

IAPR

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# Newsletter <sup>1978-2018</sup>

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October 2018

**ICPR** *Special Issue*  
2018 with highlights from the 24th INTERNATIONAL  
CONFERENCE ON PATTERN RECOGNITION



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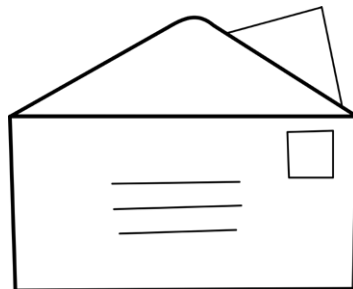
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## Letter from the President



[Apostolos Antonacopoulos](#)

It is certainly very exciting and at the same time humbling to be elected President of the IAPR—the organisation I have considered my scientific home since my PhD days—even after having served it for several years in a variety of [Technical](#) and [Standing](#) Committees and for four terms on the [Executive Committee](#). By the time my involvement in the ExCo ends, I will only have missed serving as Secretary. This has been and continued to be a hugely enjoyable and rewarding experience, one I have been very fortunate to be part of and would very strongly recommend.

### Volunteer your services

The IAPR needs you. If you are not already active in the IAPR, consider being part of this world-wide community. You will meet and work with other dedicated and enthusiastic volunteers who share

similar interests and value your contributions.

Join a Technical Committee in your field of interest and become actively involved in making it your main hub and reference for scientific discussions and events.

Become involved in organising workshops, conferences, summer schools and competitions.

Contribute research datasets and code. The more we all put into it, the more benefit everyone gets out of the IAPR.

### Shape the IAPR

The IAPR is unique in its variety and inclusivity both in terms of scientific topics and geographical reach. Encourage friends and colleagues to join a national society and automatically become members of the IAPR. We are

*continued on [next page](#)*

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keen to hear your ideas on how the IAPR can best serve you, your scientific area and your national society.

### **Start a Technical Committee**

Take some time and explore the topics of our existing [Technical Committees \(TCs\)](#). You will find a wealth of mainstream and niche areas where like-minded researchers congregate.

If you find that your particular interests are not reflected in any of the existing TCs, get together with other people sharing similar interests and propose starting a new TC. As an example, a new TC has just been approved on Computer Vision for Underwater Environmental Monitoring (see [article in this issue](#)). We are particularly keen on hearing from researchers in health care analytics and other data analytics applications in business/finance.

### **Participate in the ICPR**

Spread the word about ICPR—the IAPR's flagship conference—and participate in it and its associated workshops to contribute to and benefit from quality research exchanges in a wide range of theory and application domains.

With its broader scope, the IAPR's International Conference on Pattern Recognition, ICPR, offers many opportunities for cross-fertilisation among research areas.

And, of course, it is where most of the IAPR's face-to-face business is conducted, where representatives from the 50 national member societies meet and key decisions are made.

## **World Map with IAPR National Member Societies**

### **Plans for 2018-2020**

Thanks to the very good work of our predecessors and the inspiring leadership of the past Presidents, the new ExCo receives a strong IAPR with good growth, better internal procedures, and a stable financial situation that enables the continuation of its community work. For the next two years, in addition to working on existing initiatives, the new ExCo will focus on expanding and energising our portfolio of Technical Committees, on strengthening links with industry, and on making the ICPR an even more compelling focal event for our community.

I am genuinely looking forward to working with excellent colleagues who bring a wealth of experience and enthusiasm to the ExCo: Alexandra Branzan-Albu as 1st Vice President, Lale Akarun as 2nd Vice President, Arjan Kuijper as Secretary, and Dan Lopresti as Treasurer, while I am particularly grateful that Simone Marinai will continue serving on the ExCo, sharing his invaluable experience as Past President.

The ExCo will miss the wise and influential presence of Ingela Nyström, who as the previous Past President “retires” from the ExCo after 10 years of service. Her contributions will most surely continue in significant

ways. Similarly, the ExCo needs the support and continued involvement in IAPR organization and management of all the other exceptional colleagues who were on the previous ExCo or were proposed for ExCo positions by the Nominating Committee. And it goes without saying that, while ExCos come and go, there is one person who “holds the fort” with tireless enthusiasm, professionalism and deep care about the IAPR—our Secretariat, Linda O’Gorman. It is a privilege to work with her and with our Technical Officer/Webmaster, Ed Sobczak, who maintains our digital presence with unwavering dedication and incomparable technical prowess.

