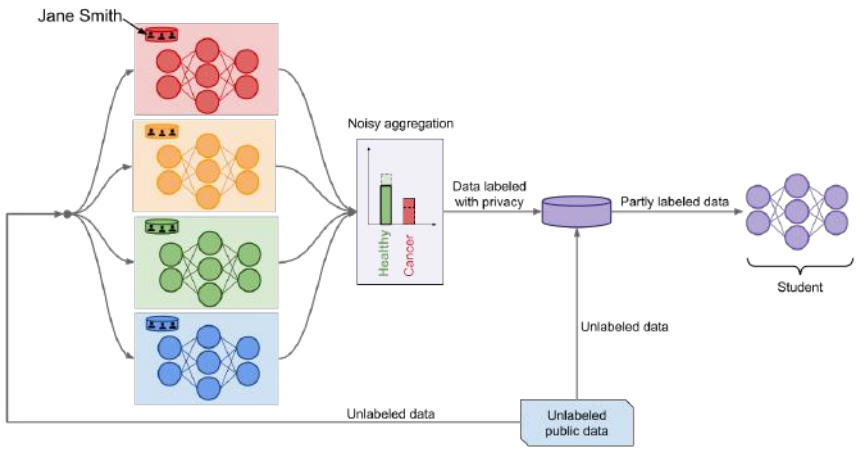
PROTOTYPING FRAMEWORK

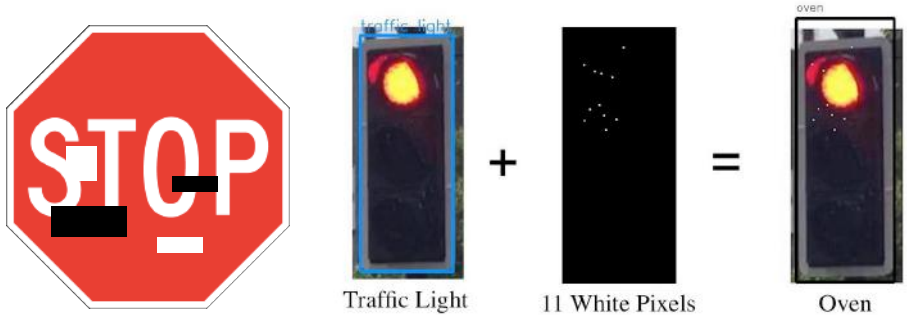
- Unique system allowing to design and validate new user interfaces for future cars easily
- Framework for dashboard / infotainment module / head-up display
- Shortening the development cycle to agile respond to the latest trends in HMI

„For the next period, we would like to continue working with experts from FIT BUT, especially in the field of innovations for autonomous mobility.“ *Vít Neruda, ŠKODA AUTO*

SAFETY & SECURITY

- Trustworthiness of AI in autonomous driving
- Research on robustness guarantees for deep learning in an adversarial setting





