LIVIA LABORATOIRE D'IMAGERIE, DE VISION ET D'INTELLIGENCE ARTFICIELLE

ÉTS

Research Axes

- machine learning
- computer vision: perception in 2D and 3D scenes
- pattern recognition in static and dynamically-changing environments
- information fusion
- optimization of complex systems
- O(log N) image indexing - big data

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Application Domains

- analysis of medical, aerial and satellite images
- video analytics and surveillance
- biometrics (face, voice and signature)
- document analysis
- affective computing in healthcare

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Members and Expertise (1/2)

1. **Ben Ayed, Ismail**: Computer Vision; Machine Learning and Pattern Recognition, Combinatorial Optimization, Convex Optimization, Medical Image Analysis, Information Theory
2. **Dolz, Jose:** Medical Image Segmentation, Deep Learning, Optimization
3. **Duchaine, Vincent**: Robotics, Mechatronics, Physical Human-Robot interaction, Haptics, Tactile Sensing, Nonlinear and Impedance control
4. **Cardinal, Patrick:** Affective Computing, Deep Learning, Speech Recognition, Information Extraction from Speech, Parallel Computing
5. **Desrosiers, Christian**: Data Mining; Medical Imaging; Collaborative Recommendation Systems; Network Analysis; Business Intelligence; Combinatorial Optimization
6. **Granger, Eric**: Machine Learning, Pattern Recognition, Computer Vision, Information Fusion, Adaptive and Intelligent Systems, Video Surveillance, Biometrics, Affective Computing

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Members and Expertise (2/2)

7. **Koerich, Alessandro**: Computer Vision; Machine Learning; Music Information Retrieval; Big Data Analytics; Affective Computing
8. **Pedersoli, Marco:** Visual Object Class Detection Classification and Pose Estimation, Weakly- and Semi-Supervised Learning, Convolutional and Recurrent Neural Networks
9. **Sabourin, Robert:** Document and Signature Analysis; Pattern Recognition and Learning; Information Fusion; Evolutionary Algorithms
10. **Toews, Matthew:** Medical Image Analysis; Computer Vision; Machine Learning
11. **Wong, Tony:** Industrial Engineering; Chance-Constrained and Multi-Objective Evolutionary Optimization; Data Envelopment Analysis; Statistical Ranking and Selection

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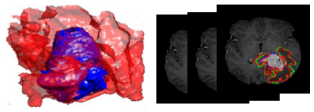
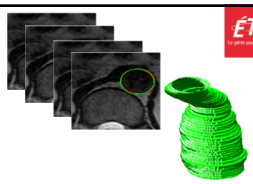
Image segmentation

ÉTS

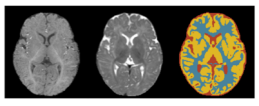


Brain tumours



Incidental findings
(vascular structures)

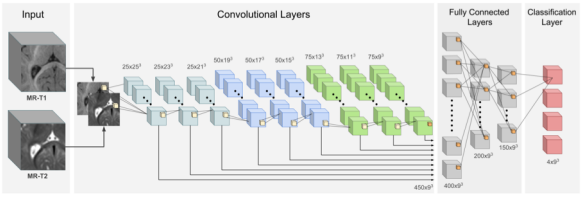
Subcortical structures



Brain tissue

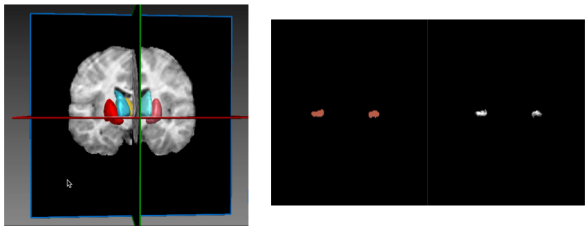
Deep semi-dense and multi-scale FCNN

LiviaNET (early fusion)