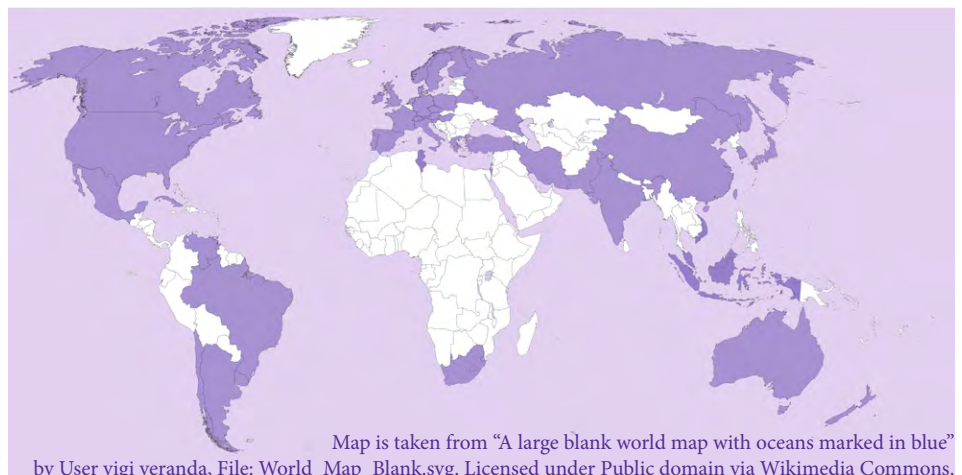
Concluding, we eagerly expect to receive your thoughts and suggestions—please email either the IAPR Secretariat ([secretariat@iapr.org](mailto:secretariat@iapr.org)), who will direct messages to most appropriate person, or myself ([A.Antonacopoulos@primaresearch.org](mailto:A.Antonacopoulos@primaresearch.org)).

On behalf of the ExCo, I wish you a successful and productive biennium, and I look forward to seeing you at ICPR 2020 in Milan!

Sincerely,



IAPR President, 2018-20





# CALLS for PAPERS

For the most up-to-date information on IAPR-supported conferences, workshops and summer schools,  
please visit the IAPR web site: [www.iapr.org/conferences/](http://www.iapr.org/conferences/)

## 2019

### [MVA 2019](#)

16th International Conf on Machine Vision Applications  
Tokyo, Japan  
Deadline: Dec. 7, 2018  
Dates: May 27-31, 2019

### [IWBF 2019](#)

7th International Workshop on Biometrics and Forensics  
Cancun, Mexico  
Deadline: Dec. 10, 2018  
Dates: May 2-3, 2019

### [GbR 2019](#)

12th Intl. Workshop on Graph-based Representations  
Tours, France  
Deadline: Dec. 12, 2018  
Dates: Jun. 19-21, 2019

### [ICB 2019](#)

12th IAPR International Conference on Biometrics  
Crete, Greece  
Deadline: Dec. 15, 2018  
Dates: Jun. 2-5, 2019

### [PRIP 2019](#)

14th International Conference on  
Pattern Recognition and Information Processing  
Minsk, Belarus  
Deadline: Feb. 1, 2019  
Dates: May 21-23, 2019

### [SCIA 2019](#)

2019 Scandinavian Conference on Image Analysis  
Norrköping, Sweden  
Deadline: Jan. 30, 2019  
Dates: Jun. 11-13, 2019

### [IbPRIA 2019](#)

9th Iberian Conference on  
Pattern Recognition and Image Analysis  
Madrid, Spain  
Deadline: Mar. 1, 2019  
Dates: Jul. 1-4, 2019

### [CAIP 2019](#)

18th International Conference on  
Computer Analysis of Images and Patterns  
Salerno, Italy  
Deadline: Apr. 1, 2019  
Dates: Sep. 3-5, 2019

### [MedPRAI 2019](#)

3rd Mediterranean Conference on  
Pattern Recognition and Artificial Intelligence  
Istanbul, Turkey  
Deadline: Jun. 14, 2019  
Dates: Dec. 22-24, 2019

## 2020

### [ICFHR 2020](#)

17th International Conference on  
Frontiers in Handwriting Recognition  
Dortmund, Germany  
Deadline: TBD  
Dates: Aug. 31 - Sep. 4, 2020

### [ICPR 2020](#)

25th International Conference on  
Pattern Recognition  
Milan, Italy  
Deadline: TBD  
Dates: Sep. 13-18, 2020

# Calls from IAPR Committees

From the IAPR Education Committee:

## Call for Applications for IAPR Research Scholarships

<http://www.iapr.org/docs/IAPR-EC-RS-Call-2018.pdf>

**Description:** IAPR Research Scholarships, awarded by the IAPR through its Education Committee (IAPR-EC), seek to make possible mobility across institutions and international boundaries for Early Career Researchers working in fields within the scope of the IAPR's interests. Through this program, the IAPR sees an opportunity to make a significant contribution to the development of Early Career Researchers as well as the wider Pattern Recognition community.

