Curriculum Vitae

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1 Short CV

1.1 Education

- **2018** HDR, Habilitation to Direct Research: Disputation date: 26.09.2018
  Faculty of Science and Technology, Université de Bourgogne, France

- **2009** PhD in the field of instrumentation and informatics of image: Disputation date: 13.10.2009
  Faculty of Science and Technology, Université de Bourgogne, France

- **2006** MSc in Vision, Image and Signal Processing
  Faculty of Science and Technology, Université Jean Monnet, France

1.2 Current and previous positions

- **2019-** Associate Professor, Norwegian University of Science and Technology (NTNU), Department of Computer Science (IDI), Gjøvik, Norway

- **2010-** Associate Professor (Maître de Conférences), Université de Bourgogne, Faculty of Science and Technology, Dijon, France (**Sabbatical since 2016**)

- **2016-2019** Research fellow, Norwegian University of Science and Technology (NTNU), Department of Computer Science (IDI), Gjøvik, Norway

- **2010** Research fellow, Centre de Recherche et Restauration des Musées de France (C2RMF), Paris, France

- **2009** Research fellow, Gjøvik University College (GUC), Faculty of Computer Science and Media Technology (IMT), Gjøvik, Norway

- **2006-2009** PhD candidate, Université de Bourgogne, Faculty of Science and Technology, Dijon, France. Research fellow, Gjøvik University College (GUC), Faculty of Computer Science and Media Technology (IMT), Gjøvik, Norway

1.3 Fellowships and awards

- **2015-2016** Délégation CNRS, 1 year (Grant from the French national scientific research council to cover my teaching expenses and free up research time; Used for mobility.)

1.4 Mobility

- **2016-2021** Sabbatical (5y) from my position in France, as researcher at NTNU that led to a permanent position as Associate Professor at NTNU.

- **2021** Invited scholar (1w), Master EMJMD IMLEX, Université Jean Monnet, Saint-Etienne, France (Online)

- **2017** Visiting researcher (1w), Giessen University, Dpt of psychology, Giessen, Germany

- **2015-2016** Visiting researcher (6m), EPFL, Image and Visual Representation Lab (IVRL), Lausanne, Switzerland

- **2016** Visiting researcher (2w), Psychology and NeuroCognition Lab (LPNC), Grenoble, France

- **2016** Visiting researcher (2w), Université Savoie-Mont-Blanc, LISTIC, Annecy, France

- **2015** Visiting scholar (1w), HAINAN University, Hainan, China

- **2015** Visiting researcher (2w), Gjøvik University College (GUC), Faculty of Computer Science and Media Technology (IMT), Gjøvik, Norway

- **2012** Visiting researcher (4m), Gjøvik University College (GUC), Faculty of Computer Science and Media Technology (IMT), Gjøvik, Norway

1.5 Supervision of graduate students and research fellows

- **2019-** 7 PhD students under current supervision (2 as Principal supervisor at NTNU), 6 at NTNU, 1 at Université de Bourgogne
- **2020-** 1 post doc in current position at NTNU
- **2010-** 4 PhD Students supervised to successful completion, 3 at Université de Bourgogne, 1 at NTNU
- **2010-** 3 Post-Doctoral fellows supervised, 2 at Université de Bourgogne, 1 at NTNU
- **2006-** 13 Master students, Université de Bourgogne, NTNU, Gjøvik University College

1.6 Teaching activities

- **2019-** Specialisation on Colour Imaging at Master level (IMT4895, 7.5 ECTS), Colour Imaging at PhD level (DT8121, 7.5 ECTS).
- **2010-** Teaching various courses and project works on the topics of colour science, colour and spectral imaging, sensors, signal and image processing, electronics, etc.

1.7 Qualifications

- **2011** Followed a 6 days (45h) education program on pedagogy for PhD supervision (Université de Bourgogne)

1.8 Institutional responsibilities

- **2019-** Coordinator of the Master EMJMD COSI, NTNU
- **2015** Co-head of the research team Methods and tools for image processing (MOTI) at the Laboratoire d'électronique, informatique et image (LE2I), Université de Bourgogne
- **2015-2016** Responsible for the Master Advanced Electronics Systems Engineering (taught in English), Université de Bourgogne
- **2012-2016** Elected member at the board of the LE2I to represent the thematic "Vision", Université de Bourgogne

1.9 Commissions of trust

- **2021-** Member of the Editorial Board of the section MDPI Sensing and Imaging of Sensors
- **2021-** Associate Editor for OSA JOSA-A special issue in Image Quality and Perception
- **2021-** Associate Editor for MDPI Journal of Imaging special issue in Advances in Color Imaging
- **2020-** Member of RF-01 Spectral imaging of the Commission Internationale de l'éclairage (CIE)
- **2020-21** Associate Editor for MDPI Sensors special issue in Advances in Spectroscopy and Spectral Imaging
- **2020** Associate Editor for the IS&T Journal of Imaging Science of Technology (CIC JIST-FIRST)
- **2019-** Topical Editor for Sensors
- **2019** Associate Editor for the IS&T Journal of Imaging Science of Technology (CIC JIST-FIRST)
- **2018** Associate Editor for MDPI Sensors special issue in Snapshot Multi-Band Spectral and Polarization Imaging Systems
- Reviewer for various indexed journals, i.e. **Elsevier** Pattern Recognition, Applied soft computing, Image communication, **IS&T** Journal of Imaging Science and Technology, **Wiley** Journal of the Society for Information Display, Color Research & Applications, **OSA** Optics Express, Chinese Optical Letters, Applied Optics, **IEEE** Transactions on Image processing, Transactions on Circuits Systems and Video Technology, Transactions on Industrial Electronics, **TFO** Journal of Modern Optics, **SPIE** Optical engineering, **MDPI** Sensors, Remote sensing, ISPRS International Journal of Geo-Information, **AJ** Scientific Research and Essays, **Springer** Multimedia Tools and Applications, **Plos One**
- Chair, co-chair, program chair, session chair, scientific committee member and reviewer for several scientific conferences, e.g. CIC, CoMI, WAI, CVCS, MCS, EUVIP, ICIP, ICISP, CCIW, AIC
- Opponency and review of numerous master degree defences and 2 PhD degree defences

1.10 Membership of scientific societies

- Member of the IS&T
- Member of the Groupe Francais de la Couleur
- Member of the Colour Group (UK)

1.11 Major collaborations

- Profs. A. Mansouri and P. Gouton, Université de Bourgogne
- Profs I. Farup, M. Pedersen, J. Hardeberg, NTNU
- Profs P. Colantoni and A. Trémeau, Université Jean Monnet

1.12 Track records

- Citations and indexes from Google Scholar, the 20.03.2021.
- Publications: 93, Citations: 938, H-index: 16, i-10: 30.