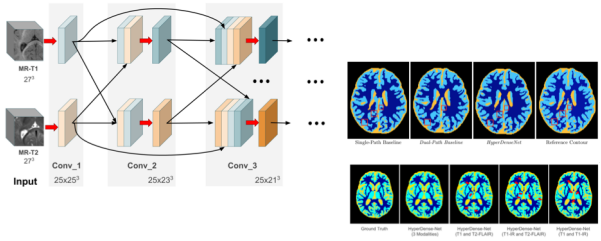
https://github.com/josedolz/LiviaNET

Subcortical structures and brain tissue in MRI



Multi-modal learning

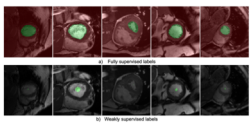
HyperDenseNet

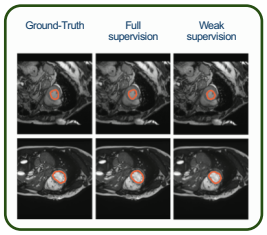


https://github.com/josedolz/HyperDenseNet

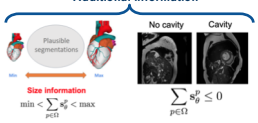
Weakly supervised learning

Reduce the cost of manual annotations





Additional information

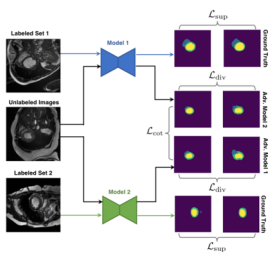


$$\min < \sum_{p \in \Omega} s_p^p < \max \qquad \sum_{p \in \Omega} s_y^p \leq 0$$

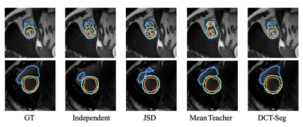
https://github.com/LIVIAETS/SizeLoss_WSS_

Semi-supervised learning

Co-training multiple CNNs

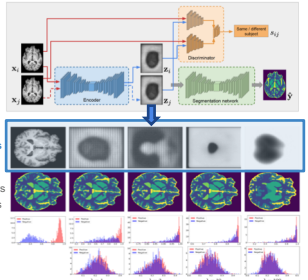


$\mathcal{L}_{\text{sup}}$: Supervised loss on labeled examples
$\mathcal{L}_{\text{div}}$: Diversity loss using adversarial examples
$\mathcal{L}_{\text{cot}}$: Co-training loss on unlabeled examples



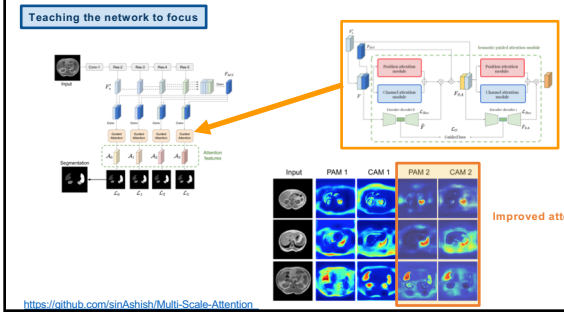
Privacy preserving

Avoid leakage of sensitive information



Deep attention

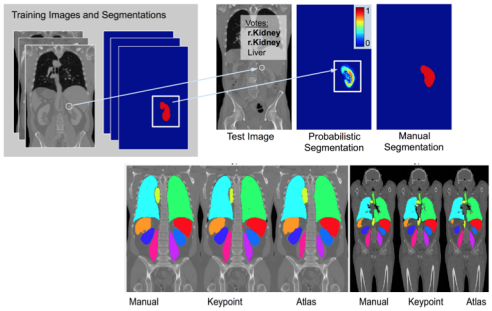
Teaching the network to focus



Improved attention

https://github.com/sinAshish/Multi-Scale-Attention

Keypoint Transfer for Fast Whole-Body Segmentation



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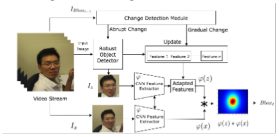
Deep Learning Models for Recognition in Video