**Covered expenses and duration:** The scholarship covers round trip travel & basic living expenses for a visit of less than 12 months.

**Requirements:** The candidate must be a full-time researcher with between one and eight years experience. The candidate must also be a member of an IAPR member society. See [Call for Applications](#) for a full list of requirements.

### Contact information:

c/o Linda O'Gorman, [secretariat@iapr.org](mailto:secretariat@iapr.org)

From the IAPR Industrial Liaison Committee:

## Call for Internship Listings for the IAPR Internship Brokerage Page

for Companies with internships available  
for Students seeking internship opportunities

<http://homepages.inf.ed.ac.uk/rbf/IAPR/INDUSTRIAL/>

**Description:** The IAPR-ILC wishes to promote opportunities for students to undertake internships at companies working in Pattern Recognition, AI, Computer Vision, Data Mining, Machine Learning, etc. We propose to do this by having a web-based internship listing service. Companies can list their internship opportunities; students can browse the listings and contact the company.

### For companies with internships to list: For students:

(see examples at the URL above)

If you are a student, please visit the web site given above.

Please email your listings as follows:

To: Bob Fisher - [rbf@inf.ed.ac.uk](mailto:rbf@inf.ed.ac.uk)

Subject: IAPR internship listing

Details:

- Host:
- Location:
- Post Type:
- Specialty:
- Funded:
- Length:
- Degree & Visa Requirements:
- Internship start date:
- Application closing date:
- Details:
- Contact:

**NOTE:** At the time of publication, there were 22 opportunities listed and more than 5548 views.

### Contact Information:

Bob Fisher, [rbf@inf.ed.ac.uk](mailto:rbf@inf.ed.ac.uk)  
Chair, IAPR-ILC

From the IAPR  
Executive Committee (ExCo):

## Call for Proposals for "Summer" Schools

**Deadline: February 1, 2019**  
(for schools planned for  
April 2019 - July 2019)

"Summer" schools are training activities that expose participants to the latest trends and techniques in the particular pattern recognition field. ("Summer" is used generically; the school can take place in any season.)

To be eligible for a grant, the organizers must work through at least one of the IAPR's technical committees as they develop and present the proposal.

**How to Submit:** Proposals for IAPR funded summer schools should be submitted to IAPR Secretariat Linda O'Gorman by email ([secretariat@iapr.org](mailto:secretariat@iapr.org)). A PDF attachment containing all the required information is appreciated.

For detailed guidelines on the proposal, see the **ExCo Initiative on Summer Schools**, <http://www.iapr.org/committees/SummerSchool-2018.pdf>.