1.13 Organisation of international conferences

- **2020** Program Chair, Colour and Visual Computing symposium
- **2019-** Chair, Workshop on Appearance and Imaging, within IEEE SITIS conference
- **2011-2018** Chair, Color and Multispectral Imaging workshop, within IEEE SITIS conference
- **2018** General Chair, Colour and Visual Computing symposium
- **2018** Workshop Chair, Color and Imaging Conference
- **2018** Chair, Multispectral colour science workshop
- **2018** Proxy General Chair, ICISP conference
- **2015** Program Chair, Colour and Visual Computing Symposium
- **2013** Publicity Chair, Colour and Visual Computing Symposium

1.14 Projects

- **2019-2025** COSI, EMJMD EU-funded Master program, Program coordinator for the EU project; Program leader for the local Master COSI aligned to this project
- **2020-** Technology transfer grants: Discovery grant and Innovation grant
- **2019-** PhD grant from Faculty IE, NTNU, Project leader
- **2019-** PhD grant from Dpt IDI, NTNU, Project leader
- **2016-2019** MUVApp, FRINATEK Toppforsk, Researcher Project member
- **2017** MOSAIC, CNRS-INS2I-JCJC, Researcher, Project member
- **2015-2018** EXIST, H2020, Technical coordinator for Université de Bourgogne until 2016
- **2015-2018** CISTERN, CATRENE, Technical coordinator for Université de Bourgogne until 2016
- **2015** AURORA, Hubert Curien program, Project leader on the French side
- **2015** PARI, PhD regional grant, Project leader
- **2014** BQR-PRES Université de Bourgogne, Project member
- **2013-2016** OFS, PSPC, Principal investigator and project leader for Université de Bourgogne
- **2012** BQR Université de Bourgogne, Project leader
- **2012-2018** Hypercept, SHP, Foreign Project member
- **2011** PARI, PhD regional grant, Project leader

2 General information

2.1 Synopsis

- Since 2019, I am **Associate Professor** in colour and spectral imaging (førsteamenuansis) at NTNU, department of Computer Science, located in Gjøvik, Norway. I carry out my research at the Norwegian Colour and Visual Computing Laboratory. I teach within the Master EMJMD Computational Colour and Spectral Imaging (COSI) and the Master of Applied Computer Science (MACS) at NTNU.

- Since 2010, I am **Maître de Conférences** (Associate Professor, permanent staff) at Université de Bourgogne (Dijon, Bourgogne, France). I am with the department IEM (Computer Science, Electronics and Mechanics) and my research is associated to the Laboratory Le2i (Laboratoire d'Electronics, Computer Science and Image), which became ImVIA (Imaging and Artificial Vision).

- Between 2016 and 2019, I took a **research leave** funded by a Post Doctoral position on a research project at NTNU-Gjøvik, where I worked on the project MUVApp, that focuses on the measurement and understanding of visual appearance. After that, I was offered a permanent position.

- I was 50% **invited researcher** at IVRL, EPFL (Lausanne, Suisse) during the year 2015-16 funded by a **délégation CNRS**. We developed an unmixing method to separate the visible and near infrared components in the images acquired by our prototype of multispectral imaging device[58]. I also used this year to visit and initiate collaborations with the LISTIC[43,48] and the LNPC[11].

- My scientific expertise focuses on **colour and spectral imaging, from the acquisition to the visualization of images** and on **computational appearance, i.e. the development of methods to measure appearance and preserve the perceptual attributes of objects across diverse technologies**. In this context, I use and develop knowledge within several fields: the related technologies, the physical models and measurements, the human visual system and the appearance of objects or materials. Applications are numerous, including robotics, advanced material design and extended reality. My teachings include electronics, signal and image processing, sensor technologies, colour science and colour appearance, colour and spectral imaging.

- I contribute to the **internationalisation of education**. I coordinate the EMJMD COSI[1] Master program at NTNU, this project is funded by EU. I contributed to run the second year of Master taught in English in Dijon, the Master Advanced Electronic Systems Engineering[2] in 2015-16. I was co-head of the research team MOTI (MethOds and Tools for Image processing) within Le2i in 2015, to help to write the activity report for the national evaluation. I was elected to represent the department Vision at the laboratory board between 2012 and 2016.

- Among other research projects, I was **principal investigator and coordinator** of the project PSPC Open Food System[3] for the Le2i until the end of this project. I was technical coordinator for the EU projects H2020-EXIST[4] and CATRENE-CISTERN[5] until I took my sabbatic leave in 2016.

- I conduct a technology transfer initiative to enable Spectral Filter Array technology for computer vision, robotics and medical imaging applications. This is supported by different grants within NTNU.

2.2 Scientific history

- Associate Professor in Colour and Spectral Imaging, since May 2019 at NTNU, Norway.
  - Thema: Developing and strengthening the research and educational activities at the department of computer science in fields related to colour and spectral imaging in relation with material appearance.
  - Main project at the moment: EMJMD-COSI. I also contribute to the ITN projects CHANGE and APPEARS.
- Maître de Conférences, since September 2010 at Université de Bourgogne, France.
  - Thema: Acquisition and modelling of multispectral images (technology design, optimization, demosacing, illumination, etc.). We developed technologies to take multispectral imaging outside of the labs.

[1] https://cosi-master.eu/
[2] http://www-iem.u-bourgogne.fr/MASTER/MSCAESE/homepage_128.htm
[3] http://www.openfoodsystem.fr
[4] http://cordis.europa.eu/project/rcn/198017_en.html
[5] http://www.cistern.nl/index.php/consortium

  - Main projects: Open Food System (PSPC), EXIST (H2020), CISTERN (CATRENE).
  - Habilitation thesis: Multispectral imaging for computer vision.
    * Reviewers: Prs Edoardo Provenzi (CNU 26), Patrick Lambert (CNU 61) and Kacem Chehdi (CNU 61).
    * Jury president: Pr Ludovic Macaire (CNU 61).
    * Examiners: Prs Jon Hardeberg, Albert Dipanda (CNU 27) and Pierre Gouton (CNU 61).

