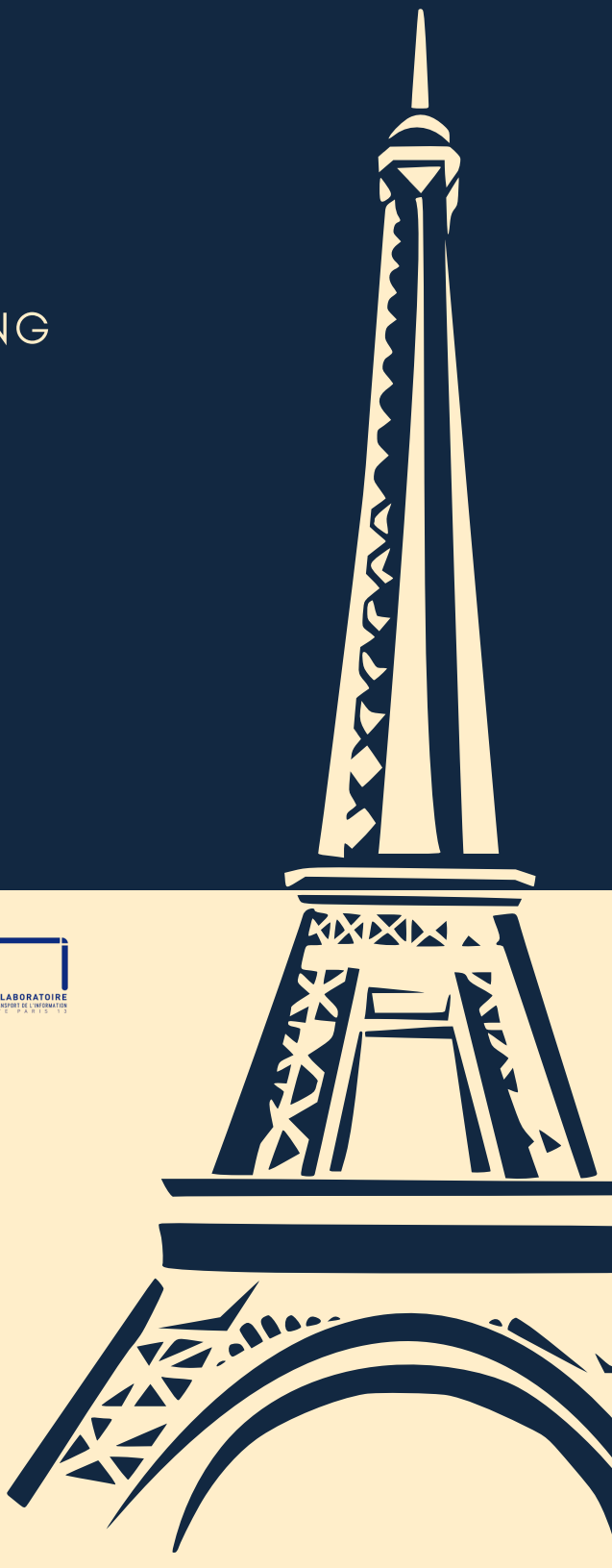
EUVIP 2021

23 - 25 June, 2021, Paris, France

EUVIP 2021

9-TH EUROPEAN WORKSHOP ON VISUAL INFORMATION PROCESSING



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About

EUVIP 2021

The 9th European Workshop on Visual Information Processing (EUVIP) will take place in Paris, France, 23-25 June 2021. EUVIP 2021 continues the series of workshops on visual information processing, modeling, and analysis methods inspired by the human and biological visual systems, with applications to image and video processing and communication. EUVIP 2021 offers experienced researchers an intellectually stimulating environment for discussion and interactions with their peers, encourages early career researchers to widen their experience and horizons, and guides Ph.D. students towards new research directions. The flagship theme of this edition is « Image Quality Assessment and Enhancement (IQAE) in the context of medical diagnostic imaging ».

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Lu Zhang	*(INSA Rennes, France)*

Timetable

TT: Tutorial, PS: Plenary Speaker, SC: Session Chair, PD: Project Dissemination.

Tuesday, 22th June

8:30–9:30	TT	Tutorial 1 part 1
9:30–9:40	**Coffee break**	
9:40–10:40	TT	Tutorial 1 part 2
10:40–10:50	**Coffee break**	
10:50–11:50	TT	Tutorial 2 part 1
11:50–13:00	**Break**	
13:00–14:00	**Lunch**	
14:00–15:00	TT	Tutorial 3 part 1
15:00–15:10	**Break**	
15:10–16:10	TT	Tutorial 3 part 2
16:10–16:20	**Break**	
16:20–17:20	TT	Tutorial 4 part 1
17:20–17:30	**Break**	
17:30–18:30	TT	Tutorial 4 part 2
18:30	End	

Wednesday, 23th June

9:00–9:30	Opening		
9:30-10:30	PS	**P. Mamassian** Paris, France	Visual Confidence
10:30–11:00	**Coffee break - France 1 Tour**		
11:00-12:00	Paper ID	**Session 1 – Special Session**	
	SC	**Karen Egiazarian** Tampere University, Finland	Image and video quality assessment
11:00-11:15	35	**Waqas Ellahi et al.** University of Nantes, France	Evaluation of the bubble view metaphor for the crowdsourcing study of visual attention deployment in tone-mapped images
11:15-11:30	41	**Aladine Chetouani et al.** Université d'Orléans, France	Combination of Deep Learning-based and Handcrafted Features for Blind Image Quality Assessment
11:30-11:45	50	**Zohaib Amjad Khan et al.** Université Paris 13, France	Learning based contrast enhancement evaluation using cartoon texture decomposition
11:45-12:00	29	**Mykola Ponomarenko et al.** Tampere University, Finland	Color image database HTID for verification of no-reference metrics: peculiarities and preliminary results
12:00–14:00	**Lunch**		
14:00-14:45	Paper ID	**Session 2**	
	SC	**Mounir Kaaniche** Université Sorbonne Paris Nord, France	Biomedical Image Processing
14:00-14:15	11	**Ronny Xavier Velastegui Sandoval et al.** NTNU, Norway	The impact of using different color spaces in histological image classification using convolutional neural networks
14:15-14:30	26	**Anuja Vats et al.** NTNU, Norway	A Preliminary Analysis of Self-Supervision for Wireless Capsule Endoscopy
14:30-14:45	18	**Ilyes Mrad et al.** Qatar University, Qatar	Machine learning screening of COVID-19 patients based on x-ray images for imbalanced classes
14:45–15:00	**Coffee break**		

15:00-15:45	Paper ID	Session 3 – Special Session	
	SC	**Ahmed Bouridane** Northumbria University, UK	Multimedia Forensics and Biometric Security: Recent Advances
15:00-15:15	45	**Mays Alshaikhli et al.** Qatar University, Qatar	FaceFakeNet: The Deep Learning Method for Image Face Anti-spoofing Detection
15:15-15:30	43	**Ismahane Cheheb et al.** Northumbria University, UK	Video steganalysis in the transform domain based on morphological features of the motion vectors map
15:30-15:45	48	**Sid Ahmed FEZZA et al.** National Institute of Telecommunications and ICT	Visual Quality and Security Assessment of Perceptually Encrypted Images based on Multi-output Deep Neural Network
15:45–16:00	**Coffee break**		
16:00-16:45	Paper ID	Session 4	
	SC	**Wassim Hamidouche** INSA Rennes, France	Multimedia processing and enhancement
16:00-16:15	2	**Lingyu Zhu et al.** Tampere University, Finland	Leveraging Category Information for Single-Frame Visual Sound Source Separation
16:15-16:30	14	**Sahar Husseini et al.** Tampere University, Finland	Color Constancy Model Optimization with Small Dataset Via Pruning of CNN Filters
16:30-16:45	38	**Mykola Ponomarenko et al.** Tampere University, Finland	Blind estimation and suppression of additive spatially correlated Gaussian noise in images
16:45	End of day 1		

Thursday, 24th June

9:00–10:00	PS	**W. Heidrich** Thuwal, Saudi Arabia	Deep Optics — Joint Design of Imaging Hardware and Reconstruction Methods
10:00–10:15	**Coffee break - France 2 Tour**		
10:15–11:00	**Paper ID**	**Session 5**	
	SC	**Aladine Chetouani** Université d'Orléans, France	Image and Video Analysis I
10:15–10:30	**31**	**Baptiste Magnier et al.** IMT Mines Ales CERIS, France	Shen-Castan based edge detection methods for Bayer CFA images
10:30–10:45	**17**	**Jerome Treboux et al.** HES-SO Valais - IIG, Switzerland	Improved line detection in images using neural networks and DTE subclassifiers
10:45–11:00	**37**	**Kaouther Ouenniche et al.** Télécom sud Paris, France	A deep learning-based approach for camera motion classification
11:00–11:15	**Coffee break**		
11:15–12:00	**Paper ID**	**Session 6**	
	SC	**Sayed Ali Amirshahi** NTNU, Norway	Image and Video Analysis II
11:15–11:30	**5**	**Debabrata Pal et al.** Honeywell	MSHSCNN: Multi-scale Hybrid-Siamese Network to differentiate visually similar character classes
11:30–11:45	**13**	**Tero Partanen et al.** Tampere University, Finland	Implementation and Accuracy Evaluation of Fixed Camera-Based Object Positioning System Employing CNN-Detector
11:45–12:00	**8**	**Jakub Žádník et al.** Tampere University, Finland	Performance of Texture Compression Algorithms in Low-Latency Computer Vision Tasks
12:00–14:00	**Lunch**		
14:00–15:00	PS	**S. Cotin** Strasbourg, France	Augmented Surgery: how numerical simulation, computer vision and machine learning can help reduce risks in the operating room