COMPUTER VISION & GRAPHICS

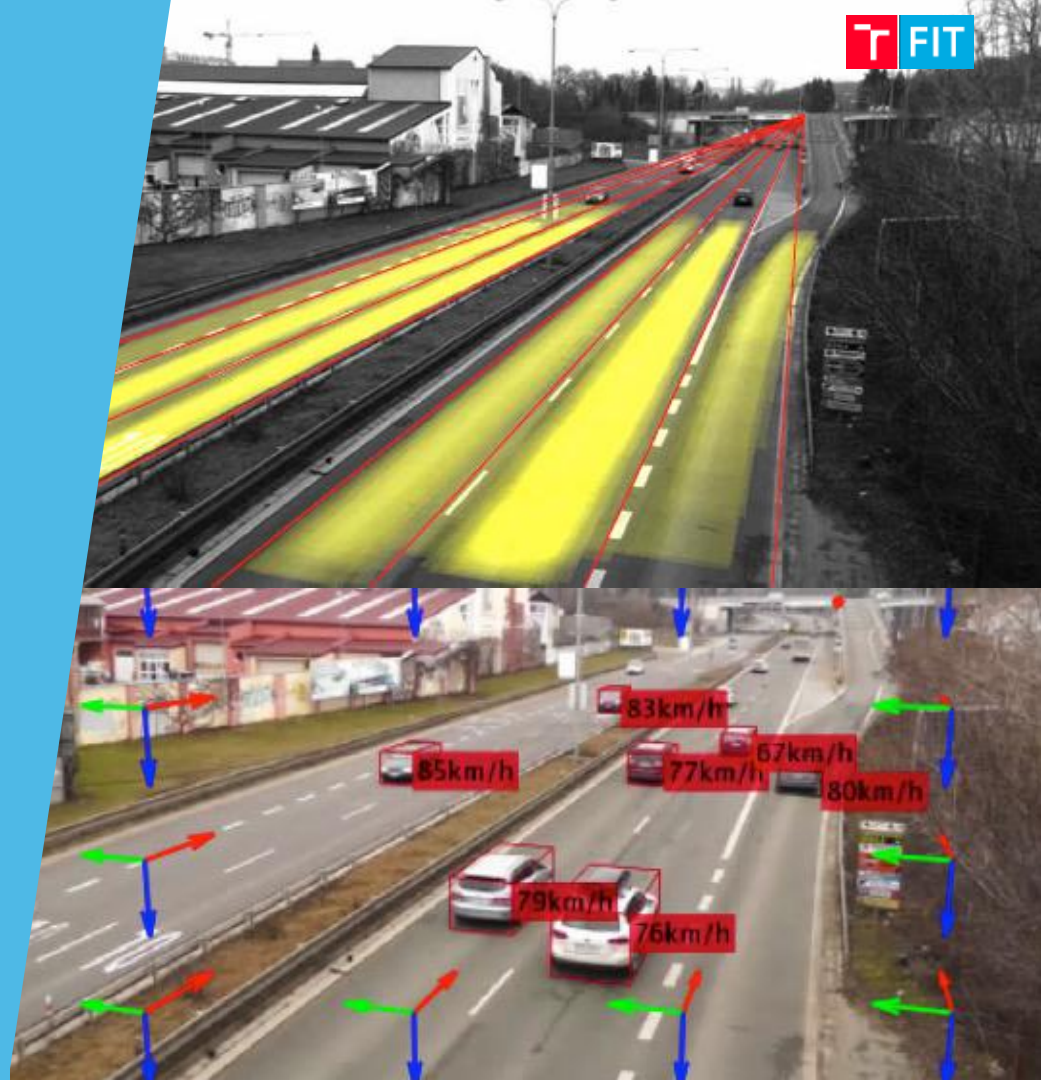
camea

- Object detection & recognition
- Fully automatic visual surveillance
- Camera systems
- Image processing
- HDR experiments
- Mapping technologies
- Detection, measurement, scaling

Our spin-offs / start-ups:

COGNITECHNA geodrom

- Fully Automatic Visual Traffic Surveillance
- HDR & CV in Embedded HW
- Camera system automatic calibration
- Vehicle classification & re-identification
- License plate recognition
- Detection, measurement, scaling
- Real time object detection