- Post doctoral research fellow, September 2016 to April 2019.
  - At NTNU, Gjøvik, Norway.
  - Thema: Measuring and understanding the appearance of 3D complex transparent or translucent objects.
  - Project: MUVApp.

- Post doctoral research fellow, February 2010 to July 2010.
  - At Centre de recherche et de restauration des Musées de France (C2RMF), Paris, France.
  - Thema: Obsolescence and contemporary art; Digitization of artist films.

- Post doctoral research fellow, October 2009 to December 2009.
  - At Gjøvik University College, Gjøvik, Norway, The Norwegian Color Research Laboratory (Colorlab).
  - Thema: Spatial characterization of video-projection systems and colorimetric optimization of 3D video-projection systems.

- Research fellow, PhD candidate, October 2006 to September 2009.
  - At Université de Bourgogne, Dijon, France, and at Gjøvik University College, Gjøvik, Norway.
  - Laboratories: Le2i and Colorlab.
  - Thesis: Colorimetric characterization of displays and multi-display systems.
    * Supervisors: Prs Pierre Gouton and Jon Y. Hardeberg, and Dr. Irène Foucherot.
    * Reviewers: Prs Sabine Süsstrunk and Lindsay MacDonald.
    * Jury president: Pr Françoise Viénot.

- Master thesis, Mars 2006 to September 2006.
  - At Université Jean Monnet, Saint-Etienne, France.
  - Laboratory: Laboratory of computer graphics and vision engineering (LIGIV).
  - Supervisor: Pr Alain Trémeau.
  - Thesis: Color image watermarking for the insertion of a representative color chart into the image.

- Internship, April to July 2005.
  - At Université Jean Monnet, Saint-Etienne, France.
  - Laboratory: LIGIV.
  - Supervisor: Dr. Philippe Colantoni.
  - Technical report: Colorimetric characterization of displays, estimation of a model quality.

3 Research expertise

My research[93,104] focuses on colour[106] and spectral imaging and on computational appearance. The latter intends to develop methods to understand and measure the appearance of objects and materials and maintain the perception of the appearance of objects across diverse technologies. It also helps to provide standardized data representation that can be used in several application fields, such as extended reality, medical imaging, robotics and machine vision, data visualisation, computer graphics, remote sensing and material design (3D prints, programmable matter, etc.).

I develop imaging technologies and solutions with the goal to use them toward the measurement or estimation of object appearance in uncontrolled conditions. I am also very eager to use those concepts into the visualization of multi-modal data[27,79].

In summary, we need to capture information, and to extract indicators from this information, that correlates with the subjective data collected through psychovisual experiments. For that, various methods, techniques and models can be used, linear or non-linear, rooted in physics (optical models) or rooted in data (machine learning). This is naturally a transdisciplinary approach with connexions to signal processing, physics, computer science, cognitive psychology and metrology[39].

3.1 Material appearance

The appearance of material or objects is an open research field. Although most of us are able to perceive and describe more or less the appearance of an object, we still do not understand the underlying mechanisms, neither the measure we could use to quantify those perceptions and descriptions.

- I analysed the correlation between contrast and gloss perception[56]. We investigate the impact of the scale in the measurement of the BRDF through the thesis of **Dipenjana Saha**.
- I initiated a qualitative research through the creation of a collection of art objects that permits to study, in practice, the different concepts related to material appearance[45,103,105]. We presented quantitative results at Colour and Imaging Conferences[38,41] and at Electronic Imaging[40]. We are investigating how caustics impact transparency and gloss perception. I am also conducting measurement and acquisition campaigns on those objects.
- We investigate on the perception of translucency[29,37] through the thesis of **Davit Gigilashvili**.
- I investigated the perception of glint with **Min-Ho Jung**[32].
- I investigate how we can consider texture features[2,7,31].
- We investigate how Reflectance Transformation Imaging can help in manufactured object quality assessment[34], this is done within the thesis of **Abir Zendagui**.
- Several other aspects are considered within the recently started PhDs, with more onsight on material analysis (snow, painting, etc.).

3.2 Colour image reproduction, modelling and visualization

- Up to 2010, I focused on the colorimetric characterization of display devices. I worked on the physical modelling of the technologies around colour, spatial uniformity image fusion and seamlessness. We did communicate heavily on this topic[18,22–25,76,78,80–85,87,91,96].
- I considered the image gamut and the sampling of colorspaces[17,70,86,88]. By using graphs formalism, we investigated the image structure and developed new visualization processes[79].
- I contributed to the evaluation of displayed image quality through **Ping Zhao** PhD thesis[19,60,65,69,75], where we used a camera to replace the observer for quality evaluation.
- We recently used those different knowledge to visualise spectral and colour data in a calibrated way through web browsers[35,36]. This is because web-browsers offer a tool independent from platform that can display contents easily in Head-Mounted Display, that would be very interesting in a video see-through extended reality setups).
- We develop the understanding of the peripheral vision contrast sensitivity and its application to green media via the PhD thesis of **Aliakbar Bozorgian**.

