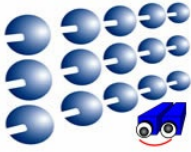
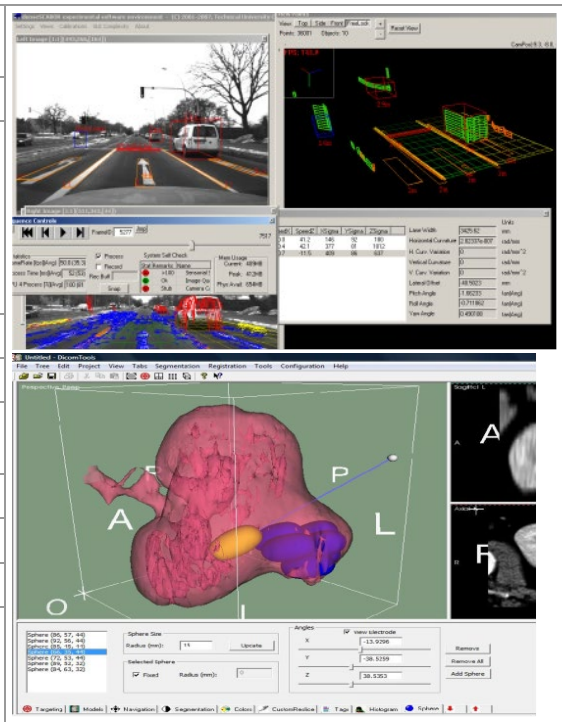


IMAGE PROCESSING AND PATTERN RECOGNITION RESEARCH CENTER

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Areas of expertise

Image processing and pattern recognition: Color, grayscale and 3D image processing; Automatic image and media annotation
Stereovision based sensorial perception: Stereovision; Dense optical flow; Object detection, classification and tracking; Real-time computer vision
Object detection, classification and tracking: use of deep learning and probabilistic model-based techniques for object detection, classification and tracking from grayscale, colour and 3D information
Advanced driving assistance and Autonomous mobile systems: -Sensorial perception; Environment representation; Risk assessment, Autonomous vehicles. Autonomous drones
Medical image analysis: Segmentation; Recognition; Prediction; Structured reporting; Ultrasonography, CT, MRI

Team

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 Phd. students: Eng. Marius Drulea, Eng. Catalin Golban, Eng. Mircea Muresan, Eng. Horatiu Florea

Representative projects

SenseMaking - Collaborative research project targeted toward the development of a distributed autonomous response for Humanitarian Assistance and Disaster Relief (HADR), in particular, all-domain wildfire response, funded by LM (2022-2025)
DeepPerception, "Deep Learning Based 3D Perception for Autonomous Drivideeng", code: PN-III-P4-PCE-2021-1134, (2022-2024), <https://cv.utcluj.ro/deepperception/>
MEDALS, "Modeling, Estimation and Management of Dangerous Situations by Continuous Analysis of the Driver-Vehicle-Environment System, code: PN-III-P4-ID-PCE-2020-1700, (2021-2023), <https://cv.utcluj.ro/medals/>
SEPICA, "Visual Semantics and Integrated Control for Autonomous Systems", code PN III-P4-ID-PCCF-2016-0180, (2018-2022), <http://vision.imar.ro/sepica/index.html>
MULTISPECT, "Multispectral environment perception by fusion of 2D and 3D sensorial data from the visible and infrared spectrum", code PN-III-P4-ID-PCE-2016-0727, (2017-2019), <https://cv.utcluj.ro/multispect/>
UP Drive, "Automated Urban Parking and Driving", H2020 project, <http://up-drive.eu/> (2016-2020)
MULTIFACE, "Multifocal System for Real Time Tracking of Dynamic Facial and Body Features", PN-II-RU-TE-2014-4-1746 project, (2015-2017). <https://cv.utcluj.ro/multiface/index.php/home.en.html>
"Reconfigurable ROS-based Resilient Reasoning Robotic Cooperating Systems", FP7 ARTEMIS (2014-2017).
Road surface measurement and modeling, funded by Rober Bosch GMBH, (2013-2016)
PAN-ROBOTS, "Plug and Navigate ROBOTS for smart factories", FP7 project, (2012-2015)
CoMoSef, "Co-operative Mobility Services of the Future", Eureka project, (2012-2015)
INTERSAFE-2, "Cooperative Intersection Safety", FP7 project, <http://cv.utcluj.ro/intersafe-2.html> (2008-2011)
SMARTCODRIVE, "Cooperative Advanced Driving Assistance System Based on Smart Mobile Platforms and Road Side Units", PNII PT PCCA (Joint Applied Research Project), <http://cv.utcluj.ro/smartcodrive/> (2012-2016)

AMHEOS, “Automatic Medium and High Earth Orbit Observation System Based on Stereovision”, PNII PCCA (Joint Applied Research Project), <http://cv.utcluj.ro/amheos/> (2012-2016)

MULTISENS, “Multi-scale multi-modal perception of dynamic 3D environments based on the fusion of dense stereo, dense optical flow and visual odometry information”, PNII-Idei, <http://cv.utcluj.ro/multisens/> (2011-2016)