WE GO BEYOND

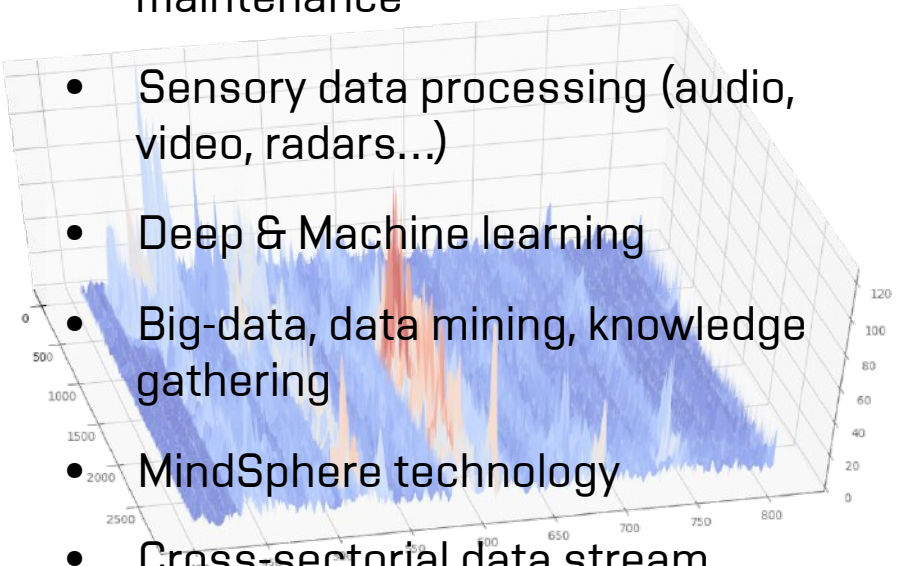
- Smart cities
- Applied from Cross-CPP project
- Learning from data streams
- Interconnected vehicles & Smart buildings & E-chargers & Hyperscale Weather forecast etc.

SIEMENS

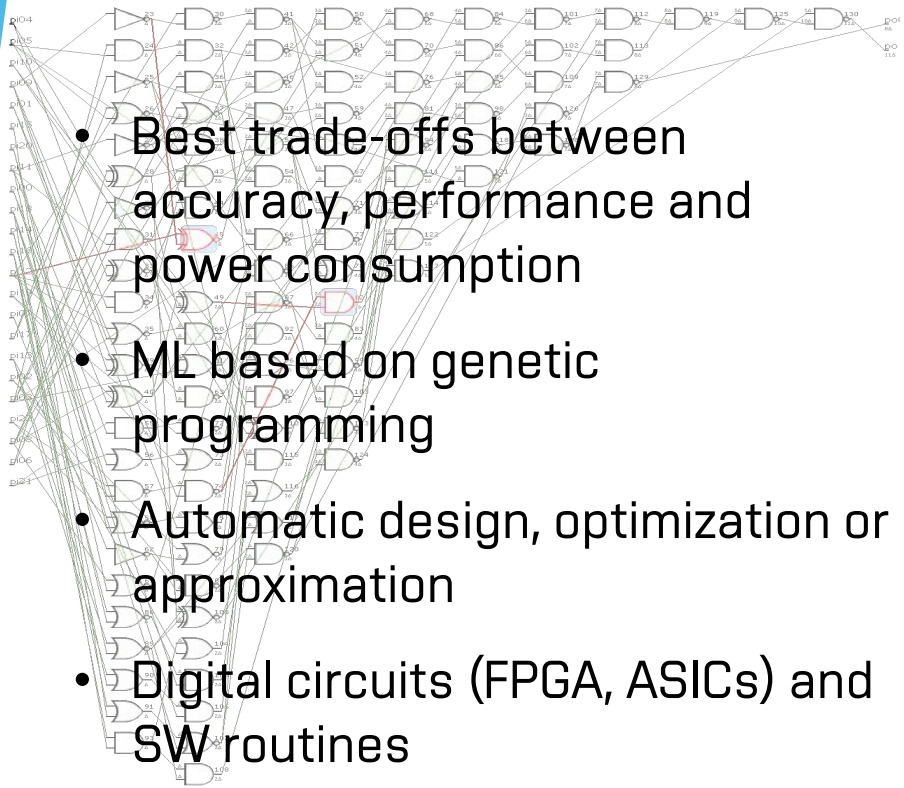
Meteologix AG

BIG DATA

- Data analysis & predictive maintenance
- Sensory data processing (audio, video, radars…)
- Deep & Machine learning
- Big-data, data mining, knowledge gathering
- MindSphere technology
- Cross-sectorial data stream
- Action recognition (invideo)



EVOLVABLE HARDWARE



- Best trade-offs between accuracy, performance and power consumption
- ML based on genetic programming
- Automatic design, optimization or approximation
- Digital circuits (FPGA, ASICs) and SW routines