3.3 Image acquisition and modelling

- Since 2010, I focused on colour and spectral image acquisition and related processing. On colour image capture, I transferred my expertise from displays to scanners[77] then to cameras[89,90].
- I contributed strongly to the development of the SFA technology (Spectral Filter Arrays) for multispectral image acquisition[97–100]. This research was visible so we gave a *short course* on this technology at Colour and Imaging Conference[101] and I was invited to a *Dagstuhl Seminar*[102] to provide expertise. This is also the keystone of my French Habilitation thesis[93].
- We realized a prototype camera that captures visible and near infrared information in a single shot[16,20,54,68] and redefined the imaging pipeline for this camera[14,52]. This was made possible thanks to the funding of the OFS project, augmented by a BQR project, and by the collaboration with **Pierre-Jean Lapray**, hired as post doctoral fellow. We generated multi and hyperspectral image data sets for algorithm benchmark or simulation[7,14,54]. The new generation prototypes and commercial products based on this technologies are the output of the projects CISTERN and EXIST.
- I discussed what should be the spectral sensitivities of such sensors[15,21,57,71,74]. I developed and compared demosaicing algorithms, in particular through the PhD thesis of **Xingbo Wang**,[6,11,44,49,51,62,66,72,73] and through a collaboration with the EPFL, we combined demosaicing and unmixing of spectral components[58].
- I developed the concept of *multispectral constancy* and of *spectral adaptation* within the PhD thesis of **Haris Ahmad Khan**[9,13,47,53,55,61]. This permits a stable representation of spectral information in case of illumination change or for uncalibrated images [5].
- I considered the dehazing of colour and spectral images through the PhD of **Jessica El Khoury**[8,10,12,30,43,46,48,50,59,63,67].
- I consider the imaging of snow through the PhD thesis of **Mathieu Nguyen**, with also applications to Remote Sensing.
- I consider applications to Cultural heritage through the PhDs of **Silvia Russo**[26] and **Federico Grillini**[1,28,33].
- We investigate the potential of spectro-polarization imaging, by generalising the concept of SFA to GFA (General Filter Arrays)[3] via a collaboration with Pierre-Jean Lapray.
- We compared several SFA cameras for oxygenation estimation from skin imaging[4]. An application of multispectral video applied to background subtraction was also presented[64].

The robustness and simplicity of the SFA technology coupled with the understanding of the illumination permit to take multispectral cameras outside of laboratories. That enables innovation on many fields, and application examples are demonstrated in medical, agriculture and automotive fields.

3.4 Publications

The list of scientific communications appears at the end of this document. I refer to my Google Scholar for citation counts and popular indices[6].

In the following list, references 1 to 25 are articles published in journals with peer-review. I added a note for the *impact factor* JCR 2017; References 26 to 88 are published in conference proceedings with peer-review[7]; References 89 to 93 are book chapters; Reference 92 is my PhD thesis, reference 93 is my French Habilitation thesis; The last references are noticeable invited talks given to seminars, and technical reports. I contributed also to minor events not listed here (i.e. animations at scientific night at Gjøvik science center). References 107 to 110 are the PhD thesis completed under my supervision.

You will access my publications at my personal webpage[8], which I try to keep up to date.

[6] https://scholar.google.fr/citations?user=MkzII3cAAAAJ&hl=fr

[7] I let in the list a Norwegian conference without proceedings because I thought it was relevant for this application[48].

[8] http://jbthomas.org/publications-2.html

4 Pedagogical experience

I want my students to be capable of independent, original and critical thinking based on causal reasoning. I also want them to be able to learn by themselves. In order to ensure that, I believe there are important ingredients: technical tools to understand and model observations, and self-confidence are amongst the most important items to be transferred to them. Communication skills and other humanistic values are also at the top of the list to me.

The nature of the specific technical tools are actually not very important as long as the students understand the reasoning behind them, and an example is always useful to start from. However, teacher expertise is important, because the student must acknowledge the teacher competences, and vocations might be generated by the course, this is especially important for undergraduate students, but is difficult to implement within the traditional amphitheatre teaching, that is a sender-centric communication mode.

In this regard I am very much into flipped-classroom, where the roles are exchangeable in the class, which distributes the role of Teacher to anyone in the class, making me more a Mentor than an authority. This demonstrated to help the students to engage and take responsibilities. It is to note also that this can be implemented at a very early stage in the Bachelor level (e.g. students in first year sometimes come from very different backgrounds, and rather than making it a weakness, it can be used to increase the participations of students). Also for the grading, my experience in the Norwegian system made me to realise that the grading system alone is of very limited information to the student as feedback, and a more qualitative description of the expected knowledge, skills, and general competences expected to be achieved is very important for the students.

4.1 Education in pedagogy

- Within my different positions, I learnt mostly pedagogy by myself.
- I have been nevertheless looking for material and support to improve my skills in this direction. Noticeably I followed an education program on pedagogy for PhD candidates ($\tilde{4}$5h on 3 sessions of two days), that covered four main topics: 1-inter-personal communication, 2-interview, 3-inter-cultural management, 4-Problem resolution. This course outcome was strengthen by my experience as project manager and by my responsibilities in international programs.
- I also followed several smaller seminar that considers pedagogy, use of digital technologies in teaching, open courses, etc.
- I believe that we maximise impact on students by maximising the diversity of supports. In fact every individual has a preferred way to learn, and it is the pedagogical role to identify this way and to propose adapted content.

4.2 Teaching

Since 2019, I am teaching within the department of computer science at NTNU.

Between 2010 and 2016 I was teaching at the Dpt of computer science, electronics and mechanics at the Faculty of sciences and technologies at UBFC, Dijon. Most teachings were related to the bachelor programs in *Computer science* or *Engineering science*; And to the Master program *Information and communication science and technologies*, with majors in *Computer Science* or in *Electronics, Signal, Image*. The names of those programs may have slightly changed for the 2017-21 education programs. Between 2016 and 2019, I was mostly doing research and did only little academic teaching, while I kept on supervising student projects in several formats and levels.

- Since September 2019, I am responsible for the course **Specialisation on colour imaging** at NTNU, Master level course. Within this course, we investigate the broad topic of colour imaging, trying to understand the current limitations, so that the students can identify tomorrow's promising research topics. The course evaluation is based on a project achievement, report and presentation, and an oral exam. I contribute to the Colour Imaging course at the PhD level, that uses very similar methods. I also conduct seminar series for the COSI program: This program enrols very different profiles, and some recall and leveling on diverse topics are required.
- I was responsible for the course **color science** within the first year of Master *Electronics, Signal, Image*, within which I gave the course and the practice. I initiated a new course format based on an individual project for which every student was responsible for, with my help, the choice and limit of the topic and the way to convey it and to present it to the classroom. This was defined after the observation that very few students had a clear educational project or professional project when they arrived in the first year of Master. This project permitted to generate discussions about that. This course was also a great support to invite several colleagues [9], in particular from Norway within our ERASMUS agreements or within research projects. Students could benefit from diverse visions on the topic and recommendations on their projects in French or in English. I also invited several French colleagues. The goal of this format was to make the students more

[9] Pr. Ivar Farup, Pr. Marius Pedersen, Pr. Edoardo Provenzi, Ass. Pr. Philippe Colantoni, Ass. Pr. Marco Anisetti.

responsible and standalone, which is usually not the best quality of the French standard education strategy. According to the evaluations I got from the students (through the University yearly survey on quality) and direct feedbacks, this format helped them very much, beyond the content of the course. The evaluation was a written exam in addition to the project achievement, report and presentation.