15:00-16:45	Project dissemination session		
	SC	**Titus Zaharia** Télécom SudParis, France	**Sony George** NTNU, Norway
15:00-15:15	**P1**	**Jon Yngve Hardeberg** NTNU, Norway	ApPEARS
15:15-15:30	**P2**	**Jon Yngve Hardeberg** NTNU, Norway	MUVapp
15:30-15:45	**P3**	**Matthieu Parmentier/ Ruxandra Tapu** France TV/ Télécom SudParis	AITV
15:45-16:00	**P4**	**Marius Preda** Télécom SudParis, France	SILENSE
16:00-16:15	**P5**	**Soren Forchhammer, Fotonik** DTU, Denmark	RealVision
16:15-16:30	**P6**	**P. Tsakanikas** ICCS	ALAMEDA
16:30-16:45	**P7**	**Ole Jacob Elle** University of Oslo, Norway	HiPerNav
16:45–17:00	**Coffee break**		
17:00–17:45	Panel Discussion		
17:45	End of day 2		

Friday, 25th June

9:00–10:00	PS	**A. Bouzerdoum** Doha, Qatar	Semantic Segmentation for Assistive Navigation using Deep Bayesian Gabor Networks
10:00–10:15	**Coffee break - France 3 Tour**		
10:15–11:30	**Paper ID**	**Session 7**	
	SC	**Stefania Colonnese** Sapienza University Roma, Italy	Visual Object Tracking and Surveillance
10:15–10:30	**30**	**Zolbayar Shagdar et al.** NTNU, Norway	Geometric Deep Learning for Multi-Object Tracking: A brief Review
10:30–10:45	**7**	**Olfa Haggui et al.** IMT Mines Alès, France	A Comparison of OpenCV Algorithms for HumanTracking with a Moving Perspective Camera
10:45–11:00	**27**	**Hamza Riaz et al.** Dublin City University, Ireland	Anomalous human action detection using a cascade of deep learning models
11:00–11:15	**25**	**Xingyang Ni et al.** Tampere University, Finland	FlipReID: Closing the Gap between Training and Inference in Person Re-Identification
11:15–11:30	**21**	**Zahra Mortezaie et al.** Shahrood University of Technology, Iran	A color-based re-ranking process for people re-identification
11:30–11:45	**Coffee break**		
11:45–12:30	**Paper ID**	**Session 8**	
	SC	**Mohib Ullah** NTNU, Norway	Learning-Based Methods
11:45–12:00	**10**	**Saeed Bakhshi Germi et al.** Tampere University, Finland	Selective Probabilistic Classifier Based on Hypothesis Testing
12:00–12:15	**34**	**Muhammad Waqas et al.** National University of Computer and Emerging Sciences, Pakistan	Ensemble-based instance relevance estimation in multiple-instance learning

12:15-12:30	15	**Bishwo Prakash Adhikari et al.** Tampere University, Finland	Sample selection for efficient image annotation
12:30–12:45	Awards and Closing Ceremony		

Plenary Speakers

Wednesday 23th

Visual Confidence

Pascal Mamassian [1]

PS

[1] Laboratoire des Systèmes Perceptifs at the Ecole Normale Supérieur, Paris

Visual confidence refers to our ability to predict the correctness of our perceptual decisions. Knowing the limits of this ability, both in terms of biases (e.g. overconfidence) and sensitivity (e.g. blindsight), is clearly important to approach a full picture of perceptual decision making. In recent years, we have explored visual confidence using a paradigm called confidence forced-choice. In this paradigm, observers have to choose which of two perceptual decisions is more likely to be correct. I will review some behavioral results obtained with the confidence forced-choice paradigm, together with a theoretical model based on signal detection theory.

Thursday 24th

Deep Optics — Joint Design of Imaging Hardware and Reconstruction Methods

Wolfgang Heidrich[1]

PS

[1] King Abdullah University of Science and Technology (KAUST)

Classical imaging systems are characterized by the independent design of optics, sensors, and image processing algorithms. In contrast, computational imaging systems are based on a joint design of two or more of these components, which allows for greater flexibility of the type of captured information beyond classical 2D photos, as well as for new form factors and domain-specific imaging systems. In this talk, I will describe how numerical

optimization and learning-based methods can be used to achieve truly end-to-end optimized imaging systems that outperform classical solutions.

Augmented Surgery: how numerical simulation, computer vision and machine learning can help reduce risks in the operating room

Stéphane Cotin[1,2] PS

[1] Inria
[2] MIMESIS team

Developments of imaging devices, numerical methods, and medical robotics are profoundly changing how modern medicine is practiced. This talk will highlight the increasing role of real-time numerical simulation in the fields of surgery and interventional radiology, with an impact in two major application areas: surgical training and computer-assisted interventions.

Numerical simulations have been used for several decades to perform complex biomedical phenomena analysis, with various levels of success. A specificity of our application contexts is the need for real-time simulations adapted to each patient. To this end, we have developed specific numerical methods, which allow for real-time computation of finite element simulations. While information about the organ shape, for instance, can be obtained pre-operatively, other patient-specific parameters can only be determined intra-operatively. This is achieved by exploiting our application domain's context, where images of different nature are acquired during the intervention. Machine learning methods are then used to extract information from these images and, in some cases, to replace the numerical simulation itself. An illustration of these different topics will be demonstrated by modeling liver biomechanics and its parametrization to achieve patient-specific augmented reality during surgery.

Friday 25th

Semantic Segmentation for Assistive Navigation using Deep Bayesian Gabor Networks

Abdesselam Bouzerdoum[1] PS

[1] Hamad Bin Khalifa University (HBKU), Qatar.

Semantic scene segmentation is a challenging problem that has great importance in assistive and autonomous navigation systems. Such vision systems must cope well with image distortions, lighting variations, changing surfaces, and varying illumination conditions. For a vision-impaired person, the task of navigating in an unstructured environment presents major challenges and constant danger. It is reported that on average one in 12 pedestrians living with blindness is hit by a cyclist, a motorbike, or a car. Safe navigation involves multiple cognitive tasks at both macro and micro levels. At the macro level, a blind person needs to know the general route to take, his/her location along the route at any time, and the relevant landmarks and intersections. At the micro-level, the blind person needs to walk within the pedestrian lane on a safe surface, maintain his or her balance, detect obstacles in the scene, and avoid hazardous situations. To support the vision impaired navigating safely in unconstrained outdoor environments, an assistive vision system should perform several vital tasks such as finding pedestrian lanes, detecting and recognizing traffic obstacles, and sensing dangerous traffic situations.

In this talk, we will present vision-based assistive navigation systems that can segment objects in the scene, measure their distances, identify pedestrians, and detect a walking path. Using range and intensity images enable fast and accurate object segmentation and provide useful navigation cues such as distances to nearby objects and types of objects. Furthermore, the talk will present a new hybrid deep learning approach for semantic segmentation. The new architecture combines Bayesian learning with deep Gabor convolutional neural networks (GCNNs) to perform semantic segmentation of unstructured scenes. In this approach, the Gabor filter parameters are modeled as normal distributions with mean and variance that are learned using variational Bayesian inference. The resulting network has a smaller number of trainable parameters, which helps mitigate the overfitting problem while maintaining the modeling power. In addition to the output segmentation map, the system provides two maps of aleatoric and epistemic uncertainty—a measure that is negatively correlated with the confidence level with which we can trust the segmentation results. This measure is important for assistive navigation applications since its prediction affects the safety of its users. Compared to the state-of-the-art semantic segmentation methods, the hybrid Bayesian GCNN yields a competitive segmentation performance with a very compact architecture (a size reduction of between 25.4 and 231.2 times), a fast prediction time (1.6 to 67.4 times faster), and a well-calibrated uncertainty measure.