Evolutionary circuit optimization

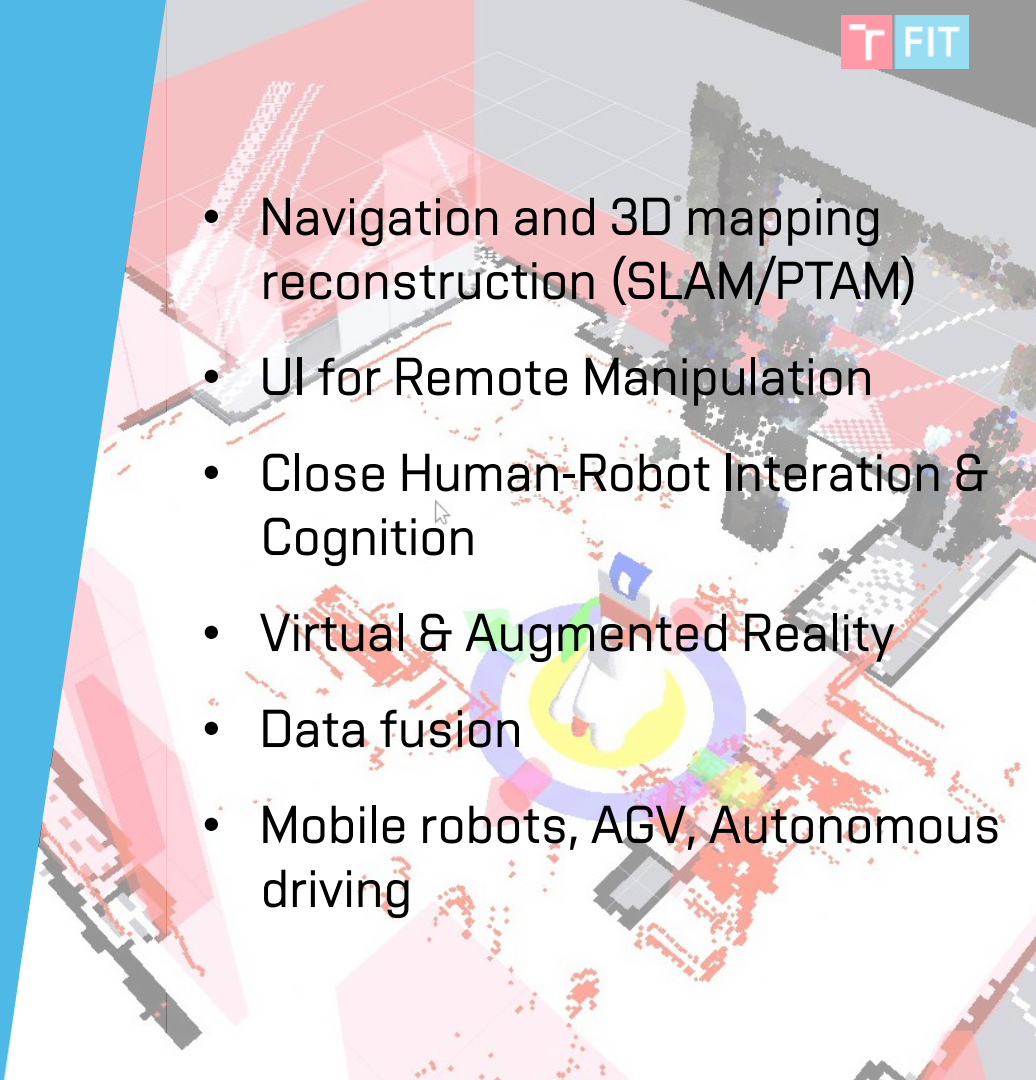
Circuit: Cordic (LGSynth93)

23 inputs, 2 outputs

Original: 106 gates

After optimization: 39 gates

AUTOMATION & ROBOTICS



- Navigation and 3D mapping reconstruction (SLAM/PTAM)
- UI for Remote Manipulation
- Close Human-Robot Interation & Cognition
- Virtual & Augmented Reality
- Data fusion
- Mobile robots, AGV, Autonomous driving

Let's work together