- The rest of my teaching was mostly within courses managed by my colleagues where my involvement varied. In the Bachelor programs, I did a lot of **Electronics** practice where the exam was based on the practice. I reformatted partly practice for the courses **Introduction to vision** and **Signal processing**, which exam was based on the practice. I helped with the course **Professional project**. In the Master programs, I contributed to the course **Image processing** in the *Computer science* Master and in the course of **Spectral imaging** in the *Electronics, Signal, Image* Master. Those exams were classical written examinations.

- I was also giving a course on **image processing** in English with the Master MaTEA at AgroSup Dijon between 2011 and 2015. Those students were mostly coming from mechanics in farming, so I had to adapt the content and examinations. Depending on the year, I used different strategies for the teaching and exam. The most successful course was to do a lot of improvisation based on discussions and interest of the students for a specific topic.

4.3 Teaching hours

In the French system, the teaching hours spent in front of the student should be 192 hours a year by regulation, it is a common practice to do a little extra hours to round up and finish the courses. I did my full service every year since 2010, except when I was temporary assigned to 100% research at the CNRS in 2015-16, and since I was in a research sabbatical since 2016. This is summarized in the Table below.

Year	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-19	2019-20	2020-21
Hours of teaching	226	231	210	231	243	Temporary assignment to CNRS	Research sabbatical	7.5 ECTS	15 ECTS

Table 1. Summary of teaching hours, by year, since 2010. Hours as counted as in the French system as *Heures equivalent TD* until 2019, then the number is given as ECTS.

I also taught about 70 hours of diverse topics during my PhD between 2006 and 2009, in particular within the Masters Media Technology and the EMJMD CIMET at HIG in Norway.

4.4 Responsabilities

- I coordinate the EMJMD COSI Master program since summer 2019.

- I was involved in the former version (coordinated by Université Jean Monnet in France) of this Master as *faculty advisor* and in the *quality board*. I was specially appointed by NTNU, to reshape, resubmit this program to the EU in 2019 and take over the coordination.

- I was in charge of the Master Advanced Electronic Systems Engineering[10] in 2015 and 2016, program in English towards internationalization. My action was to start this program and in Fall 2016 it opened with 14 students. Within this program, we signed a MoU with HAINAN University in China, that planned student exchange. I also collaborated with the French embassy in Nigeria and obtained 3 student grants from the Nigerian oil industry for Nigerian students in our program. When I took my sabbatical, Pr Jean-Marie Bilbault took over the coordination in Fall 2016.

My expertise in education management is clearly oriented to **internationalization** and towards **joint programs**. I am experienced in foreign students management, and in the interaction with international offices of diverse Universities.

4.5 EMJMD COSI

4.5.1 Master program

The 2-years (120 ECTS) Erasmus Mundus Joint Master Program Computational Colour and Spectral Imaging (COSI) provides interdisciplinary and innovative training program in a specialized field combining colour and spectral imaging with advanced data science. We provide students with a unique competence and skill set, including advanced methodologies, models, and practical applications with two goals: Enhance their employability and improve their career prospects on one hand, and meet the current and future needs of industrial R&D and academic research on the other. The Information and Communication

[10] http://www-iem.u-bourgogne.fr/MASTER/MSCAESE/homepage_128.htm

Technologies, Health & Life Science, and Science & Technology sectors are in full growth. The innovative use of images is increasingly important in these sectors, particularly in Quality Control of Manufactured Products, Medical and Biomedical Imaging, Spectral Systems Design, Media Technology, Internet of Things. COSI competence is highly sought after in a wide range of sectors where the continued evolution of R&D fields requires adapted and extremely specialized courses with a strong focus on industrial applications and recent trends in various research areas. COSI is building on more than ten years of excellence in European higher educational collaboration between the four full partner universities: NTNU -The Norwegian University of Science and Technology (NO), UJM - Université Jean Monnet Saint-Etienne (FR), UGR - University of Granada (SP), UEF - University of Eastern Finland (FI). Furthermore, a large number of universities and companies worldwide have joined the COSI consortium as associate partners. The first semester at NTNU includes a comprehensive coverage of the fundamentals of colour and spectral imaging through Computer graphics fundamentals and applications, Cross-media colour reproduction, Deep learning and visual computing, Introduction to research on colour and visual computing. Then, the students have the opportunity to select between different specialisation areas, at either UJM (Colour Image Modelling and Understanding) or UGR (Photonics, Image and Vision) in the second, and between NTNU (Colour and Visual Computing) and UEF (Computational Spectral Imaging) in the third semester. Between the 2 years, the students carry out a summer internship with one of our associate partners. In the fourth semester, the students devote themselves to their master thesis, which is carried out in a company or a research center. With competitive scholarships available we recruit excellent students from various educational backgrounds worldwide. The whole curriculum is entirely taught in English, but students also gain multicultural skills as well as other transversal skills. COSI students receive a specialized education very well adapted to their background, interests, and future career plans.

4.5.2 My role

I wrote and submitted the program in February 2019. During a preparatory year, I created the equivalent Master program at the local level within NTNU that i am leading since then. I coordinated the local preparation of the course curriculum, including the creation of new courses. Together with a designer, we created the visual identity of this program.

At the program level, I have been prepared to coordinate this program through interaction with our EU-project officer in Bruxelles, but also with my colleagues at Université Jean Monnet, who are very experienced in coordinating this type of program.

I have been the head of the Consortium since the project was labelled and funded (3.5 millions of euros, covering up to 69 EMJMD scholarships over 4 cohorts). I am in the process of finalising the signature of the Consortium Agreement with our Industrial partners (Norsk Elektro Optik, Microsoft Surface, Vilmorin-Mikado, Huddly, HP, Barbieri, Tecnalia, Olympus, Chromasens, Sedoptica, InterDigital, Mihaly, Barco and DxO) and our Academic partners (Università degli Studi di Milano-Bicocca, University of Minho, University of Zagreb, Unversity of Leuven, Universidad Nacional del Sur, Tecnológico de Monterrey, Federal University of Minas Gerais, NIT Silchar, National Cheng Kung University, Khulna University, Tribhuvan University, Chulalongkorn University, Amirkabir University of Technology,Suleyman Demirel University, Technological University of Tajikistan, Toyohashi University of Technology).