List of Abstracts – Talks

Leveraging Category Information for Single-Frame Visual Sound Source Separation

L. Zhu[1]; *E. Rahtu*[1]

[1] Tampere University, Finland

Paper ID: 2

Visual sound source separation aims at identifying sound components from a given sound mixture with the presence of visual cues. Prior works have demonstrated impressive results, but with the expense of large multi-stage architectures and complex data representations (e.g. optical flow trajectories). In contrast, we study simple yet efficient models for visual sound separation using only a single video frame. Furthermore, our models are able to exploit the information of the sound source category in the separation process. To this end, we propose two models where we assume that i) the category labels are available at the training time, or ii) we know if the training sample pairs are from the same or different category. The experiments with the MUSIC dataset show that our model obtains comparable or better performance compared to several recent baseline methods. The code is available at `https://github.com/ly-zhu/Leveraging-Category-Information-for-Single-Frame-Visual-Sound-Source-Separation`

MSHSCNN: Multi-scale Hybrid-Siamese Network to differentiate visually similar character classes

D. Pal[1]*; A. Alladi*[1]*; Y. Pothireddy*[1]*; G. Koilpillai*[1] Paper ID: 5

[1] Honeywell, United States

We address the character recognition challenge of similar-looking character classes. Human Vision System often misinterprets visually similar characters while they are present at singular instances. Often, we pay soft attention to a combination of characters to read and interpret a word. A graphical readout of a display device dashboard shows characters generated from a custom vectored font library. A poorly defined character library or dimension adjustment of fonts in the pre-defined layout can often distort the geometric shape of characters. It requires additional intellectual cues for a human to understand and causes poor accuracy by an automated system responsible for character recognition. Even after generalizing over a large-scale dataset, a well-trained character recognition engine misclassifies these custom character images and exhibits low model confidence. In this paper, we optimize a multi-scale Siamese network using multitask Learning to learn significant discriminative features of visually similar characters from a few labeled samples of a custom vectored English font dataset. Using classification and similarity learning, Multitask Learning improves recognition performance and introduces strong inductive biases. Experiments show that our method can effectively distinguish visually similar characters and improves overall classification accuracy.

A Comparison of OpenCV Algorithms for HumanTracking with a Moving Perspective Camera

O. Haggui[1]*; B. Magnier*[2]*; M. A. TCHALIM*[3] Paper ID: 7

[1] IMT Mines Alès, France
[2] IMT Mines Ales CERIS, France
[3] IFSTTAR, France

Visual tracking has received much attention in recent years, especially pedestrian tracking. People tracking represents an important computer vision problem with numerous real-world applications. While significant progress has been achieved for human tracking and detection, trackers are still prone to failures and inaccuracies to master all difficult situations that may arise during the process: changes in appearance, illumination, occlusions, camera movement or cluttered background.To overcome these limitations, tracking algorithms offered by the OpenCV software library are evaluated through this paper.These trackers are fast and easy to use. However, pedestrians are particularly difficult to track with a moving camera. This paper brings a benchmark of human tracking algorithms implementations using moving camera. Here, we propose a qualitative and quantitative assessment followed by a comparison with a particle filter algorithm based on histograms of both color and texture features. Finally, in order to compare to new developed tracking algorithms in the framework of a pedestrian tracking accuracy in an unknown environment, experiments with a new available dataset validate either the reliability of OpenCV trackers or an easy-to-use particle filter.

Performance of Texture Compression Algorithms in Low-Latency Computer Vision Tasks

J. Žádník[1]*; M. Mäkitalo*[1]*; J. Iho*[1]*; P. Jääskeläinen*[1] Paper ID: 8

[1] Tampere University, Finland

Deep learning has been successfully used for computer vision tasks, but its high computational cost limits the adoption in lightweight devices such as camera sensors. For this reason, many low-latency vision systems offload the inference computation to a local server, requiring fast (de)compression of the source images. Texture compression is a compelling alternative to existing compression schemes, such as JPEG or HEVC, due to its low decoding overhead, straightforward parallelization, robustness, and a fixed compression ratio. In this paper, we study the impact of lightweight bounding box–based texture compression algorithms, BC1 and YCoCg-BC3, on the accuracy of two computer vision tasks: object detection and semantic segmentation. While JPEG achieves superior per-pixel error rate, the YCoCg-BC3 encoding can provide comparable vision accuracy. The BC1 encoding results in significant degradation of vision performance. However, by retraining the FasterSeg teacher network with a BC1-compressed dataset, we reduced its segmentation mIoU loss from 2.7 to 0.5 percent. Thus, both BC1 and YCoCg-BC3 encoders are suitable for use in low latency vision systems, since they both achieve significantly higher encoding speed than JPEG and their decoding overhead is negligible.

Selective Probabilistic Classifier Based on Hypothesis Testing

S. B. Germi[1]*; E. Rahtu*[1]*; H. Huttunen*[2] Paper ID: 10

[1] Tampere University, Finland
[2] Visy Oy, Finland

In this paper, we propose a simple yet effective method to deal with the violation of the Closed-World Assumption for a classifier. Previous works tend to apply a threshold either on the classification scores or the loss function to reject the inputs that violate the assumption. However, these methods cannot achieve the low False Positive Ratio (FPR) required in safety applications. The proposed method is a rejection option based on hypothesis testing with probabilistic networks. With probabilistic networks, it is possible to estimate the distribution of outcomes instead of a single output. By utilizing Z-test over the mean and standard deviation for each class, the proposed method can estimate the statistical significance of the network certainty and reject uncertain outputs. The proposed method was experimented on with different configurations of the COCO and CIFAR datasets. The performance of the proposed method is compared with the Softmax Response, which is a known top-performing method. It is shown that the proposed method can achieve a broader range of operation and cover a lower FPR than the alternative.

The Impact of Using Different Color Spaces in Histological Image Classification using Convolutional Neural Networks

R. X. V. Sandoval[1]*; M. Pedersen*[1] Paper ID: 11

[1] NTNU, Gjovik, Norway

Classification is an important aspect of medical image analysis. Nowadays, Convolutional Neural Networks (CNNs) are extensively used in the field of medical image classification. There are several kinds of research on medical image classification combining different CNN architectures and data sets. When using color image data sets, most of those research works use RGB as the standard color space to train and test the models. While RGB is a standard color space to represent images on multimedia devices, RGB might not be the best color space to train CNN models for medical image classification applications. We implement an AlexNet CNN to classify colon tissue images to detect tumors. We perform this task using several color spaces, such as RGB, XYZ, CIELAB, HSV, and YCbCr. We analyze the results and indicate which color spaces give the best accuracy in performing this medical image classification task.

Implementation and Accuracy Evaluation of Fixed Camera-Based Object Positioning System Employing CNN-Detector

T. Partanen[1]*; M. Muller*[1]*; J. Collin*[1]*; J. Björklund*[1] Paper ID: 13

[1] Tampere University, Finland

Today, different positioning applications such as location-based services and autonomous navigation are requiring more and more precision. Especially fully autonomous navigation requires accurate positioning solution, not only for the vehicle but also for the surrounding objects. Thus, many new positioning techniques, algorithms and fusion schemes have been developed. One essential technique is visual positioning. Thanks to intensive research in neural networks and deep learning, Convolutional Neural Network-based (CNN) object detectors have evolved greatly in recent years. This paper proposes a widely deployable scheme of fixed camera-based (e.g. surveillance camera) object positioning utilizing the CNN-detector. The accuracy of the implemented positioning solution is evaluated with precise Real-Time Kinematic (RTK) satellite positioning receiver. The implemented system can be used in indoors and outdoors, and it can estimate simultaneously positions from multiple camera views for multiple objects in real-time. When positioning a person, the measured mean positioning error was 10.7–15.6 cm with a simple bias correction and a standard deviation was 6.7-8.7 cm. Thus, the accuracy is excellent and would be sufficient to wide variety of applications.

Color Constancy Model Optimization with Small Dataset Via Pruning of CNN Filters

S. Husseini[1]*; P. Babahajiani*[1]*; M. Gabbouj*[1] Paper ID: 14

[1] Tampere University, Finland

Color constancy is an essential part of the Image Signal Processor (ISP) pipeline, which removes the color bias of the captured image generated by scene illumination. Recently, several supervised algorithms, including Convolutional Neural Networks (CNN)-based methods, have been proved to work correctly on this problem. It is time-consuming and costly to collect many raw images of various scenes with different lighting conditions and measure corresponding illumination values. To reduce the dependence on a large scale labeled dataset and take advantage of standard CNNs architectures, we proposed an approach to create an efficient color constancy algorithm. Firstly, we utilized a structure channel pruning method to thin our baseline model. We iteratively pruned 75% channels of a specific Mobilenet version used as our model's backbone, trained on a large-scale classification dataset. It means the backbone with the classification head is used to deal with our network pruning task. Then the resulted compact model was transferred and trained on a small dataset doing color constancy. During training on the color constancy task, we applied the DSD technique. The proposed method reaches comparative performance with other state-of-the-art models, produces fewer MACs, and can significantly decrease computational costs.

Sample Selection for Efficient Image Annotation

B. P. Adhikari[1]*; E. Rahtu*[1]*; H. Huttunen*[1] Paper ID: 15

[1] Tampere University, Finland

Supervised object detection has been proven to be successful in many benchmark datasets achieving human-level performances. However, acquiring a large amount of labeled image samples for supervised detection training is tedious, time-consuming, and costly. In this paper, we propose an efficient image selection approach that samples the most informative images from the unlabeled dataset and utilizes human-machine collaboration in an iterative train-annotate loop. Image features are extracted by the CNN network followed by the similarity score calculation, Euclidean distance. Unlabeled images are then sampled into different approaches based on the similarity score. The proposed approach is straight-forward, simple and sampling takes place prior to the network training. Experiments on datasets show that our method can reduce up to 80% of manual annotation workload, compared to full manual labeling setting, and performs better than random sampling.