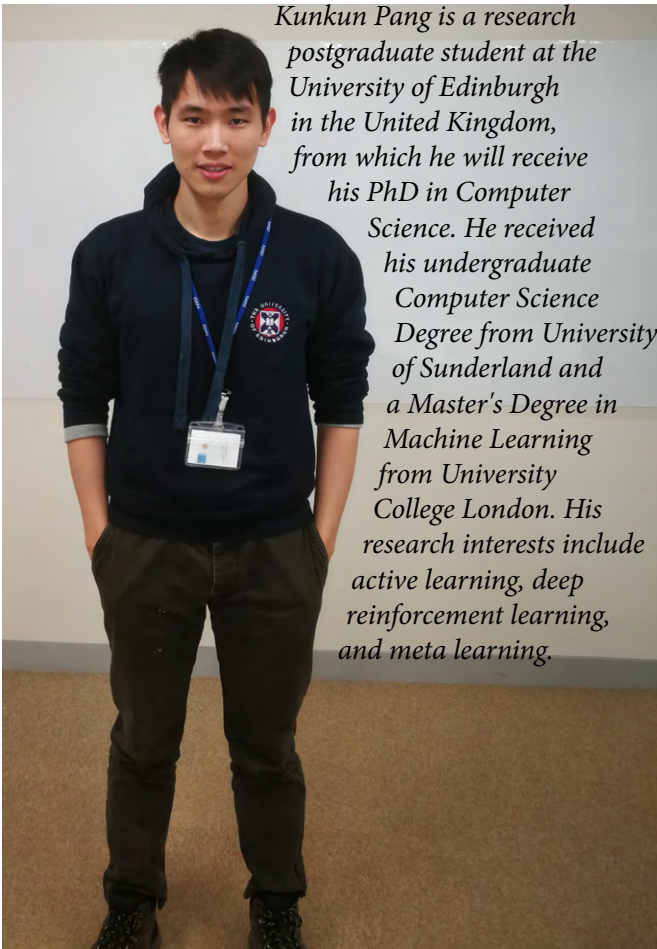
# IAPR...The Next Generation

*In this series of Feature Articles, the IAPR Newsletter asks young researchers to respond to three questions:*

- *Briefly: How did you get involved in pattern recognition?*
- *In more detail: What technical work have you done and what is/are your current research interest(s)?*
- *How can the IAPR help young researchers?*

*~Arjan Kuijper, Editor -in-Chief*

## Kunkun Pang



*Kunkun Pang is a research postgraduate student at the University of Edinburgh in the United Kingdom, from which he will receive his PhD in Computer Science. He received his undergraduate Computer Science Degree from University of Sunderland and a Master's Degree in Machine Learning from University College London. His research interests include active learning, deep reinforcement learning, and meta learning.*

by Kunkun Pang, School of Informatics, University of Edinburgh, Scotland, UK

### ***Briefly: How did you get involved in pattern recognition?***

In the final year of the undergraduate program at University of Sunderland, students are encouraged to learn about different research areas through coursework; among the choices was pattern recognition. During the period of studying the coursework and my final year project, I found that my interests are in analyzing the problems in pattern recognition and developing new solutions, which greatly affected the choice of my master's degree and doctoral research direction.

The major of my Master's degree at University College London (UCL) was machine learning, and most of the course content was related to pattern recognition. In this period, we studied various algorithms for machine learning, and implemented the algorithms to verify our understanding. This course content greatly enriched my theoretical understanding of machine learning and pattern recognition. What's more, this learning process provided a concrete foundation for my subsequent PhD study.

### ***In more detail: What technical work have you done and what is/are your current research interest(s)?***

There were two memorable projects during my Master's degree at UCL. One project was in an 'applied machine learning' course. This course required student to participate a Kaggle competition. Our group participated the competition to tackle the multiclass classification problem on images in the CIFAR-100

#### *Editor's note:*

*Kunkun Pang was the winner of the [Piero Zamperoni Best Student Paper Award](#) at ICPR 2018.*

*The conference is the subject of this ICPR 2018 Special Issue of the IAPR Newsletter.*

*~ Arjan Kuijper, Editor-in-Chief*

dataset (see <https://www.kaggle.com/c/ml2016-7-cifar-100>). The task of multiclass classification problem is classifying which image into one class among three or more classes. We decided to apply deep learning, which can bring the largest performance boost over the conventional machine learning method, and had the best results in the course.

Another memorable project was my master's final project 'Active Image Retrieval', which was assigned by Professor John Shawe-Taylor. The aim of this project was to reduce the human effort in ranking and scoring an image. The images with higher scores were supposed to be the more interesting images for the user. We expected our algorithm to be able to substitute most of the human labour for filtering those non-interesting images and have a correct ranking score for the interesting images. Our proposed method used a one-class support vector machine to rank the data and we trained this model with an extremely small number of annotations. These experiences brought us a better understanding of the connection between theoretical application and practice.

After my master's final project, I realized that the key barrier to scaling or applying supervised learning in practice is often the cost of obtaining sufficient annotation. During the study of my PhD degree, my research interest is active learning to make the current supervised learning method more economical and practical to both industry and academia.

The problem of active learning is that data acquisition is cheap but the annotation is more expensive in supervised learning tasks. Active learning aims to address this by designing query algorithms

that effectively predict which data would be useful to annotate, thus enabling efficient allocation of human annotation effort.