At the end of the preparatory year, during the student selection process, the Covid-19 crisis started, and I had to handle the instability created by this event. With cooperation with the immigration services of Norway, with our international office, and with the good will of my colleagues, we could start the program as planned, with most of the 16 students physically present in Norway (except one student who joined for the second semester). I prepared the summer internships for the first cohort at our industrial partners, part of those internships will be unfortunately conducted remotely. I did a first mid-term reporting to the EU in December. The selection of the second cohort just happened, and we recruited 20 students with a grant. I am anticipating on the Covid regulation and initiate a discussion with the immigration services at the moment.

I am handing over the coordination to my colleague Ali Amirshahi, Associate Professor at NTNU, which I am educating to take over this role in prevision of my reintegration in the French system.

4.6 Popular science

I contribute to popular science through different actions.

- With my colleague Philippe Colantoni, we developed several demonstrator that can be used to communicate the concept of colour management and the concept of spectral images through some interactive demo supported by visualisations.
- I was invited as keynote speaker to Forum Farge two times[103,105]. Forum Farge is an association oriented towards designers and architects interested in the use of colors.
- Animations at scientific night at Gjøvik science center. This event happens once a year and is dedicated to kids. I have built a demo where kids can interact with objects based on their appearance. My first intention was to see if I could

collect data from gaming, but this proved to be difficult to get the kids to focus on the game. However, it is a line that is interesting to develop.

5 Education through research

5.1 Post Doctoral fellows

I worked with 2 post doctoral fellows that we hired on the projects OFS and EXIST with UB. I worked with one post doctoral fellow under an ERCIM grant at NTNU. I am currently working with one post doctoral fellow based on an innovation grant. They are summarized in Table 2.

- Dr Pierre-Jean Lapray is now *Maître de Conférences* at Université de Haute-Alsace.
- Dr Keivan Ansari is back to Iran where he is Assistant Professor at Institute for Colour Science and Technology in Tehran.
- Dr Min-Ho Jung is back to Korea, he is investigating several job opportunities.

Table 2. Post doctoral research fellow management.

Name	Time	Thema	Funding	Management
Pierre-Jean LAPRAY	01/12/2013 - 31/07/2014	Spectral Filter Array: Prototyping of a camera	OFS	J.B. Thomas
Keivan ANSARI	01/12/2015 - 30/09/2016	Multispectral face recognition: Design and demonstrator	EXIST	J.B. Thomas
Min-Ho JUNG	01/10/2019 - 30/09/2020	Modelisation of appearance of metallic surfaces	ERCIM	J.B. Thomas
Jacob BAUER	01/10/2020 -	Spectral Filter Array applied to medical imaging	Discovery Innovation	J.B. Thomas

5.2 PhD candidates

I co-supervised four PhD thesis that were successfully defended. I am currently supervising several PhDs related to NTNU or UB. Two of them are under my main responsibility. There are two PhD students within the ITN projects CHANGE and APPEARS, one of this student works with CNAM in Paris. The other one works with HE-ARC in Switzerland. Another PhD student is fully at NTNU, the last one is fully at UB. They are summarized in Table 3.

- Dr Xingbo Wang works now for AAC Technologies, a company in China that develops smartphone components. He is in charge of the chinese branch of the departement that handle imaging solutions, with major interest in image quality - IQ (IQ lab, IQ assessment, IQ tuning, and algorithms, and lab management, including hiring process).
- Dr Ping Zhao is software developer for Idletechs AS, he develops real time analysis of multivariate data. Before that, he was system developer for Epson Norway R&D AS, where he worked on interactive computer vision based on projection systems.
- Dr Jessica El Khoury works for PNO Consultants, in France. She was teaching assistant at Université de Bourgogne in Auxerre. She opened her expertise towards RTI (reflectance transformation imaging) and surface inspection.
- Dr Haris Ahmad Khan is now research fellow in the Farm Technology Group, Wageningen University Development & Research, Wageningen, in the Netherlands.

5.3 Master thesis

I supervised or co-supervised 13 Master thesis. I am co-supervising 1 Master thesis in Spring 2021. They are summarized in Table 4.

5.4 Other supervisions

- I used to be occasionally Master thesis external examiner for HIG/NTNU, Norway and for EPFL, Switzerland.
- I supervise each year several student projects in Master and Bachelor programs from different Universities.
- I was member of the Jury for the PhD defense of Hasan SHEIKH FARIDUL (Université Jean Monnet, the 06/01/2014).
- I was member of the Jury for the PhD defense of Sofiane MIHOUBI (Université de Lille, the 22/11/2018).

Table 3. Co-supervision of PhDs. The responsibility is given as percentage as for the French system and then as Principal Supervisor (PS) and Associate Supervisor (AS) for the Norwegian system.

Name	Time	Title	Employer	Context & Funding	Supervision (%) (or as PS/AS)
Xingbo WANG	01/10/2011 - 10/10/2016	Filter array based spectral imaging: demosaicking and design considerations	co-tutelle UB + NTNU-Gjøvik	50% Burgungy regional council 50% NTNU-Gjøvik	Pr. J.Y. Hardeberg (25%) Pr. P. Gouton (25%) **J.B. Thomas (50%)**
Ping ZHAO	01/10/2012 - 23/11/2015	Camera Based Display Image Quality Assessment	100% HIG	hypercept project	Pr. J.Y. Hardeberg (50%) M. Pedersen (30%) **J.B. Thomas (20%)**
Jessica EL KHOURY	01/10/2013 - 05/12/2016	Model and quality assessment of single image dehazing	100% UB	OFS project PSPC	Pr. A. Mansouri (50%) **J.B. Thomas (50%)**
Haris AHMAD	01/10/2015 - 09/10/2018	Illuminant estimation from uncalibrated multispectral images	co-tutelle UB + NTNU-Gjøvik	50% Burgungy regional council 50% NTNU-Gjøvik	Pr. J.Y. Hardeberg (30%) Pr. O. Laligant (10%) **J.B. Thomas (60%)**
Davit GIGILASHVILI	01/09/2018-	Translucency perception	100% NTNU	MUVAPP NRC	Pr. J.Y. Hardeberg (PS) Pr. M. Pedersen (AS) **J.B. Thomas (AS)**
Abir ZENDAGUI	01/10/2018-	Numérisation et modélisation de la réflectance des surfaces manufactureées: vers un pilotage fonctionnel de l'apparence	UB	NAPS ANR	Pr. A. Mansouri (PS) G. Le Goic (AS) **J.B. Thomas (AS)**
Dipanjana SAHA	01/09/2019-	Characterization of Natural and Artificial Surfaces using a multiscale approach based on BRDF measurement	CNAM	ITN APPEARS EU	G. Obein (PS) M. Barbieri (AS) **J.B. Thomas (AS)**
Silvia RUSSO	01/09/2019-	Analysis and assessment of degradation of polychrome artworks	HE-ARC	ITN CHANGE EU	Pr. E. Joseph (PS) L. Brambilla (AS) **J.B. Thomas (AS)**
Mathieu NGUYEN	03/2020-	Snow Imaging : Optical properties and Appearance models	NTNU	Department funding	Pr. I. Farup (AS) **J.B. Thomas (PS)**
Federico GRILLINI	01/10/2020-	Spectral imaging and analysis of cultural heritage in combined VNIR and SWIR	NTNU	Department funding	S. George (AS) **J.B. Thomas (PS)**
Aliakbar BOZORGIAN	01/10/2020-	Contrast sensitivity in the peripheral vision for color imaging	NTNU	Department funding	Pr. M. Pedersen (PS) **J.B. Thomas (AS)**

