



## INTRODUCTION

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In 2011, the leadership teams of TC-10 and TC-11 jointly organized the first Doctoral Consortium in conjunction with ICDAR 2011. Its success motivated repeating the initiative in conjunction with each new edition of ICDAR: ICDAR 2013 (in Washington D.C., USA), ICDAR 2015 (in Nancy, France), ICDAR 2017 (in Kyoto, Japan) and ICDAR 2019 (in Sydney, Australia). The Doctoral Consortium at ICDAR 2021 gives continuity to this tradition, creating a unique opportunity for Ph.D. students to test their research ideas, present their current progress and future plans, and to receive constructive criticism and insights related to their future work and career perspectives. For that, a mentor (a senior researcher who is active in the field) has been assigned to each participant to provide individual feedback on the student's Ph.D. project. In addition, students also have the opportunity to present an overview of their research plan during a special poster session.

The ICDAR 2021 Doctoral Consortium has accepted 16 students, which have been mentored by 16 senior active researchers of all nationalities working in the field of Document Image Analysis and Recognition. During the DC, which is organized this year as an hybrid (remote & onsite) event, students present research proposals through a teaser/poster session, focusing on the outline of the objectives, the methodology, the expected results, the state of the art in their area, and the current stage of their research. During the teaser (introductory) session, each student makes a brief presentation of his/her research to the public, inviting them to attend the poster session in which the students and all interested attendees discuss projects' details. A jury of senior researchers will select best poster presentation, and the award will be announced at the end of the DC event.

## PROGRAM

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- 2:00 – 2:15 pm**    Opening - Introduction to ICDAR Doctoral Consortium 2021  
*Nibal Nayef & J-C Burie*
- 2:15 – 2:45 pm**    Brief presentations (teasers) of the projects by the PhD students
- 2:45 – 3:15 pm**    Talk "How to succeed in your Ph.D. degree"  
**Prof. Daniel Lopresti**, *Lehigh University, Bethlehem, USA*
- 3:15 – 3:30 pm**    Setting-up of posters / beginning of poster session and discussions
- 3:30 – 4:00 pm**    *Coffee Break / Poster session and discussions*
- 4:00 – 5:15 pm**    Poster session and discussions
- 5:15 – 5:30 pm**    Concluding remarks and best poster award  
*Nibal Nayef & J-C Burie*

## OVERVIEW OF CONTRIBUTIONS

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The Ph.D. research plans of the ICDAR-DC attempt to bring innovative solutions for research problems relevant to the community of ICDAR (Document Analysis and Recognition). In this 6th edition of the DC, we had works in popular recurring topics such as: handwritten text recognition (in historical or modern document images), and layout analysis (based on semantic or structural information). Multiple works in natural language processing (NLP) topic have been presented. NLP is traditionally not a typical area of ICDAR but has recently become a topic of interest to the ICDAR community for semantic information extraction from documents. Another interesting topic is text recognition in natural scenes where it is more challenging to recognize the text than in regular document images (legal, historical ...). The trend in all the presented approaches – as it is in other related research communities – is the use of deep learning-based methods. In addition to utilizing such methods, some of Ph.D. works aim to provide theoretical and/or experimental approaches towards understanding the deep neural networks for document analysis applications. Finally, we had a couple of diverse topics related to pattern analysis in general.

The 16 projects of this year may be clustered in the following research areas:

- Recognition of (historical) handwritten documents (4)
- Scene text recognition and its applications (2)
- Layout analysis (3)
- Natural language processing and semantic analysis (4)
- Theoretical deep learning (1)
- Miscellaneous pattern analysis topics (2)

Student	Ph.D. Topic	Country
Raphaela Heil	Computerised Image Processing for Handwritten Text Recognition of Historical Manuscripts	Sweden
Rubèn Pérez Tito	Text based Visual Question Answering	Spain
Christoph Zaugg	Information Theoretical Approach to Understand Deep Neural Networks	Switzerland
Ibrahim Souleiman Mahamoud	Automatic and model-free learning of semantic-structural links of fields in a document	France
Iheb Brini	Towards an Explainable Deep Model for Archival Document Image Segmentation	Tunisia
Tien Nam Nguyen	Segmentation, Recognition and Indexing of characters in CHAM documents	France / Vietnam
Francesco Lombardi	Towards semantic understanding of scientific papers	Italy
Daichi Haraguchi	Font Design Analysis: Understanding Designers' Knowledge by Using Machine Learning	Japan
Sanket Biswas	Structural Analysis and Understanding of Complex Layouts in Document Images	India
Solène Tarride	Automatic recognition of historical handwritten parish records.	France
Sahar Arshad	Automated Summarization of Legal Judgements	Pakistan