One of the current tendencies of active learning is that there is no best active learning algorithm. Inspired by various philosophies about what constitutes a good criterion, different algorithms perform well on different datasets. This has motivated research into ensembles of active learners that learn what constitutes a good criterion in a given scenario, typically via multi-armed bandit algorithms. One of my recent works under the supervision of Dr. Timothy Hospedales is that we developed dynamic ensemble selecting of the right criteria at each step of active learning, which makes our research more practical.

### ***How can the IAPR help young researchers?***

I think the core strengths of young researchers are the ability to discover new research problems, the ability to think up a new method, and the ability to look at research from a broader perspective.

The abilities to discover new research questions and to develop a new methods need to be continuously improved through reading and communication. This aspect can be further inspired by senior researchers. By studying and discussing issues with people in different fields, young researchers can broaden their own horizons. IAPR is a well-known international pattern recognition association, which provides young researcher with more opportunities and platforms. With more and more success of IAPR Newsletters, events, and workshops and conferences, senior researchers can lead the trend of pattern recognition, and young researchers can get more inspiration from them.

In addition, contact with different research areas will also help the young researcher to have a different view of their own problem and have different angle to take one step further and improve.

Learning and inspiration from senior researchers can be very helpful to guide young researchers towards successful careers.





# BENCHMARK DATASETS

Editor's note: Do you have benchmarking news to share?

Send the link.

Describe the contents.

Include a contact person.

We'll feature your dataset in this series.

~ Arjan Kuijper, IAPR Newsletter EiC, [arjan.kuijper@igd.fraunhofer.de](mailto:arjan.kuijper@igd.fraunhofer.de)



## Edinburgh Ceilidh Overhead Video Data

<http://homepages.inf.ed.ac.uk/rbf/CEILIDHDATA/>

Contact: [Bob Fisher](mailto:Bob.Fisher@inf.ed.ac.uk) at [rbf@inf.ed.ac.uk](mailto:rbf@inf.ed.ac.uk)

This small dataset contains video data and ground truth for 16 dances with two different dance patterns. The style of dancing is inspired by Scottish Ceilidh dancing, but the dances shown here are original patterns.

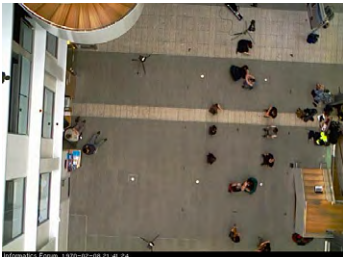
This dataset is interesting because there are very few video analysis datasets where there is highly structured behavior. In this case, the basic moves of all of the dancers are prescribed; however, the timing

and positioning can vary by dancer, time and instance of the dance.

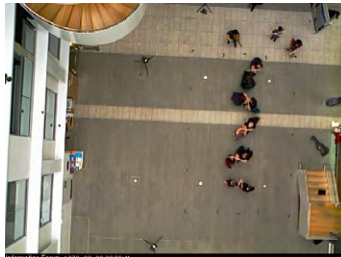
The two dances can be described by a state model, and we have ground-truthed the position of each dancer and their state in each video frame.

The data is acquired using a ceiling camera as a set of 640x480 frames captured at about an average of 8 FPS, for a total of about 5000 frames, with 10 dancers (and some other people as well).

*Typical frames from the two dances are shown here, along with an annotation of the dancers and a 'background' frame where no dancers are in the performance area.*



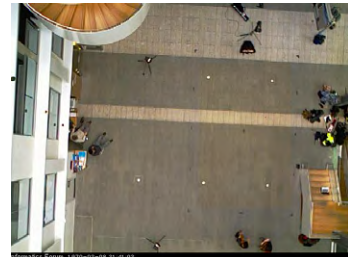
Frame from first dance style



Frame from second dance style



Identified dancers in ground truth



Background frame with no dancers

### Publish an Imaging Dataset or Software?

The CVonline resource (<http://homepages.inf.ed.ac.uk/rbf/CVonline>) includes an extensive list of datasets (over 1100 in 25 categories) and software packages (over 200 in 16 categories) that are of interest to the image processing and computer vision communities. These can be seen at:

<http://homepages.inf.ed.ac.uk/rbf/CVonline/Imagedbase.htm>

<http://homepages.inf.ed.ac.uk/rbf/CVonline/SWEnvironments.htm>

### Why contribute a Dataset or Software?

1. Most items have an associated paper, and you can get more citations.
2. People comparing results on the same dataset advances computer vision methods.
3. People can advance their research faster using these tools.