Table 4. Supervision of Master thesis.

Name	Time	Title	Context	Supervision
Espen MIKALSEN	01/01/2007 - 01/07/2007	Verification and extention of a camera based calibration method for projection displays	HIG	J.B. Thomas Pr. J.Y. Hardeberg
Julie-Gaelle ALBRECHT	15/03/2013 - 15/07/2013	Colorimetric characterization and classification for generating a color palette of Burgundy wines	collaboration BIVB	J.B. Thomas
Jessica EL KHOURY	15/03/2013 - 15/07/2013	Spectral measurement in cooking environment	OFS project	J.B. Thomas
Daniel SUAZO	01/01/2013 - 01/07/2013	Edge blending in multiprojection systems	collaboration HIG	M. Pedersen J.B. Thomas
Hassan A. MAHAMAT	15/05/2014 - 14/07/2014	Automatic photometric compensation of projection surfaces		J.B. Thomas
Antoine GHORRA	30/03/2015 - 30/07/2015	Illuminant estimation from uncalibrated multispectral images		J.B. Thomas
Samir RAOUI	30/03/2015 - 30/07/2015	Integration of a colorimeter into a prototype of commercial oven for real-time analysis	OFS Project	J.B. Thomas S. Jacquir
Najwa ALKAOUI	01/04/2017 - 31/08/2017	Translucent material Analysis and modelling	MUVApp Project	J.B. Thomas I. Farup
Nathan MIOT-BATTU	16/03/2017 - 15/09/2017	Spectral filter array image quality	OFS Project	J.B. Thomas P.-J. Lapray
Federico GRILLINI	06/01/2019 - 31/07/2020	Spectral unmixing for cultural heritage	NTNU	S. George J.B. Thomas
Guillaume COURTIER	10/02/2019 - 31/07/2020	Data analysis for spectral and polarization imaging	UHA	P.-J. Lapray J.B. Thomas I. Farup
Gael DESERTOT	16/03/2019 - 30/06/2020	Shadow removal from othophoto in VISNIR	NTNU	J.B. Thomas R.S. Ødegaard
Alexandra SPOTE	10/02/2021 -	Spectro-polarization image demosaicing	UHA	P.-J. Lapray J.B. Thomas I. Farup

6 Projects participation and fundings

6.1 EMJMD-COSI

I coordinate the EMJMD EU Master program COSI (Computational, Colour and Spectral Imaging). This program received a funding of **3.5 millions of euros** (2019-2025) and aims at providing research and industry with good scientists specialised in our research expertise. The program is spread between France, Spain, Finland and Norway and involves several academics and

industrial partners.

6.2 Technology transfer

I am leading an innovation initiative with NTNU and TTO, their technology transfer organisation. Within this framework we obtained **500.000 NOK** (̃50.000 euros) for 6 months of post doc (Jacob Bauer) within the innovasjonStipend CFP, and **250.000 NOK** (̃25.000 euros) within the Discovery Forny CFP to develop a Minimum Viable Product, that is working. We are now in the process of developing demo and creating a spin-off company to commercialise our products related to the use of spectral imaging for computer vision, robotics and medical imaging.

6.3 ITNs CHANGE and APPEARS

I interact with the ITN projects APPEARS and CHANGE, coordinated at NTNU by J.Y. Hardeberg. My research being related to both of them, I contribute as a researcher, and also in the supervision of two PhD thesis funded by those projects. I do not have management tasks.

6.4 NTNU PhD Grants

With my Associate Professor position at NTNU, the department offered me a grant for a PhD. I invited Pr. Ivar Farup to co-supervise. The projects was co-written with him. 31 candidates applied, we selected Mathieu Nguyen who is working on his PhD. Within the call for excellent Master students, Federico Grillini obtained a PhD grant to conduct his phD under my supervision with Sony George. Within the innovation call, Marius Pedersen and me obtained a PhD grant that was attributed to Aliakbar Bozorgian.

6.5 MUVApp

I joined the MUVApp project (Measuring and Understanding Visual Appearance) as post doctoral fellow between 2016 and 2019. I did not contribute to the writing of the project and I do not contribute to its management. I interacted with the Colorlab members, in particular Prs Ivar Farup et Jon Hardeberg. I interacted also with the other members, e.g. Prs Karl Gegenfurtner, Patrick Callet or Shoji Tominaga. A part of my research is still aligned with this on-going project. Within this project, I co-supervise the PhD of Davit Gigilashvili.

6.6 EXIST and CISTERN

I worked on two EU projects for which I was technical coordinator for my Lab in France until my sabbatical: EXIST(H2020) and CISTERN (CATRENE). Those projects target the definition of new generation image sensors CMOS. Those projects were launched in 2015.

EXIST 36 months; Kick off the 01/05/2015; **26.8 millions** euros.

CISTERN 36 months; Kick off the 01/04/2015.

I wrote the project proposal about multispectral imaging for the Le2i-UB. Pr Pierre Gouton took over the coordination after I left for my sabbatical in 2016.