<b>Student</b>	<b>Ph.D. Topic</b>	<b>Country</b>
Iqra Basharat	Information Extraction from Legal Documents Based on Natural Language Processing (NLP)	Pakistan
Mengbiao Zhao	Weakly-Supervised Scene Text Detection	China
Thomas Constum	Optical Handwritten Named Entity Recognition	France
Kieu-Diem Ho	Multivalent Graph Matching and Ant Colony Optimization for Pattern Recognition	France / Vietnam
Killian Barrere	Deep Neural Networks and Attention Mechanisms for Handwritten Text Recognition	France

## List of Mentors

The student participants of the DC were mentored by a group of senior researchers who discussed with them their research plans. 21 mentors have thankfully accepted this role. We have assigned a mentor to each student depending on matching areas of research interests. The mentors who were not paired with students (since we had less students than mentors) have contributed to the DC event by serving in the jury committee to select the best poster presentation and/or by discussing with the students during the event to give them more feedback on their research work.

<b>Mentor</b>	<b>Affiliation</b>
Bertrand Couasnon	Irisa / Insa, France
C V Jawahar	CVIT, IIT, Hyderabad, India
Dimosthenis Karatzas	CVC, Universitat Autònoma de Barcelona, Spain
Abdel Belaid	Université de Lorraine – LORIA, France
Faisal Shafait	National University of Sciences and Technology, Pakistan
Cheng-lin Liu	Institute of Automation of Chinese Academy of Sciences, China
Simone Marinai	University of Florence, Italy
Rafael Lins	Federal University of Pernambuco, Brazil
Thierry Paquet	Laboratoire LITIS, Université de Rouen, France
Nicholas Howe	Smith College, USA
Josep Lladós	CVC, Universitat Autònoma de Barcelona, Spain
Seiichi Uchida	Kyushu University, Japan
Angelo Marcelli	DIEM - Università di Salerno, Italy
Ioannis Pratikakis	DUTH, Democritus University of Thrace, Greece
Harold Mouchère	IRCCyN, Université de Nantes, France
Oriol Ramos Terrades	CVC, Universitat Autònoma de Barcelona, Spain
Jean-Yves Ramel	Université François-Rabelais de Tours, France
Elisa Barney-Smith	Boise State University, USA
Nicole Vincent	Université de Paris, France
Richard Zannibi	Rochester Institute of Technology, USA
Shivakumara Palaiahnakote	University of Malaya, Malaysia

## Short bio of the DC Chairs

**Nibal Nayef** is a senior research and development engineer at MyScript, France working in the field of online handwriting recognition, gesture recognition and layout analysis in online handwritten documents. She has previously worked as a post-doc researcher at the L3i Lab at the computer science department, university of La Rochelle, France. She worked there on different research topics: scene text detection, quality assessment & quality enhancement of mobile captured documents, license plate spotting & recognition, logo & information spotting, and analyzing and predicting user behavior in social networks. She received her Ph.D. degree (2012) in computer science from the Technical University of Kaiserslautern, Germany. She was a member of the IUPR (Image Understanding and Pattern Recognition) research group there, where she worked on geometric-based symbol spotting, feature grouping and textureless object recognition. She is an active participant in creating public datasets and competitions. She was the main contributor of the RRC-MLT 2017 and 2019 datasets and the associated ICDAR competitions, she participated in the organization of SmartDoc competition in ICDAR 2015, and she was the main contributor in creating the dataset SmartDoc-QA presented in ICDAR 2015. She is an active reviewer of many conferences and journals in the field of document image analysis and text recognition.

**Jean-Christophe Burie** is full Professor in computer science at La Rochelle University, France. He is currently deputy director of the L3i Lab, Head of the Joint Laboratory SAIL and vice-president of the University of La Rochelle. He is also Chair of the TC10 on Graphic Recognition of IAPR. He received his Ph.D. degree in Automatic Control Engineering and Industrial Data Processing from University of Lille, France, in 1995. He was a research fellow in the Department of Mechanical Engineering for Computer-Controlled Machinery, Osaka University, Japan from 1995 to 1997 in the framework of the Lavoisier Program of the French Foreign Office. He has been involved in the European Project EUREKA- Prometheus and has actively contributed to the ANR projects: Navidomass and Alpage. His research interests include computer vision, image processing, pattern recognition. His research topics concerns Comics analysis and indexing of, characters recognition written on ancient documents. Since 2011, he is co-leader of the e-bdtheque research program dedicated to the indexing of comics' books. He has actively participated, recently, in the organization of SmartDoc competition for ICDAR 2015, AMADI competition for ICFHR 2016 and 2018 and SSGCI competition for ICPR 2016, RRC-MLT at ICDAR 2017 and 2019. He was Co-chair of the Doctoral Consortium in 2019, General Chair of GREC workshop in 2019 and 2021 and General Co-chair of MANPU Workshop in 2016,2017,2019 and 2021.

## **Research plans of the PhD students**