If you want to contribute a dataset or a package, contact Bob Fisher ([rbf@inf.ed.ac.uk](mailto:rbf@inf.ed.ac.uk)) with the:

- URL
- credits
- summary
- object title
- category





# INSIDE the IAPR

## The IAPR Welcomes the Indonesian Association for Pattern Recognition (INAPR)

by Anto Satriyo Nugroho, INAPR President

**The 1st International Conference of INAPR (September 7, 2018)**



Indonesian Association for Pattern Recognition (INAPR) was created in October 5, 2017, with the help of the French Embassy in Indonesia (Prof. Nicolas Gascoin) and the IAPR membership committee (Prof. Luc Brun and Prof. Jean Marc Ogier).

The objectives of INAPR are to support the activity of pattern recognition research in Indonesia and to provide a forum for individual researchers in pattern recognition, machine learning, data mining, image and video processing, computer vision, natural language processing, speech recognition and big data.

INAPR currently has more than 300 members from academics, business and governmental research institutions, from the western side of Indonesia (Aceh)

to its eastern side (Papua).

INAPR applied as a formal member of the International Association of Pattern Recognition (IAPR) in January 2018 and was accepted by the Governing Board on August 23rd during its meeting at the 24th International Conference on Pattern Recognition (ICPR), Beijing, China.

The first academic activity of INAPR was conducting an international conference on September 7, 2018, at Bina Nusantara University, Alam Sutera Campus, Tangerang, Banten, Indonesia. The keynote speakers of this conference were Prof. Pitoyo Hartono (Chukyo University, Japan), Prof. Antoine Doucet (Université de La Rochelle, French), and Dr. Setiawan Hadi, M.Sc.CS. (Universitas Padjadjaran,

Indonesia). Many papers were submitted, and after careful evaluation by the reviewers, only 64 papers were accepted for publication.

In this event, the researchers presented their papers and discussed the results with and received comments and ideas from the others. This conference served as the best place to discuss the advances of pattern recognition, and to build collaboration among all members.

With the success of the 1st conference, INAPR, the second conference of INAPR will be conducted in Bali, on 25-26 March 2019.

Information on the society can be seen from <http://inapr.org>.



# IAPR Technical Committee News

*For this ICPR 2018 Special issue of the IAPR Newsletter the TC News section will focus on the new TC that was approved at the 2018 full meeting of the IAPR Governing Board that took place at ICPR 2018 in Beijing, China.*

*~Arjan Kuijper, IAPR Newsletter EiC*

## IAPR TC5 Computer Vision for Underwater Environmental Monitoring ([website under construction](#)) Chair to be appointed soon

### **Motivation and Goals:**

IAPR TC5 focuses on the development of computer vision techniques for applications in environmental underwater monitoring. Environmental monitoring encompasses a wide range of activities, such as habitat mapping, species identification, estimation of species diversity and abundance, as well as analysis of animal behaviour in response to environmental stressors, conditions, and events.

Monitoring marine and freshwater ecosystems is of critical importance in developing a better understanding of their complexity, including the effects of climate change and other anthropogenic influences. The collection of underwater video and imagery, whether from stationary or moving platforms, provides a non-invasive means of observing submarine ecosystems in situ, including the behaviour of organisms. Oceanographic data acquisition has been greatly facilitated by the establishment of cabled ocean observatories, whose co-located sensors support interdisciplinary studies and real-time observations. Scheduled recordings of underwater video data and static images are gathered with Internet-connected fixed and PTZ cameras, which observe a variety of biological processes. These cabled ocean observatories offer a 24/7 presence, resulting in unprecedented volumes of visual data and a “big data” problem for automated analysis. Due to the properties of the environment itself, the analysis of underwater imagery imposes unique challenges which need to be tackled by the computer vision community in collaboration with biologists and ocean scientists.

An international, interdisciplinary community consisting of computer vision scientists, data scientists, marine biologists and oceanographers has been coalesced via the three successive CVAUI (Computer Vision for Analysis of Underwater Imagery) workshops (co-organized by A.Branzan Albu and M. Hoeberechts), held in conjunction with ICPR 2014 (Stockholm), ICPR 2016 (Cancun), and ICPR 2018 (Beijing).