6.7 OFS

Open Food System developed the future kitchen based on connected objects and automated cooking. The project was lead by SEB and TGCP, who has local antenna in Bourgogne and Franche-Comté. The full cost of the project was about **20 millions** of euros. This project was funded by the ministry of industry of France as *Projets de recherche et développement Structurants pour la Compétitivité (PSPC)*. 42 months; Kick off, 12/01/2013; Closing, 12/07/2016.

I wrote the project proposal for the Le2i-UB and managed it until the end. With this project I could in particular finance a post doc position and a PhD position.

6.8 CNRS-INS2I-JCJC-2017 MOSAIC

We developed this project with Ass. Pr. Benjamin Mathon at the laboratory CRIStAL, around the PhD of Sofiane Mihoubi. This project answered the need of hyperspectral image database acknowledged by the French institutions (during a GDR ISIS day on multimodal imaging).

We wrote the proposal together with Benjamin Mathon, he managed the project.

6.9 AURORA 2015

With Pr. Marius Pedersen (NTNU-Gjøvik), we obtained a grant for research mobility in the call AURORA of the program Hubert Curien, funded by the embassy. We worked on the influence of orientation on the chromatic contrast sensitivity functions of the human visual system and its consequences on image quality.

We wrote the project together and managed this project for our respective Universities.

6.10 PARI

The Regional Council of Bourgogne permitted to co-finance 2 PhD thesis. The thesis of Xingbo Wang and Haris Ahmad were co-financed by NTNU-Gjøvik, Norway. The projects were co-written with the co-supervisors.

6.11 BQR PRES 2014

We obtained a local funding to develop the use of our prototype spectral cameras in automotive applications. This funding permitted to duplicate our SFA prototypes.

We co-wrote this project with Pierre Gouton, he managed this project.

6.12 BQR 2012

I obtained a local funding to continue my work on obsolescence and contemporary art, on FLICKER movies, initiated during my post doc at the C2RMF. A software for scanner colorimetric calibration was developed.

I wrote and managed this project.

6.13 Hypercept

I was invited to participate to the project hypercept[11] funded by the Norwegian Research Council. This project permitted to continue my historical collaboration with HIG/NTNU-Gjøvik. In particular I could interact with Pr. Marius Pedersen around the PhD of Ping Zhao.

I was only external member to this project.

6.14 COSCH

I was member of the network action COST COSCH[12] dedicated to imaging technologies on cultural heritage.

I was only a distance member of this project. Pr Alamin Mansouri was the principal contact for the Le2i-UB.

6.15 Diverse contributions

Projects where my contribution is limited to a PhD co-supervision, and little interaction:

- ITN APPEARS,
- ITN CHANGE,
- ANR NAPS.

[11] http://colourlab.no/research_and_development/research_projects/hypercept
[12] http://www.cost.eu/domains_actions/mpns/Actions/TD1201

7 Industrial Collaboration and Innovation

7.1 Industry and research

All the major research projects I contributed to were involving strongly industrial cooperation. The OFS project was driven by SEB and TGCP, two major players of kitchen providers at the individual and professional level. Within this project, I developed a prototype of spectral imaging sensor, in collaboration with a company that I sub-contracted (SILIOS). We made a deal on price, so it was affordable for our project, while helping to develop their products. This process was successful, and SILIOS invited me later to the EU-project consortium that lead to the two EU projects I was involved in (EXIST and CISTERN). Those projects were lead by camera manufacturers and actors (Grass Valley, ADIMEC, IMEC, AMS, Thales, etc.).

This has never prevent me to publish academic articles at a fundamental level. This is because I have a very clear communication with my partners before to enrol in a project. Neither me or the University are consultancy agencies, and I explain it in a very clear way at the first stage of the discussion. In general, this is very well accepted by my industrial contacts.

7.2 Industry and teaching

A large part of our graduated students will serve in the industry. It is thus important that the content of the teaching program relates also to the reality of the industrial needs, in addition to the academic basis required to student development.

In order to account for this reality, we have implemented an open communication with our industrial partners within the COSI program. Once a year, we invite them to a discussion where we evaluate the content of the program and develop updates in the course contents. This is made possible by the very good cooperation in both directions: we collaborate with our partners on research projects, they take our students into Master thesis and internships, so they see what skills they miss to perform well in their business. This process is very efficient to root our education programs in the reality and not into academic niches.

7.3 Technology transfer

Because I work in close collaboration with for-profit organisation, and publish my research in accessible academic journals, I do not need to implement myself the technology transfer: It is built-in within the collaborations. However, at the moment, I work toward the creation of a spin-off company. This is based on two observations: 1-the market is very recent for what we develop, and only my collaborators and me have the skills required to make it. 2-this is an experience that I run in order to see if this mechanism is efficient to make my past research unified and usable; and thus build over it to progress.

Scientific communications

Articles in international peer-reviewed journals

1. F. Grillini, **J.-B. Thomas** and S. George. VisNIR pigment mapping and re-rendering of an experimental painting. Journal of the International Colour Association. Vol. 26, pp. 3-10, 2021.

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3. G. Courtier, P.-J. Lapray, **J.-B. Thomas** and I. Farup. Correlations in Joint Spectral and Polarization Imaging. Sensors. Vol. 21(1), 2021. **[JCR-IF=3.275]**

4. J. Bauer, **J.-B. Thomas**, J. Hardeberg, and R. Verdaasdonk. An Evaluation Framework for Spectral Filter Array Cameras to Optimize Skin Diagnosis. *Sensors*, 19(21), 2019. **[JCR-IF=3.275]**

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14. P.-J. Lapray, **J.-B. Thomas**, and P. Gouton. High Dynamic Range Spectral Imaging Pipeline For Multispectral Filter Array Cameras. *Sensors*, 17(6):1281, 2017. **[JCR-IF=3.275]**

15. P.-J. Lapray, **J.-B. Thomas**, P. Gouton, and Y. Ruichek. Energy balance in Spectral Filter Array camera design. *Journal of the European Optical Society-Rapid Publications*, 13(1), jan 2017. **[JCR-IF=1.253]**

16. **J.-B. Thomas**, P.-J. Lapray, P. Gouton, and C. Clerc. Spectral Characterization of a Prototype SFA Camera for Joint Visible and NIR Acquisition. *Sensors*, 16(7):993, 2016. **[JCR-IF=3.275]**

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