Medical Image Processing @ IPPRRG

Image Processing and Pattern Recognition Research Group

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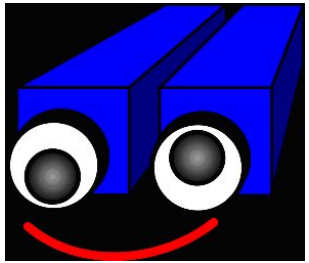

MIP: Research team and expertise


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Tiberiu MARITA


Delia Alexandrina MITREA

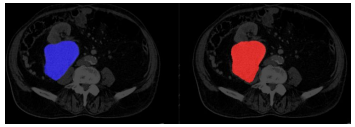

Raluca BREHAR

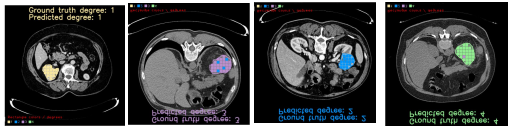

Cristian VANCEA

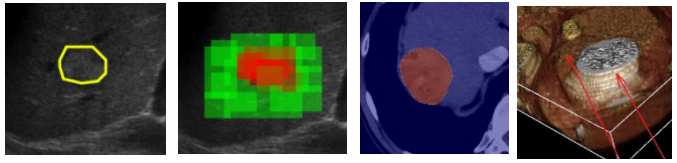
- Expertise
  - Image enhancement, textural analysis, probabilistic and machine learning based segmentation and classification for non or minimal invasive assisted diagnosis and treatment
  - 3D modeling and reconstruction from volumetric data (CT, MRI, US with known spatial position)
  - Specific solutions for several imaging modalities (Ultrasonography, CT, MRI. Mammography, OCT, X-ray) and several pathologies

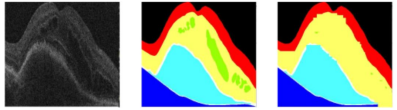
AI-driven techniques for assisted diagnosis

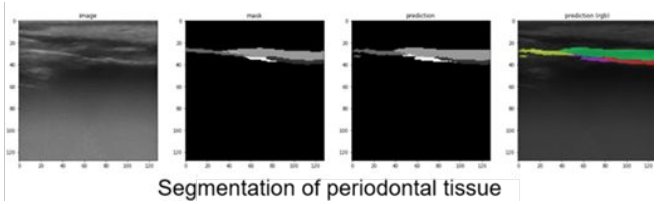
- Development of deep-learning models for medical images segmentation and classification
- Applications:
  - Kidney Tumor Segmentation & Staging (CT images)
  - Hepatocellular carcinoma (HCC) and pancreatic adenocarcinoma segmentation/classification in US and CT images
  - OCT Image Segmentation
  - Periodontal tissues, blood vessels segmentation (US images)
  - (HER2+) and (HER2–) breast tumors classification (histopathology)
  - CNN model for mass lesions segmentation (Mammography images)

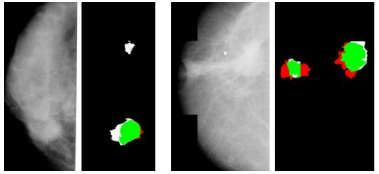












AI synergy!

Relevant research projects

- **ACADTUM,** “Automatic and computer assisted diagnosis of abdominal tumors, through advanced machine learning techniques, within various types of medical images”, TE 156/2022, (2022-2024) (TRL4), https://cv.utcluj.ro/acadtum/index.html
- **IMPROVE**, “High-precision innovative approach regarding robotic assisted intraoperative treatment of hepatic tumors based on integrated imaging-molecular diagnosis”, PN-III-P1-1.2 PCCDI 2018, (2018-2021) (TRL4)
- **3DUSAI** "Improvements of an existing 3D freehand ultrasound periodontal scanner using bidimensional neural networks driven segmentation techniques" (3DUSAI), EIT Health RIS Program, nr. 8253 / 2020 (TRL4)
- **3DentArVis**, “Software application for viewing, segmenting, sectioning, measuring and archiving the 3D models of reconstructed dental arches from US images”, Chifor Research, nr. 70/2018 (2018-2019) (TRL5)
- **M-ASSIST** “Tool for computer assisted mammographic image processing and analysis”, PN-III-P2-2.1-CI-2018-1362 , nr. 235CI / 2018 (2018) (TRL3)
- **CTC-VideoScope** (PN-II-PT-PCCA-2013-4-2289) nr. 137/2014 (2014-2017) (TRL3)
- **ElastoBreast** – “Qualitative and Quantitative Study of Ultrasonic Elastography and of Native Three-dimensional Angio-ultrasonography in Detection, Diagnosis and Monitoring of Breast Cancer with Noninvasive Techniques",, Program CEEX, no. 149/2006, (2006 - 2008) (TRL4)
- **CRIOLAPSIM** - “Laparoscopic cryosurgical treatment of the renal tumors, individualized using simulation on three-dimensional reconstructed model ”, national research grant financed by Romanian Ministry of Research , Program CEEX, no. 121/2006 (TRL3)

Collaboration inquiry/offer

- Open to **collaboration** opportunities in the following areas:
  - Medical imaging
  - Computer assisted diagnosis
  - Preventive and personalized medicine
  - Active and assisted living
- **Research** Collaborations & **Joint Proposals** in:
  - **Development of image annotation tools adapted to the imaging modality** (US, MRI, CT, US, OCT, X-ray) and **type of problem** (segmentation, classification, temporal analysis) based on advanced image processing, SAM and knowledge distillation)
  - **Analysis, processing and interpretation of medical imaging data** (image quality enhancement, automatic recognition and segmentation of anatomical structures and lesions, reconstruction and registration of multimodal images)
  - **Applying state-of-the-art methods in medical imaging, and developing new/original methods** (CNNs for classification and segmentation, Generative Models (GANs) for image synthesis and enhancement, transfer learning for adapting pre-trained models, domain adaptation learning, semi-supervised learning)
  - **Applications and integration of methods in clinical practice** (integrated decision support systems based on imaging, telemedicine platforms with automatic image analysis, clinical evaluation and validation of AI algorithms in hospitals)