### **Research Topics in focus of the TC (non-exhaustive list):**

- underwater image enhancement
- physical models of reflectance and light transport
- underwater scene understanding
- classification, detection, segmentation of underwater stationary and moving objects
- autonomous underwater navigation
- detection and monitoring of marine and freshwater life
- detection of invasive species in marine and freshwater environments
- automatic assessment of biodiversity and species abundance from visual data
- tracking of underwater moving objects
- automatic video annotation and summarization
- context-aware machine learning and image understanding
- fusion of optical imaging and passive acoustics

### **Contact:**

Maia Hoeberechts, Ocean Networks Canada, University of Victoria, British Columbia, Canada  
[maiah@uvic.ca](mailto:maiah@uvic.ca)

### Comments from the General Chair

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### [2018 Meeting of the IAPR Governing Board](#)



## Comments from the ICPR 2018 General Chair

It is truly a great pleasure and honor for us to have hosted ICPR2018 in Beijing. It was the very first time that ICPR has ever been held in mainland China. The air quality was good during the conference which was a major concern four years ago when we presented to the IAPR Governing Board the bid for hosting ICPR2018 in Beijing. I am sure the next time ICPR returns to Beijing (hopefully), the air quality will be even better!

We received a total of 1,258 submissions from across the globe. The papers were assigned to area chairs who invited reviewers and made acceptance recommendations based on the reviews. Based on the final decisions made by the track chairs, 125 oral papers and 527 poster papers were accepted for presentation in six tracks. The technical program also included six invited keynotes given by well-known scientists Long Quan, Jianchang Mao, K. Venkatesh Prasad, Ashok Popat, Zhi-Hua Zhou and Alison Noble, and three IAPR Prize lectures for the King Sun Fu Prize (Matti Pietikäinen), J.K. Aggarwal Prize (Kristen Grauman) and Maria Petrou Prize (Rita Cucchiara). The conference was attended by about 1000 people from 40 countries.

Organizing events of such a scale involves huge efforts. The conference would not have been such a success without the contributions of many people. The Program Committee chaired by Professors Cheng-Lin Liu, Rama Chellappa and Matti Pietikäinen together with the local arrangements team led by Professor Liang Wang made great efforts towards the high quality of the technical program and the social events. The advice from the other two General Co-Chairs Professors Anil Jain and Josef Kittler was most valuable. The 24 track chairs, 161 area chairs and some 2700 reviewers tirelessly helped us in evaluating the submissions. The contributions of the various working committees (finance, workshops, tutorials, contests, publicity, publication and sponsorship) were outstanding, and the support from the industrial sponsors clearly made a difference. We would like to thank them all. Last but not least, the advice and guidance from the IAPR ExCo were most appreciated.

[Tieniu Tan](#)

General Chair, ICPR 2018

Institute of Automation, Chinese Academy of Sciences, Beijing



## Winner of the 2018 K. S. Fu Prize

[Matti Pietikäinen](#)

University of Oulu, Finland

*For fundamental contributions to texture analysis and facial image analysis*

### Face Analysis for Emotion AI

Summary of King-Sun Fu Prize Speech at ICPR 2018, Beijing, China, August 21, 2018

Emotions are central for human intelligence, and should have a similar role in artificial intelligence. Many companies are now making major investments on affective computing / emotion AI, with huge expectations for coming years. There is a growing need to develop emotionally intelligent systems, which are able to read the emotions of people and adapt their operations accordingly. Among the areas of application are emotional chatbots and personal assistants, human-robot interaction, emotion-aware games, health and medicine, on-line learning, safe car driving, security, and user / customer experience analysis. Research on emotion AI is, however, still in its infancy.

Facial image analysis will play a key role in developing emotion AI. This talk provides an introduction to our research on face analysis for emotion AI. First, an introduction to emotions and faces is presented. Then our research on image and video descriptors with local binary patterns (LBP) and a comparison of LBP and convolutional neural network (CNN) based texture descriptors is briefly reviewed, and future challenges are outlined. Approaches combining strengths of LBP and CNN type descriptors are needed. Then, methods for facial expression recognition and some of its challenges are presented. An application to pain estimation from facial expressions is also introduced. Recognition of spontaneous micro-expressions for reading hidden emotions in faces is then presented. Our pioneering methods for micro-expression recognition and spotting are introduced. Heart-rate measurement from subtle color changes in face videos is then considered, with applications in anti-spoofing for face mask attacks and atrial fibrillation detection for remote health diagnostics. Our past work on visual speech recognition from mouth movements is also briefly discussed.

Multimodal data would be needed for many applications of emotion AI, including facial expressions, head, body and eye movements, speech, and physiological signals. Results of our research in combining face, upper body and scene information for group-level emotion analysis, and emotion analysis from facial expressions and EEG are briefly presented.