Improved Line Detection in Images Using Neural Networks and DTE Subclassifiers

J. Treboux[1]*; R. Ingold*[2]*; D. Genoud*[1] Paper ID: 17

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[2] Fribourg University, Switzerland

It is widely accepted that deep neural networks are very efficient for object detection in images. They reach their limit when multiple long line instances have to be detected in very high resolution images. In this paper, we present an original methodology for the recognition of vine lines in high resolution aerial images. The process consists in combining a neural network with a subclassifier. We first compare a traditional U-Net architecture with a U-Net architecture designed for precision agriculture. We then highlight the significant improvement in vine line detection when a DTE is added after the customized U-Net. This methodology addresses the complex task of dissociating vine lines from other agricultural objects. The trained model is not sensitive to the orientation of the lines. Therefore, our experiments have improved the precision by around 15% compared to our improved neural network.

Machine Learning Screening of COVID-19 Patients based on X-RAY Images for Imbalanced Classes

I. Mrad[1]*; R. Hamila*[1]*; A. Erbad*[2]*;*
T. Hamid[3]*; R. Mazhar*[3]*, N. Al-Emadi*[1]

Paper ID: 18

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[2] Hamad Bin Khalifa University, Qatar
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COVID-19 is a pandemic that has already infected more than one hundred million people and has caused more than two million deaths by 23th of February 2021 and is having a catastrophic effect on the world population's safety. Therefore, efficient detection of infected patients is a key phase in the battle against COVID-19. One of the main screening methods is radiological testing. The goal of this study is the usage of chest x-ray images to detect COVID-19 pneumonia patients while optimizing detection efficiency. To achieve an efficient model, we combined three methods named: Convolution Neural Network(CNN), transfer learning, and the focal loss function which is used for imbalanced classes to build three binary classifiers, namely COVID-19 vs Normal, COVID-19 vs pneumonia and COVID-19 vs Normal Pneumonia (Normal and Pneumonia). A comparative study have been made between our proposed classifiers with well-known classifiers and provided enhanced results in terms of accuracy, specificity, sensitivity and precision. The high performance of this computer-aided diagnostic technique may greatly increase the screening speed and reliability of COVID-19 diagnostic cases.

A Color-based Re-ranking Process for People Re-indentification

Z. Mortezaie[1]*; H. Hassanpour*[1]*; A. Beghdadi*[2] Paper ID: 21

[1] Shahrood University of Technology, Iran
[2] Université Sorbonne Paris Nord, France

People re-identification is a fundamental stage in video surveillance systems. This stage is used for determining the labels of the people's images usually based on their visual similarities. The appearance salience caused by wearing the clothes and carrying objects, with specific colors can be used for improving the performance of re-identification systems. To address the mentioned point, in this paper, we propose a color-based re-ranking process. In the proposed approach first, the input images are semantically segmented as: person's body, possible carried objects, and background. Then the most frequent colors of person's body and possible carried objects are used to re-order the ranked results obtained from two commonly used re-identification approaches i.e., Gaussian of Gaussian (GOG) and Hierarchical Gaussian Descriptors (HGDs). Experimental results on various people re-identification datasets show that our proposed re-ranking approach can improve the performance of re-identification systems.

FlipReID: Closing the Gap between Training and Inference in Person Re-Identification

X. Ni[1]*; E. Rahtu*[1] Paper ID: 25

[1] Tampere University, Finland

Since neural networks are data-hungry, incorporating data augmentation in training is a widely adopted technique that enlarges datasets and improves generalization. On the other hand, aggregating predictions of multiple augmented samples (i.e., test-time augmentation) could boost performance even further. In the context of person re-identification models, it is common practice to extract embeddings for both the original images and their horizontally flipped variants. The final representation is the mean of the aforementioned feature vectors. However, such scheme results in a gap between training and inference, i.e., the mean feature vectors calculated in inference are not part of the training pipeline. In this study, we devise the FlipReID structure with the flipping loss to address this issue. More specifically, models using the FlipReID structure are trained on the original images and the flipped images simultaneously, and incorporating the flipping loss minimizes the mean squared error between feature vectors of corresponding image pairs. Extensive experiments show that our method brings consistent improvements. In particular, we set a new record for MSMT17 which is the largest person re-identification dataset. The source code is available at `https://github.com/nixingyang/FlipReID`.

A Preliminary Analysis of Self-Supervision for Wireless Capsule Endoscopy

A. Vats[1]*; M. Pedersen*[1]*; A. K. Mohammed*[1] Paper ID: 26

[1] NTNU, Gjovik, Norway

Human learning relies on both supervised as well as unsupervised tasks in grasping visual semantics in general. Is it then- possible to learn meaningful features from data without annotations or even knowledge about the number of inherent classes within a dataset? This problem is open and being heavily researched as of today. However, most of the focus in finding answers lies in the domain of natural images. Despite impressive progress, the state-of-the-art from such methods is rarely, if ever, transferable directly to other domains. In this paper, we veer off from natural images to investigate self-supervised learning in a challenging medical domain, that of wireless capsule endoscopy. We implement the self-supervision pipeline, with the adaptation of two different pretext tasks for learning representations and evaluate the utility of the self-supervised features for clinical diagnosis. We further infer that a gap exists between the actual requirements and resulting characteristics of features when trained under inadequately adapted 'self-supervision' which is more pronounced in medical domains and discuss the factors that influence this gap.

Anomalous Human Action Detection Using A Cascade of Deep Learning Models

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[4] NTNU, Gjovik, Norway

Human actions that do not conform to usual behavior are considered as anomalous and such actors are called anomalous entities. Detection of anomalous actions using visual data is a challenging problem in computer vision. This paper presents a new approach to detect anomalous actions in complex situations of examination halls. The proposed method uses a cascade of deep convolutional neural network models. In the first stage, we apply a pretrained model of human pose estimation on frames of videos to extract key feature points of body. Patches extracted from each key point are utilized in the second stage to build a densely connected deep convolutional neural network model for detecting anomalous actions. For experiments we collect a video database of students undertaking examination in a hall. Our results show that the proposed method can detect anomalous actions and warrant unusual behavior with high accuracy.

Geometric Deep Learning For Multi-Object Tracking: A Brief Review

Z. Shagdar[1]*; M. Ullah*[1]*; H. Ullah*[2]*; F. Alaya-Chekh*[1] Paper ID: 30

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Graphs frequently appear as a type of data structure that efficiently models a set of interrelated objects as nodes and their relations as edges between them. Geometric deep learning emerged as a promising field for modeling non-Euclidean geometric data as graphs, Riemannian manifolds and meshes. In this paper, we review geometric deep learning based state of- the-art approaches for multi-object tracking. We illustrate the main concept, the model architecture, loss functions, and optimization strategies of the main algorithms. Moreover, algorithms are quantitatively evaluated on standard performance metrics using the standard dataset. The potential of geometric deep learning in tracking is discussed and future directions are proposed.

Shen-Castan based edge detection methods for Bayer CFA images

B. Magnier[1]*; A. Aberkane*[2]*; Z. LI*[1] Paper ID: 31

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Color Filter Array (CFA) represents a mosaic of incomplete color information from a digital image. This paper presents two edge detection methods performing directly on CFA images, without the necessity of the demosaicing process, thus saving significant computation steps. First, existing methods for CFA images based on well-known Deriche recursive filters are revisited. Then, new algorithms based on Shen-Castan filters design are proposed. They correspond to recursive first-order filters, outperforming the complexity of other edge detection techniques. Finally, quantitative assessments based on synthesized images using normalized Figure of Merit evaluate the performances of the edge detection methods, while qualitative results based on real images are also reported, illustrating the new methods reliability.

Ensemble-based Instance Relevance Estimation in Multiple-instance Learning

M. Waqas[1]*; M. Tahir*[1]*; R. Qureshi*[2] Paper ID: 34

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[2] City University of Hong Kong, China

The objective of Multiple-instance learning (MIL) is to learn a mapping function from weakly labeled training data, the training data in MIL is arranged in the form of labeled bags, and every bag holds several instances. The label of the bag depends upon the characteristics of unlabeled instances. This formulation has been used in decision-making applications, such as medical image classification and molecular activity prediction. This data formulation leads to a complex hypothesis, and many existing MIL algorithms are not robust to complex hypothesis space. To deal with this limitation, this paper proposes a Fisher vector-based ensemble design with an instance relevance estimation process, called relevance-based multiple-instance Fisher vector encoding (RMI-FV). The ensemble design builds on top of the instance relevance estimation mechanism. The instance relevancy calculation process employs a Gaussian mixture-based subspace clustering approach, which helps to identify instances with higher relevance to the bag label. The experiments show that the proposed RMI-FV achieves better performance than state-of-the-art MIL approaches

Evaluation Of The Bubble View Metaphor For The Crowdsourcing Study Of Visual Attention Deployment In Tone-mapped Images

W. Ellahi[1]*; T. Vigier*[1]*; P. L. Callet*[1] Paper ID: 35

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Attention is an important attribute of human vision for study of user's quality of experience (QoE). The attention information collection from eye tracking is impossible in the current scenario of Covid-19. Different mouse metaphors have been proposed to study visual attention without eye tracking equipment. These methods have shown promising results on different types of images (visualizations, natural images and websites) with well-identified regions of interest. However, they have not been precisely tested for QoE applications, where natural images are processed with different algorithms (compression, tone-mapping, etc.) and visual content can induce more exploratory behavior. This paper studies and compares different configurations of bubble view metaphors for the study of visual attention in tone-mapped images.