Significant results

The most representative publications of the past 5 years:

1. V.-C. Miclea, S. Nedevschi, Dynamic Semantically Guided Monocular Depth Estimation for UAV Environment Perception, IEEE Transactions on Geoscience and Remote Sensing, 62, pp. 1–11, 5605111, 2024.
2. A Petrovai, S Nedevschi, MonoDVPS: A Self-Supervised Monocular Depth Estimation Approach to Depth-aware Video Panoptic Segmentation, Proceedings of the IEEE/CVF Winter Conference on Applications of Computer Vision, Pages 3077-3086, 2023.
3. H Florea, A Petrovai, I Giosan, F Oniga, R Varga, S Nedevschi, Enhanced perception for autonomous driving using semantic and geometric data fusion, Sensors 22 (13), 5061, 2022.
4. A Petrovai, S Nedevschi, Exploiting pseudo labels in a self-supervised learning framework for improved monocular depth estimation, Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, pages 1578-1588, 2022.
5. V.C. Miclea, S. Nedevschi, “Monocular Depth Estimation With Improved Long-Range Accuracy for UAV Environment Perception”, IEEE Transactions on Geoscience and Remote Sensing, Vol. 60, AN: 5602215, 2022, DOI: 10.1109/TGRS.2021.3060513.
6. A Petrovai, S. Nedevschi, “Semantic Cameras for 360-degree Environment Perception in Automated Urban Parking and Driving”, IEEE Transactions on Intelligent Transportation Systems, vol. 23, Issue 10, pp. 17271-17283, Oct 2022, DOI:10.1109/TITS.2022.3156794.
7. M.P. Muresan, S. Nedevschi, R. Danescu, “Robust Data Association using Fusion of Data-Driven and Engineered Features for Real Time Pedestrian Tracking in Thermal Images”, SENSORS, Vol. 21, Issue 23, AN 8005, NOV 2021, DOI: 10.3390/s21238005.
8. R. Brehar, M.P. Muresan, M. Tiberiu, C. Vancea, N. Mihai, S. Nedevschi, “Pedestrian Street-Cross Action Recognition in Monocular Far Infrared Sequences”, IEEE ACCESS, Vol. 9, pp. 74302-74324, JUN 2021, DOI:10.1109/ACCESS.2021.3080822.
9. A.D. Costea, A. Petrovai, S. Nedevschi, "Fusion Scheme for Semantic and Instance level Segmentation", *Proceedings of 2018 IEEE Intelligent Transportation Systems Conference (ITSC)*, Maui, Hawaii, USA, November 4-7, 2018, pp. 3469-3475.
10. D. Borza, R. Itu, R. Danescu, “In the Eye of the Deceiver: Analyzing Eye Movements as a Cue to Deception”, *Journal of Imaging*, Vol. 4, No. 10, 2018, Art. No. 120.
11. V. Miclea, S. Nedevschi, „Real-Time Semantic Segmentation-Based Depth Upsampling Using Deep Learning”, Proceedings of 2018 IEEE Intelligent Vehicles Symposium (IV), Changshu, China, June 26-30, 2018

Significant solutions:

High accuracy dense stereovision; High accuracy dense optical flow; Stereovision based ego-motion estimation; Lane detection and tracking; Detection and classification of painted road objects; Obstacle detection and tracking; Obstacle classification; Perception & representation of unstructured environments; Forward collision detection; Dynamic environment perception; High level reasoning on perception and domain knowledge; Automatic image annotation; Omnidirectional stereovision, Deep learning based detection, semantic segmentation, panoptic segmentation; Spatio-temporal and appearance based representation of 3D environment.

Products and technologies:

1. Real-time stereovision-based perception solution stance sensorial system for highways
2. Real-time stereovision-based sensorial system for city driving assistance functions
3. Real-time stereovision-based advanced driving assistance for cooperative intersection safety.
4. Real-time GPU based solutions for accurate dense stereovision and accurate dense optical flow estimation.
5. Ground-base long baseline observation system for automatic detection and ranging of Low Earth Orbit objects.
6. Automatic visual annotation system
7. Medical diagnosis assistance system based on ultrasonic image texture analysis, for detection of diffuse diseases, malign and benign liver tumours, prostate cancer
8. Omnidirectional stereovision for surrounding perception used for robotic applications
9. Spatio-temporal and appearance based representation for environment representation; Panoptic segmentation solutions

The offer addressed to the economic environment

Research & development	Sensory perception based on 3D depth sensors and colour cameras: organization, identification and interpretation of the sensory information for environment representation and understanding. Advanced driving assistance and Autonomous mobile systems: environment perception and representation, risk assessment, planning. Medical imaging: textural analysis, probabilistic segmentation and machine learning for assisted diagnosis from ultrasonography and tomography.
Consulting	Consulting, design, research and prototyping towards development of 2D and 3D sensors based solutions for multiple industrial and scientific fields, autonomous mobile systems.
Training	Image processing, Pattern recognition, Deep Learning, Perception, Autonomous mobile systems

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