**IMAGE PROCESSING AND PATTERN RECOGNITION RESEARCH CENTER**

**Contact details**

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**Areas of expertise**

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| **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  **Advanced driving assistance and Autonomous mobile systems**  **-**Sensorial perception; Environment representation; Risk assessment  **Medical image analysis**  **-**Enhancement; Segmentation; Recognition; Prediction; Structured reporting; Ultrasonography, CT, MRI |

**Team**

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| **Prof. Dr. Eng. Sergiu Nedevschi**; Assoc. Prof. Dr. Eng. Tiberiu Mariţa; Assoc. Prof. Dr. Eng. Radu Danescu; Assist. Prof. Dr. Eng. Florin Oniga, Assist. Prof. Dr. Eng. Delia Mitrea; Assist. Prof. Dr. Eng. Cristian Vicas; Assist. Dr. Eng. Anca Ciurte, Dr. Eng. Voichita Popescu, Dr. Eng. Pangyu Jeong,  Phd. students: Assist Eng. Raluca Brehar, Assist. Eng. Mihai Negru, Assist. Eng. Ion Giosan, Assist. Eng. Andrei Vatavu, Eng. Cristian Vancea, Eng. Marius Drulea, Eng. Arthur Costea, Eng. Robert Varga |

**Representative projects**

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| **PAN-ROBOTS**, **“Plug and Navigate ROBOTS for smart factories”**, European FP7 project, (2012-2015)  **CoMoSef**, **“Co-operative Mobility Services of the Future”,** European Eureka project, (2012-2015)  **DRIVE C2X** - **Accelerate cooperative mobility,** European FP7 project, <http://www.drive-c2x.eu/> (2011-2014)  **INSEMTIVES**, **“Incentives for Semantics”**, European FP7 project, [www.insemtives.eu](file:///D:\calculator%20vechi\D\Work_UT\Structuri_cercetare\Brosura_domenii\www.insemtives.eu) (2010-2012)  **LarKC**, “Large Knowledge Collider”, European FP7 project, (2008-2011), <http://www.larkc.eu> (2010-2011)  **INTERSAFE-2**, **“Cooperative Intersection Safety”**, European 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/> (2012-2015)  **AMHEOS**, **“Automatic Medium and High Earth Orbit Observation System Based on Stereovision”**, PNII PCCA (Joint Applied Research Project), <http://cv.utcluj.ro/amheos/> (2012-2015)  **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/> (2011-2014)  **PERSENS**, **“Sensorial perception, modeling and representation of the world model for driving assistance systems”**, PNII-Idei (PCE), <http://cv.utcluj.ro/persens/> (2009-2011)  **LEOSCOP**, **“Experimental Low Earth Orbit Surveillance Stereoscope”**, PNII-PDP (Joint Applied Research Project), D8, <http://www.bitnet.info/proiecte/leoscop/leoscop.htm> (2008-2010) |

**Significant results**

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| **Articles in ISI rated journals, in the past 5 years:**   1. S. Nedevschi, V. Popescu, R. Danescu, T. Marita, F. Oniga, “Accurate Ego-Vehicle Global Localization at Intersections through Alignment of Visual Data with Digital Map”, in *IEEE Transactions on Intelligent* *Transportation Systems,* 2013, pp. 673-687 2. M. Drulea, S. Nedevschi, Motion estimation using the correlation transform, in *IEEE Transactions on Image Processing*, vol. 22, no. 8, 2013, pp. 3260-3270 3. R. Varga, S. Nedevschi, Label transfer by measuring compactness, in *IEEE Transactions on Image Processing*, vol. 22, no. 12. 2013, pp. 4711-4723 4. R. Danescu, F. Oniga, V. Turcu, O. Cristea, “Long Baseline Stereovision for Automatic Detection and Ranging of Moving Objects in the Night Sky”, *Sensors*, vol. 12, no. 10, October 2012, pp. 12940-12963. 5. C. Pantilie, S. Nedevschi, “SORT-SGM: Sub-pixel Optimized Real-Time Semi-Global Matching for Intelligent Vehicles”, *IEEE Transactions on Vehicular Technology*, vol. 61, no. 3, 2012, pp. 1032-1042. 6. I. Haller, S. Nedevschi, "Design of Interpolation Functions for Sub-Pixel Accuracy Stereo-Vision Systems”, *IEEE Transactions on Image Processing*, vol. 21, no. 2, 2012, pp. 889-898. 7. D. Mitrea, S. Nedevschi, M. Socaciu, R. Badea, “The Role of the Superior Order GLCM in the Characterization and Recognition of the Liver Tumors from Ultrasound Images”, *Radioengineering*, vol. 21, no. 1, 2012, pp. 79-85. 8. V. Cristian, M. Lupsor, R. Badea, S. Nedevschi, Usefulness of textural analysis as a tool for noninvasive liver fibrosis staging, *Journal of Medical Ultrasonics,* vol. 38, no.3, 2011, pp. 105-117. 9. R. Danescu, F. Oniga, S. Nedevschi, Modeling and tracking the driving environment with a particle-based occupancy grid, in *IEEE Transactions on Intelligent* *Transportation Systems,* vol. 12, no. 4, 2011, pp. 1331-1342 10. F. Oniga, S. Nedevschi, Processing dense stereo data using elevation maps: Road surface, traffic isle, and obstacle detection, in *IEEE Transactions on Vehicular Technology,* vol.59 no. 3, 2010, pp. 1172-1182 11. S. Nedevschi, S. Bota, C. Tomiuc, Stereo-based pedestrian detection for collision-avoidance applications, in *IEEE Transactions on Intelligent* *Transportation Systems,* vol. 10, no. 3, 2009, pp. 380-391   **Significant solutions:**  High accuracy feature-based stereovision; High accuracy dense stereovision; High accuracy dense optical flow; - Vision based ego-motion estimation using a stereo system; 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; Medical image processing, interpretation and structured reporting  **Products and technologies:**  1. Real-time stereovision-based driving assistance 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 tumors, prostate cancer  **International Patents:**  M. Akio, S. Nedevschi, “Optical System”, international patent no. WO2012038601-A1, March 29, 2012 |

**The offer addressed to the economic environment**

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| Research & development | Development of original solutions for modeling dynamic 3D environments.  Development of original algorithms for feature extraction from monocular grayscale or color images, from stereo images, or from medical images (CT, ultrasonic, PET).  Development of original algorithms for 3D or 6D reconstruction, using classical stereovision, omnidirectional stereovision and optical flow.  Development of original algorithms for model matching, probabilistic tracking, and object classification.  Development of real-time perception systems for structured or unstructured 3D environments, applied to driving assistance systems, autonomous robots, space observation, or computer assisted medical diagnosis.  Development of integrated hardware and software solutions for computer vision,  Development of cooperative driving assistance systems. |
| Consulting | Consulting, design, research and prototyping towards development of image processing based solutions for multiple industrial and scientific fields.  Custom integrated hardware and software solutions for specific problems related to driving assistance systems, surveillance, object and people recognition, automated medical diagnosis. |
| Training | **Image processing basics:** camera model, image formation, noise in the digital images, noise removal techniques, edge and corner detection, image segmentation, color spaces, frequency space analysis.  **Pattern recognition techniques:** extraction of features for classification, classification techniques, design and use of classifiers, object tracking techniques.  **Advanced techniques:** accurate camera calibration, real-time stereovision, realtime optical flow, FPGA based image acquisition and processing. |