A Deep Learning-Based Approach For Camera Motion Classification

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Paper ID: 37

The automatic estimation of the various types of camera motion (e.g., traveling, panning, rolling, zoom...) that are present in videos represents an important challenge for automatic video indexing. Previous research works are mainly based on optical flow estimation and analysis. In this paper, we propose a different, deep learning-based approach that makes it possible to classify the videos according to the type of camera motion. The proposed method is inspired from action recognition approaches and exploits 3D convolutional neural networks with residual blocks. The performances are objectively evaluated on challenging videos, involving blurry frames, fast/slow motion, poorly textured scenes. The accuracy rates obtained (with an average score of 94%) demonstrate the robustness of the proposed model.

Blind Estimation And Suppression Of Additive Spatially Correlated Gaussian Noise In Images

M. Ponomarenko[1]*; O. Miroshnichenko*[2]*; V. Lukin*[2]*; K. Egiazarian*[1] Paper ID: 38

[1] Tampere University, Finland
[2] National Aerospace University, Ukraine

The paper is devoted to the task of estimation of the parameters of spatially correlated noise and noise suppression in images. Several schemes of noise removal, including multiscale ones, are considered. A convolutional neural network (CNN) for blind estimation of the spectrum of spatially correlated noise images is proposed. It is shown that the proposed network in combination with the BM3D filter provides more efficient noise suppression than existing solutions. A CNN for prediction of the denoising parameters for DRUNet denoiser is also proposed and analyzed. It is shown that the usage of this network and DRUNet for multiscale denoising in comparison with other methods provides better quality of image denoising and processing speed for a wide range of sizes of "noise grain".

Combination of Deep Learning-based and Handcrafted Features for Blind Image Quality Assessment

A. Chetouani[1]*; M. Quach*[2]*; G. Valenzise*[2]*; F. Dufaux*[2] Paper ID: 41

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This last decade, a plethora of handcrafted-based image quality metrics has been proposed in the literature. Some of them are based on structural analysis, while some others exploit mutual information or perceptual characteristics. Nowadays, deep learning-based methods are widely used in several domains due to its ability to well fit the target directly from the image. In this paper, we study the impact on the performance of combining handcrafted and Deep Learning-based (DL) features, since each of them extracts specific information. Indeed, DL-based image quality assessment methods often extract local information by extracting small patches, while the handcrafted ones provide global information through a global analysis. We analyzed the performance before and after combining the two using bilinear pooling strategy. Experimental results on commonly used datasets show the relevance of combining both approaches.

Video Steganalysis In The Transform Domain Based On Morphological Features Of The Motion Vectors Map

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A. Bouridane[1]*; S. Bourennane*[3]

Paper ID: 43

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Steganography is the art of transmitting hidden messages through a cover object without raising any suspicion. In contrast, steganalysis is the science of detecting the presence of hidden information and a significant amount of research has been focused on multimedia steganalysis. In this paper, a video steganalysis method is proposed to detect the presence of hidden data by analysing the structure of the motion vectors in the compressed video data. The proposed method is based on the classification of features extracted from the morphology of the motion vector map. The proposed method has been evaluated on a large dataset of short videos with variable resolution and quality and the results suggest the efficiency of the proposed modelling scheme.

FaceFakeNet: The Deep Learning Method for Image Face Anti-spoofing Detection

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Paper ID: 45

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Due to the increasingly growing demand for user identification on cell phones, PCs, laptops, and so on, face anti-spoofing has risen to significance and is an active research area in academia and industry. Feature space and marginal distribution of probability are assumed to exist in the same space for the samples used for training and evaluation in the current state of art face spoofing detection. This is not the case; the infinite differences in face acquisition of the existing conditions such as light intensity, facial features, the efficiency of a camera, etc. Current single domain techniques lack the potential to generalize, thus prohibiting the implementation in real case applications. In this light, we present an anti-spoofing face method to solve the real-world scenario that learns the target domain classifier based on samples used for training in a particular source domain. Specifically, with the conventional regression CNN, the Spatial/Channel-wise Attention Modules were introduced. Two modules, namely the Spatial-wise Attention Module and the Channelwise Attention Module, were used at spatial and channel levels to improve local features and ignore the irrelevant features. Extensive experiments on current collections with benchmark datasets verifies that the recommended solution will significantly benefit from the two modules and better generalization capability by providing significantly improved results in anti-spoofing.

Visual Quality and Security Assessment of Perceptually Encrypted Images based on Multi-output Deep Neural Network

S. A. Fezza[1]*; M. Keita*[1]*; W. Hamidouche*[2] Paper ID: 48

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[2] INSA Rennes, France

Encryption has became an indispensable technique for mage/video-based applications. This has led to the development of many image encryption algorithms, such as perceptual/selective encryption methods which represent an effective way for the security and confidentiality of images. However, few studies focus on visual security metric, which is very important tool for evaluating the effectiveness of these encryption methods. Most of the adopted metrics are the classical randomness-based measures or the objective image quality assessment metrics. However, these metrics showed their limits as a visual security metric, because they do not deal with the content intelligibility, which is one of the key security requirements. Consequently, in this paper, we propose a no-reference (NR) visual security metric for perceptually encrypted images based on multi-output learning called VSMML. The proposed metric consists of a convolutional neural network (CNN) taking as input an encrypted image and providing two outputs corresponding to the visual security (VS) and visual quality (VQ) scores. Experiments were performed on two publicly perceptually encrypted image databases and the results show that the proposed metric significantly outperforms the state-of-the-art methods for visual security and quality assessment tasks. The source code is available at: `https://github.com/Mamadou-Keita/VSMML`.

Learning based contrast enhancement evaluation using cartoon texture decomposition

Z. A. Khan[1]*; A. Beghdadi*[1]*; M. Kaaniche*[1]*; F. Alaya-Chekh*[2] Paper ID: 50

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[2] NTNU, Gjøvik, Norway

Contrast enhancement is an important processing task needed to improve the overall perceptual quality of an image. Ide-ally, a contrast enhancement method should neither affect the naturalness of images nor introduce other unwanted artifacts when improving perceptual quality. While humans are able to detect any improvement or such unwanted side-effects rela-tively easily, designing an objective metric that does the same is still a challenge. Most existing contrast enhancement eval-uation (CEE) metrics do not take into consideration all these important criteria when evaluating quality. In this work, we propose a new measure for CEE that combines some of the carefully selected existing metrics effectively. Each of the selected metrics tackles only one of the important criteria of an effective contrast enhancement method such as structure preservation or contrast improvement. For this novel fusion-based metric, we have further exploited the full potential of the selected metrics by applying them on decomposed image using cartoon-texture decomposition. The results on two CEE databases show the effectiveness of our proposed metric.

Color Image Database HTID For Verification Of No-reference Metrics: Peculiarities And Preliminary Results

M. Ponomarenko[1]; *S. G. Bahnemiri*[1]; *K. Egiazarian*[1];
O. Ieremeiev[2]; *V. Lukin*[2]; *V-T. Peltoketo*[3]; *J. Hakala*[3]
Paper ID: 29

[1] Tampere University, Finland
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[3] Huawei Finland

The paper describes a new image database HTID for verification and training of no-reference image visual quality metrics. The database contains 2880 color images of size 1536x1024 pixels cropped from the real-life photos produced by the mobile phone cameras with various shooting and post-processing settings. Mean opinion scores for images of the database are obtained. Peculiarities of the database are considered. A comparative analysis of the state-of-the-art no-reference image visual quality metrics is carried out. It is shown that the proposed database takes its own unique place in the existing image databases and can be effectively used for metrics' verification.

Project Dissemination Session

Bridging the Early Diagnosis and Treatment Gap of Brain Diseases via Smart, Connected, Proactive and Evidence-based Technological Interventions - ALAMEDA

Panagiotis Tsakanikas[1,2,3]

PD

[1] The Institute of Communications and Computer Systems (ICCS)
[2] Project Leader: The Institute of Communications and Computer Systems (ICCS)
[3] Website if available: https://alamedaproject.eu/.

Overview and objectives of the project

ALAMEDA is a European collaborative project bringing technical and medical experts together to rethink and revolutionize the ways that patients with Parkinson's, Multiple Sclerosis and Stroke (PMSS) are treated and monitored, with the ultimate goal of improving their quality of life. Its vision is to research and framework a prototype for a personalized AI healthcare support system for people with brain diseases and disorders, specifically for PMSS patients. Appropriate Big Data Analytics, Machine and Deep Learning models will be researched and developed so as to answer the medical questions defined by the medical partners for each use case. The models will be built on lifestyle retrospective data as well as new streams of patient data that involve the monitoring of everyday activities, such as sleep, behavior and emotional status. A key concept of ALAMEDA regarding brain diseases assessment while also extends the existing protocols, is the design of a context-aware parametric decision making model. This shared decision making model (SDM) will enable medical professionals extend their care remotely in a way that can be customized for the individuals they are treating. Further, ALAMEDA aims to launch a multi-side market information platform, the ALAMEDA Digital Health Innovation Hub. A platform aiming to integrate all the acquired information while being available as an open source, targeting to promote research findings, guidelines and evaluation results to the broader audience and the relevant decision makers.