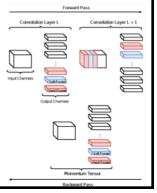
Real-Time Person Detection and Tracking

Cost-effective deep learning models for joint detection and tracking multiple individuals appearing in a videos

Adaptive Siamese FC networks for tracking with change detection

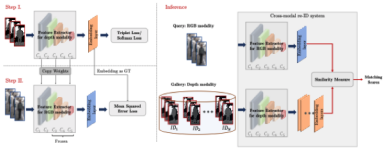


Progressive channel pruning during domain adaptation

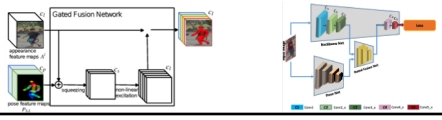


Person Re-Identification

RGB-Depth re-identification using cross-modal distillation networks



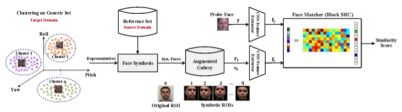
Pose-based gating networks for pose-aligned matching



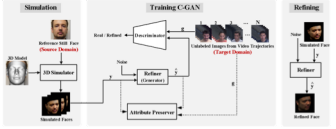
Synthetic Generation for Face Recognition

Synthetic + Variational SRC models for robust FR from a single sample

Deep Siamese networks with block-sparsity matching

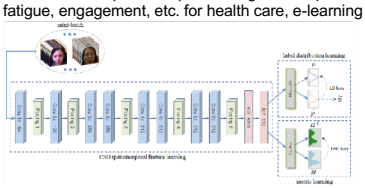


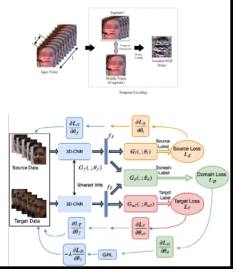
Cross-Domain Face Synthesis using a Controllable GAN



Affective Computing

DL models for spatio-temporal recognition of pain, stress, depression, fatigue, engagement, etc. for health care, e-learning and gaming





Deep weakly-supervised domain adaptation to different capture conditions

Fusion of facial and vocal modalities

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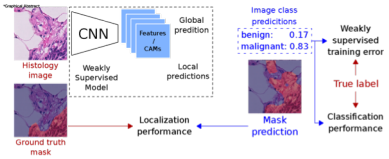
Medical Image Technology

Computer Aided Diagnosis

Deep weakly supervised learning techniques for classification and localization base on histology images with global annotations



Leverage the large quantity of weakly-labelled or unlabelled images

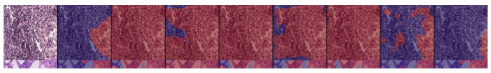
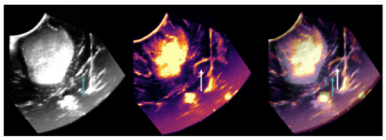


Image-Guided NeuroSurgery

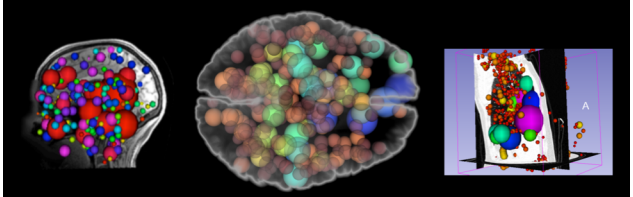


Phantomless Auto-Calibration and Online Calibration Assessment for a Tracked Freehand 2D Ultrasound Probe

A Feature-Driven Active Framework for Ultrasound-Based Brain Shift Compensation

Hybrid MRI-Ultrasound Acquisitions, and Scannerless Real-Time Imaging

Keypoint Signatures – O(log N) Medical Image Analysis



"Neuroimage signature from salient keypoints is highly specific to individuals and shared by close relatives"
NeuroImage 2020