The objective of the project is to define a framework that along with the involvement of the patients (under a patient engagement plan), will: (i) provide personalized rehabilitation treatment assessments for PMSS patients, employing a Patient-Centric AI System, (ii) ensure that medical interventions are effective and (iii) predict impairing situations. ALAMEDA aims to enable the clinicians to modify interventions based on personalized

data recordings, including both pharmacological and nonpharmacological treatment options. The evidence generated will open new opportunities for innovation and growth both in the care of Parkinson's, MS and stroke care ecosystem and in general in similar applications of Big Data and AI for quality of life improvements of brain disease patients.

Partners : names and logos

Institute of Communication and Computer Systems (GR)	

SILENSE - (Ultra)Sound Interfaces and Low Energy integrated Sensors

Marius PREDA[1,2,3]

PD

[1] Télécom SudParis, Institut Mines Telecom
[2] Project Leader: NXP
[3] Website if available: https://silense.eu.

Overview and objectives of the project

One of the main drivers for the evolution of HMIs from single push buttons, keyboards (in combination with a mouse), touch screens, to beyond screens, towards a world of Virtual and Augmented Reality, is the complexity of control, the number of devices and the information content to be exchanged between human and machine. The SILENSE focuses on innovations in the field of smart acoustic technologies to address the HMI challenges. The main objective of the project is to demonstrate concepts for touchless activation and control of devices, which are exclusively based on acoustic technologies.

The SILENSE partners researched the application of ultra sound and ultrasound components as key driver for future gesture recognition, under-water data transmission, localization in buildings and the automotive sector, implementable in all types of smart devices such as smart wearables, including underwater wearables. The work involved several areas starting with the definition of use cases for the different SILENSE applications. Different ultrasound transducer technologies are investigated, suitable for various applications including micromachined capacitive and piezoelectric single as well as array transducers. Packaging and integration of these transducer elements for the demonstrator applications was performed as a vital part of the SILENSE research. Another important research area was electronics including ultrasound and audio signal processing. This was connected with low-level ultrasound algorithms and high-level software development.

SILENSE covered the full software stack, from low-level, hardware-closed libraries, novel SONAR architectures, DSP and divers to high-level libraries for acoustic analysis, gesture recognition, US processing for beacons or chirps. Software developed in SILENSE improved state of the art in acoustic localization and communication. SILENSE consortium is one of the first research group conducting an in-deep analysis on the usage of deep learning approaches for ultrasound data. Several architectures and models were proposed, tested and validated in various settings offered by the SILENSE demonstrators.

The demonstrators show proof of concepts, such as ultrasound for device pairing and indoor navigation, gesture recognition to activate and control devices in smart homes/medical

care environment and cars, haptic touch feedback on smart phones and mobile devices, voice activation, speech recognition and underwater communication.

AITV : Artificial Intelligence for Television

Matthieu Parmentier[1] *and Ruxandra Tapu*[2]

[1] France Télévisions
[2] Télécom SudParis.

PD

Overview and objectives of the project

The creation, production and distribution of audiovisual programs require an extensive analysis of multiple textual, visual and audio data. Within this context, there are many repetitive categorization/classification tasks involved, which appear both during the program editing phase (writing, shooting, post-production) and at the time of its exploitation, for various purposes such as content search and recommendation, qualitative analysis and programming studies. Most of the time, artistic or editorial choices require a significant amount of human intervention, in order to react to on-going events, respect aesthetic considerations or simply surprise the audience. Optimizing such processes can lead to important time savings and is thus a major challenge for television channels, with potentially significant economic consequences.

In recent years, emerging artificial intelligence tools, and notably deep neural networks, have revolutionized the field of audiovisual content classification, with spectacular performances in areas as diverse as object detection, tracking or recognition, facial or voice recognition, textual data analysis, program categorization, affective computing and gesture recognition. Such methodologies seem today to be well-adapted to the needs of television channels in terms of audio-visual content analysis. Nevertheless, multiple technological bottlenecks still have to be overcome in order to be able to propose fully operational solutions, exploitable in an industrial context. They mainly concern the specification and implementation of personalized taxonomies, the inclusion of a self-adaptive, multi-modal dimension in the program categorization process, the automatic detection of semantic saliencies, the development of multi-granular, spatial-temporal representation methods, and the identification/validation of recommendation elements.

The AITV (Artificial Intelligence for Television) joint lab established between France Télévisions and Télécom SudParis specifically tackles such challenges. The ultimate aim is to develop, validate and implement a generic deep learning platform that takes into account all the audio-visual modalities for an optimized management of television content.

Partners : names and logos

France Télévisions	Télécom SudParis
france•tv	TELECOM SudParis IP PARIS

RealVision – Hyper-REAListic VISual Experience (H2020 – Marie Curie ITN)

realVision

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PD

Overview and objectives of the project

The aim of realistic digital imaging is the creation of high quality imagery, which faithfully represents the physical environment. The ultimate goal is to create images, which are perceptually indistinguishable from a real scene. The RealVision network brings together leading universities and centres focused on industrial development and companies in multimedia, optics, visual communication, visual computing, computer graphics, and human vision research across Europe, with the aim of training a new generation of scientists, technologists, and entrepreneurs that will move Europe into a leading role in innovative hyper-realistic imaging technologies.

Current imaging technologies capture only a fraction of visual information that the human eye can see. The colours and dynamic range are inadequate for most real-world scenes and not all depth cues required for natural 3D vision are captured. This limits the realism of the experience and has hampered the introduction of 3D technology. Advancement in imaging technologies makes it possible to circumvent those bottlenecks in visual systems. As a result, new visual signal-processing areas have emerged such as light fields, ultra-high definition, highframe rate and high dynamic range imaging. The novel

combinations of those technologies can facilitate a hyper-realistic visual experience. Without a doubt, this will be the future frontier for new imaging systems. However, there are several technological barriers that need to be overcome as well as challenges in what are the best solutions perceptually. The goal of this network is to combine expertise from several disciplines, i.e. engineering, computer science, physics, vision science and psychology – that are usually disconnected – and train the RealVision Early-Stage Researchers (ESRs) to be capable of working with all stages and aspects of visual processing to overcome existing interdisciplinary and intersectorial barriers to efficiently develop truly perceptually better visual imaging systems.

HyperNav – Hyper-REAListic VISual Experience (H2020 – Marie Curie ITN)

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[3] Website: https://hipernav.eu/.

Overview and objectives of the project

The main objective of HiPerNav project is to take image-guided treatment to a new level by leveraging expertise in patient-specific anatomical reconstruction, real-time soft tissue simulation and navigation including advanced bio-mechanical modelling, intra-operative imaging (US, Dyna-CT, MR) and coregistration and context-aware visualization. Furthermore, it integrates intuitive user interaction and high-performance computing to further accelerate the clinical usability of such novel technology. From a clinical impact standpoint we mainly focus on liver cancers. Indeed, hepatocellular carcinoma (HCC) alone is the fifth most common cancer worldwide and third most common cause of cancer mortality, with more than half million cases worldwide each year. The project provides a better estimation of the location of inner structures of the organ, such as tumors and vessels, as well as the extraction of other key decision information from pre- and intra-operative multimodal data. This will allow for a more efficient planning of the surgery, and more accurate targeting of the tumors, thus improving success rates and reducing postoperative complications. Through a strong involvement from some of the most merited clinicians in minimally invasive treatment of liver cancer, the proposed project integrates and assesses the use of adaptive image- and video-processing as well as advanced visualization techniques such as direct 3D, holography and augmented reality in minimally invasive treatment. The project deploys prototypes in small-scale clinical trials, providing clinical evidence of the benefits of the proposed solutions. Among the main outcomes of this work we expect to see an improved use of patient data to support clinical decision-making, and as a direct consequence a better management of complex clinical situations. By fusing various data sources like pre-operative imaging, patient's history, type of pathology, vascular information and intra-operative imaging required to plan and perform the surgery this will also enforce a better coordination in the management of the patient health, bridging for instance the fields of radiology and surgery. This will improve surgical eligibility in liver surgery and ablation treatment.

We also foresee that the use of the novel solutions developed in this project will reduce the morbidity and mortality rates in minimally invasive surgeries, and that it can reduce complication rates and improve 5-year survival rates. As a result, tens of thousands of European patients will get a better quality of care.

Partners : names, logos and descriptions

Partners - Orgnisations	Descriptions
Oslo universitetssykehus	*Oslo University Hospital* – Coordinator of the project. Model to patient registration and organ tracking; automatic feature extraction and segmentation; as well as clinical assessments.
SINTEF	*Sintef* – Registration techniques. Registration for improved preoperative planning and intraoperative navigation in laparoscopic surgery.
NTNU	*Norwegian University of Science and Technology* (colour lab – Gjøvik & IDI – Trondheim)- Image processing. Cross-modality guided image enhancement; fast and automatic extraction of important structures in pre-operative CT/MR and operative ultrasound
b UNIVERSITÄT BERN	*University of Bern* – Landmark detection. Automatic and accurate landmark detection and localization for minimally invasive liver surgery.
TU Delft Delft University of Technology	*Delft University of Technology* – To provide a detailed understanding of treatment planning and navigation workflow. User interaction and workflow analysis; automatic tracking of workflow in OR.

Partners - Orgnisations	Descriptions
	Institute of Communication and Computer Systems (GR)
	Institute of Communication and Computer Systems (GR)
 UNIVERSIDAD D CÓRDOBA	*University of Cordoba* - Acceleration through high performance computing. Acceleration for enhancement and denoising of peroperative and intra-operative images; heterogeneous parallel computing for image registration algorithms.
CASCINATION	*CAScination*– Integrate prototypes into a clinically applicable system. In-situ anatomical structure inference from pre- and intraoperative 3D imaging.
INSELSPITAL UNIVERSITÄTSSPITAL BERN HOPITAL UNIVERSITAIRE DE BERNE BERN UNIVERSITY HOSPITAL	Partner Organisation – *Bern University Hospital* – To enable transfer of research results into the clinical domain for testing. Clinical applications and validation of novel minimally invasive HPB surgery
SIEMENS Healthineers	Partner organisation – Secondments & several training courses
NVIDIA	Partner organisation – Secondments & training.

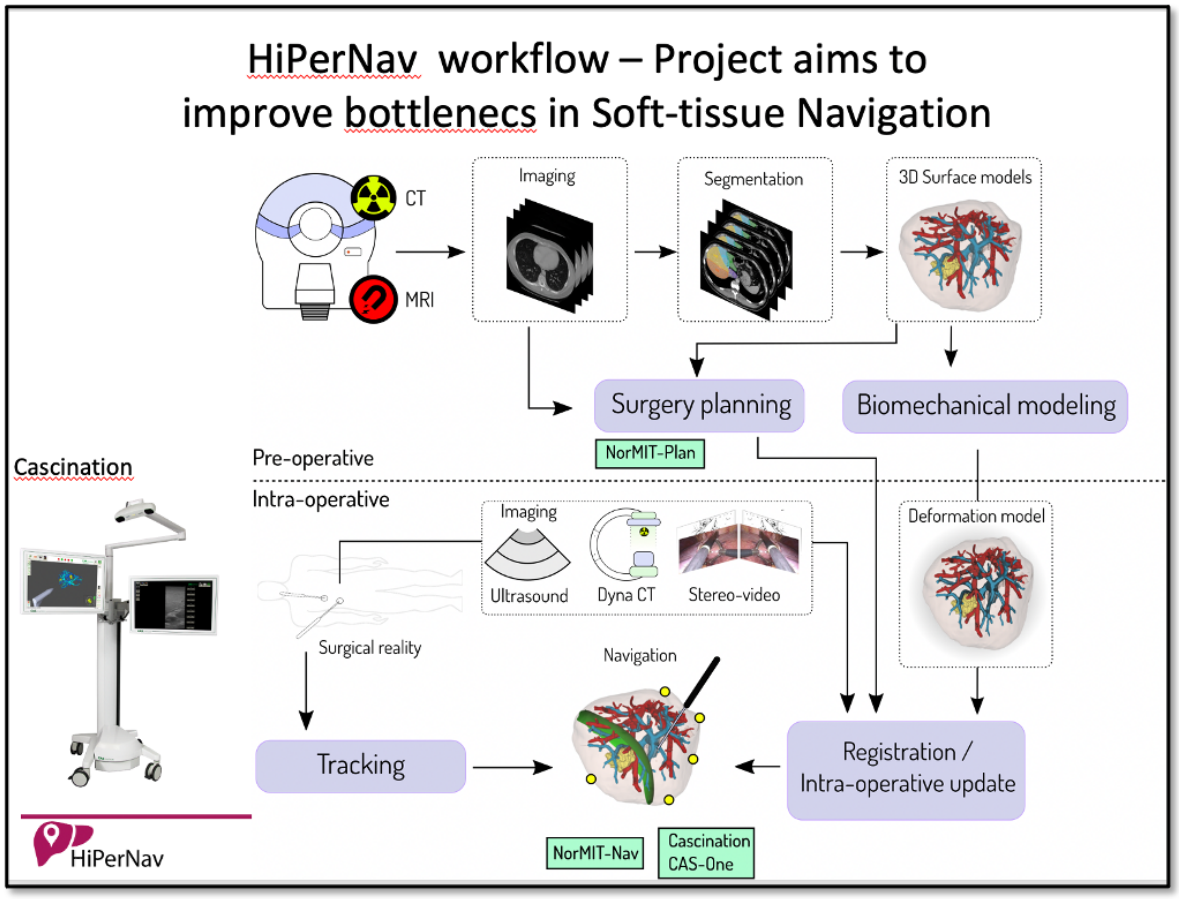
Additional Information

HiPerNav

High performance soft tissue navigation

HiPerNav is an Innovative Training Network (ITN) funded through a Marie Skłodowska-Curie grant. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 722068.

There are 14 fully funded and 2 partially funded PhD's working on the project.



Partners: names and logos

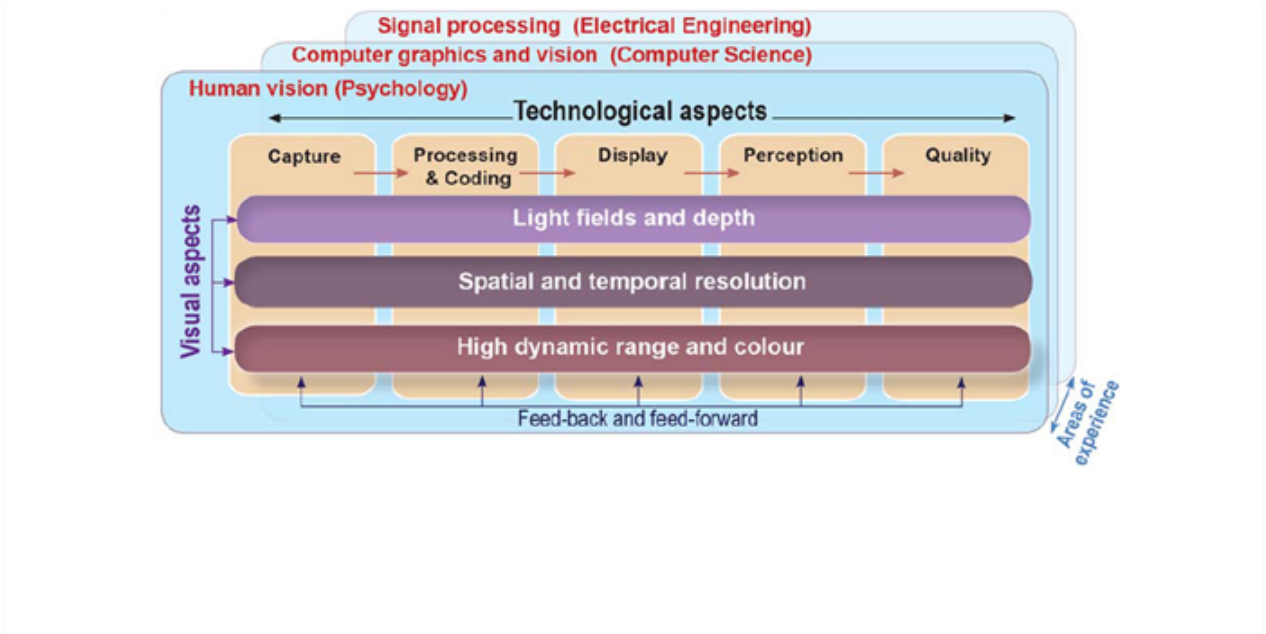
University of Nantes	UNIVERSITÉ DE NANTES
Technical University of Denmark	DTU
Bangor University	PRIFYSGOL BANGOR UNIVERSITY
University of Cambridge	UNIVERSITY OF CAMBRIDGE
University of Oxford	UNIVERSITY OF OXFORD
Max Planck Institute for Informatics	
Force Technology	FORCE TECHNOLOGY
Fraunhofer-Institut für Integrierte Schaltungen	Fraunhofer IIS
DxO	DXO
Centre National de la Recherche Scientifique	cnrs
Bang & Olufsen A/S	B&O BANG & OLUFSEN

Additional Information

realVision

INT REAL VISION

This project has received funding from the European Union's Horizon 2020 research and innovation program under Grant Agreement No. 765911.



Partners : names and logos

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Centre for Research and Technology Hellas (GR)	

ApPEARS – Appearance Printing European Advanced Research School

Jon Y. Hardeberg[1,2,3] *and/or Aditya S. Sole*[1]

PD

[1] NTNU – the Norwegian University of Science and Technology
[2] Project coordiator : SøJon Yngve Hardeberg, NTNU
[3] Website: https://www.appears-itn.eu/.

Overview and objectives of the project

Humans are highly skilled in assessing the appearance of objects. By comparing the relative qualities of materials, such as whether they are flexible or rigid, soft or hard, smooth or rough, rotten or fresh, we can quickly tell if these are pleasing or may do us harm. Understanding the appearance of materials is also of great importance for commercial products. Better understanding leads to better choice of material, which can be a key differentiator between the success or failure of a product.

2.5D or and 3D printing make it possible to reconstruct the texture and appearance of a wide range of surfaces. However, a fundamentally neglected part of the workflow is the ability to match the desired appearance of materials (in terms of colour, texture, glossiness, softness, translucency) in real life.

The overall academic objective of the **ApPEARS** project is to train a new generation of Early Stage Researchers (**ESR**) towards a common goal – to ensure the accurate reproduction of the desired visual appearance attributes of materials/ objects using 2.5D and 3D printing techniques.

The ApPEARS ESRs seek to extend our understanding of the appearance of prints from two to three dimensions by:

- Identifying the attributes that are correlated to the visual appearance of 2.5 and 3D surfaces
- Quantifying their impact on appearance and appearance matching
- Finding suitable measurement techniques to assess these attributes
- Explaining and modelling the relationship between physical material properties and psychophysical appearance attributes
- Defining a reference appearance space with the most relevant properties to communicate appearance most efficiently

Partners

Beneficiaries	*Partner Organisations*
1. The Norwegian University of Science and Technology (NTNU) 2. University of the West of England (UWE) 3. Linköping University (LIU) 4. Fraunhofer (FHG) 5. Le Cnam (CNAM) 6. Technical University of Denmark (DTU) 7. University of Leeds 8. Fogra	1. Barbieri Electronic (BAEL) 2. Technische Universität Darmstadt (TUDA) 3. MERCK 4. Stratasys 5. Physikalisch-Technische Bundesanstalt (PTB) 6. 3D Life Prints (3DLP)

Additional Information

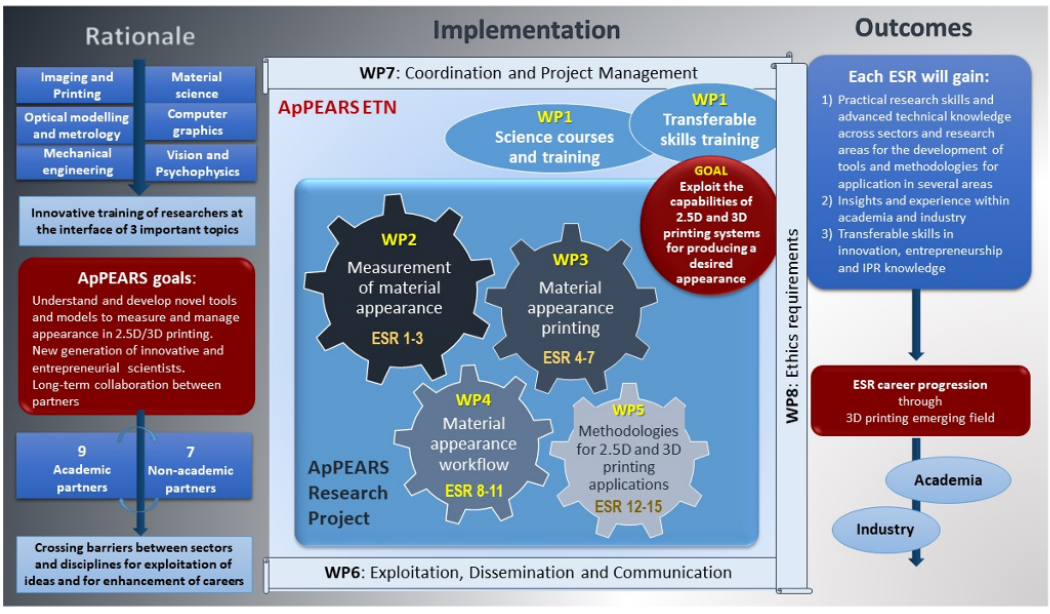


Figure 0.1: Overview of the ApPEARS research and training programme

MUVApp – Measuring and Understanding Visual Appearance

Jon Y. Hardeberg[1,2,3]

PD

[1] Norwegian Colour and Visual Computing Laboratory, Department of Computer Science, NTNU – Norwegian University of Science and Technology
[2] Project Leader : SøJon Yngve Hardeberg, NTNU
[3] Website: https://app.cristin.no/projects/show.jsf?id=536305 .

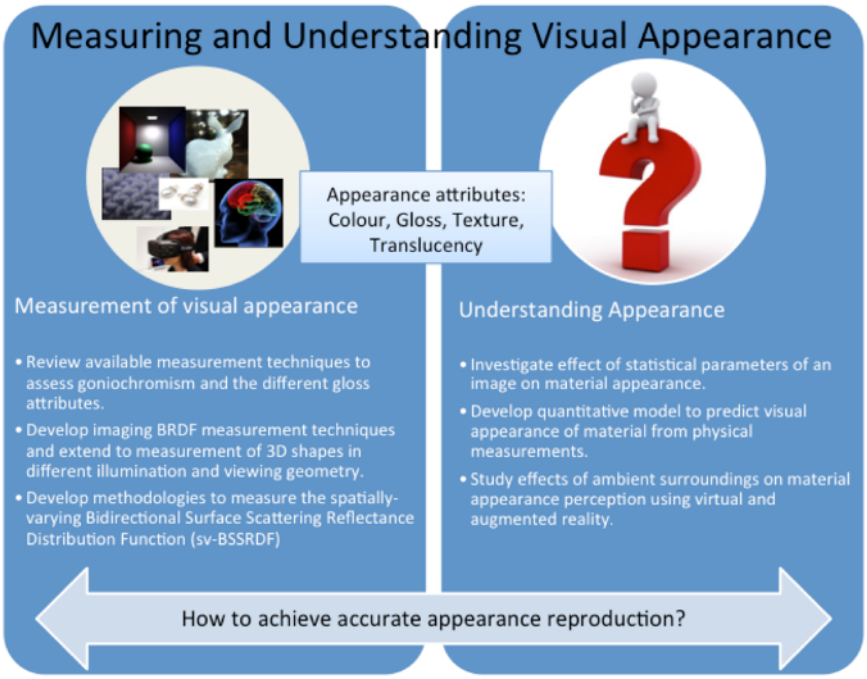
Overview and objectives of the project

The Norwegian Colour and Visual Computing Laboratory at NTNU is an internationally leading research group in the field of colour imaging. The concept of visual appearance, which includes colour but also other appearance properties like texture, gloss and translucency, is far from fully understood, neither from metrological nor perceptual points of view. The overall goal of MUVApp is two-fold: to gain new knowledge of how human beings perceive the visual appearance of materials, objects, and scenes, and to develop new methodologies for measuring and communicating visual appearance and appearance-related properties. Key research aspects of this project include the use of image domain metrics for characterizing appearance, the use of a combination of real world and virtual objects and surfaces for visual experiments, the study of interactions between appearance properties, the development of new image-based methodologies for efficient yet precise measurement of physical properties that correlate with visual appearance such as the Bidirectional Surface Scattering Reflectance Distribution Function, and the study of the correlation between physical measurements and perceived visual appearance.

Partners: names and logos

1. Yale University, Prof. Holly E. Rushmeier
2. Justus-Liebig-Universität Giessen, Prof. Karl Gegenfurtner
3. Conservatoire national des arts et metiers, Assoc. Prof. Gaël Obein
4. Chiba University, Prof. Takahiko Horiuchi

Additional Information


Measuring and Understanding Visual Appearance
Appearance attributes: Colour, Gloss, Texture, Translucency
Measurement of visual appearance
• Review available measurement techniques to assess goniochromism and the different gloss attributes.
• Develop imaging BRDF measurement techniques and extend to measurement of 3D shapes in different illumination and viewing geometry.
• Develop methodologies to measure the spatially-varying Bidirectional Surface Scattering Reflectance Distribution Function (sv-BSSRDF)
Understanding Appearance
• Investigate effect of statistical parameters of an image on material appearance.
• Develop quantitative model to predict visual appearance of material from physical measurements.
• Study effects of ambient surroundings on material appearance perception using virtual and augmented reality.
How to achieve accurate appearance reproduction?

Panel Discussion Session

Visual Information Processing And Machine Learning At The Crossroads

PD

Panel discussion session chairs

Mohamed Deriche
Professor at KFUPM, Dhahran, KSA

Mihai Mitrea
Professor at Telecom SudParis, France

Panelists

Fernando Pereira
IEEE Fellow; EURASIP Fellow;
IET Fellow Professor at Instituto de Telecomunicações, Lisbon, Portugal;
Expertise: Visual Information Coding and Representation

Louis Chevallier
Principal Scientist at Interdigital, R&I ISL, Rennes, France
Expertise: Computer Vision and Machine Learning

Stefan Winkler
IEEE Fellow Deputy Director at AI Singapore
and Associate Professor at the National University of Singapore;
Expertise: Vision modeling and perceptual approaches
for video processing and analysis

Description of the session

This session is designed around some key questions that were addressed by the three panelists of different and complementary scientific and technical culture and experience. The main objective is to share the experience of these experts, coming from different backgrounds, with the audience on topical issues that concern the evolution of the themes of the EUVIP workshop directly related to the analysis, processing and coding of visual information and applications and how to associate and integrate new approaches and technologies coming from machine learning. At the end of this session, it is expected to highlight a number of converging points of view, which would give a more or less realistic idea of the promising avenues for future research.

Useful Information

Talks

will be held at the **virtual workshop system** of EUVIP. It is situated on the this website: `https://euvip-virtual.org`).

About the registration to the tutorials

- Registration to the tutorials is free for authors and co-authors of papers accepted to EUVIP2021.
- It is also free for doctoral students from the "Galilée" graduate school of the Sorbonne Paris Nord University and doctoral students from the NTNU University. To have access to the tutorials, please fill in this questionnaire.

  questionnaire link - click here

Partner Institutions and Sponsors

Sponsors