Finally, some future challenges are outlined and a summary is presented. Multimodal analysis of spontaneous emotions in real-world conditions is a major challenge. Many factors have influence on the perceived emotions. Among these, the context (for example what a person is doing and where) should be given much more attention. Due to very high data variability, huge amounts of annotated data would be needed for learning to model and analyze natural expressions. Therefore, like in most machine vision applications, it would be preferable to focus on dedicated applications instead of trying to find too generic solutions.

*Editor's note: Please also see the University of Oulu announcement <http://www.oulu.fi/university/node/53930> about this high honor.*

*~Arjan Kuijper, IAPR Newsletter EiC*





## Winner of the 2018 J. K. Aggarwal Prize

**Kristen Grauman**

University of Texas at Austin, USA

<http://www.cs.utexas.edu/~grauman/>

*For contributions to image matching and retrieval*

### See, Hear, Move: Towards Embodied Visual Perception

#### ABSTRACT

Computer vision has seen major success in learning to recognize objects from massive “disembodied” web photo collections labeled by human annotators. Yet cognitive science tells us that perception develops in the context of acting and moving in the world—and without intensive supervision. Meanwhile, many realistic vision tasks require not only categorizing a well-composed human-taken photo, but also intelligently deciding where to look in the first place. In the context of these challenges, we are exploring ways to learn visual representations from unlabeled video accompanied by multi-modal sensory data like egomotion and sound. Moving from passively captured video to agents that control their own first-person cameras, we investigate how agents can learn to move intelligently to acquire visual observations. We present reinforcement learning approaches for active and exploratory look-around behavior, which show promising results for transferring policies to novel perception tasks and unseen environments.

#### BIO

Kristen Grauman is a Professor in the Department of Computer Science at the University of Texas at Austin and a Research Scientist at Facebook AI Research. Her research in computer vision and machine learning focuses on visual recognition and search. Before joining UT Austin in 2007, she received her Ph.D. at MIT in computer science. She is a Sloan Fellow, a recipient of NSF CAREER and ONR Young Investigator awards, the 2013 PAMI Young Researcher Award, the 2013 IJCAI Computers and Thought Award, a Presidential Early Career Award for Scientists and Engineers (PECASE), a 2017 Helmholtz Prize computer vision “test of time” award, and the 2018 J.K. Aggarwal Prize from the International Association for Pattern Recognition. She and her collaborators were recognized with the CVPR Best Student Paper Award in 2008 for their work on hashing algorithms for large-scale image retrieval, the Marr Prize at ICCV in 2011 for their work on modeling relative visual attributes, and the ACCV Best Application Paper Award in 2016 for their work on automatic cinematography for 360 degree video. Grauman has given recent conference keynotes at AAAI 2017, MICCAI 2018, and ICLR 2018. She previously served as Program Chair of the Conference on Computer Vision and Pattern Recognition (CVPR) in 2015 and currently serves as Associate Editor-in-Chief for the journal Pattern Analysis and Machine Intelligence (PAMI) and as a Program Chair of Neural Information Processing Systems (NIPS) 2018.





## Winner of the 2018 Maria Petrou Prize

[Rita Cucchiara](#)

University of Modena and Reggio Emilia, Italy

*For pioneering contributions to tracking and reidentification  
and as a role model for early career researchers*

### **The space, the time and the people: A journey in Re-id, Tracking and detection**

Summary of Maria Petrou Prize Lecture at ICPR 2018, Beijing, China, August 22, 2018

(Slides are available at [http://imagelab.ing.unimore.it/imagelab/uploadedFiles/Rita\\_icpr2018\\_prize\\_45min.pdf](http://imagelab.ing.unimore.it/imagelab/uploadedFiles/Rita_icpr2018_prize_45min.pdf).)

Human behaviour understanding is a never-ending hot topic in Computer Vision and Pattern Recognition, starting from the extraction of visual features to the typical tasks of detection, tracking and understanding (classification, recognition, (re-) identification, prediction), and up to the applications. They are strictly interconnected but are not necessarily addressed in a pipeline; according with human cognitive systems, the “Way of What”, i.e. semantic segmentation, detection and recognition goes often in parallel with the “Way of Where”, i.e. the spatio-temporal identification and tracking. Both tasks concur to have a consciousness of what and where the targets are and cooperate to extract useful visual information for higher level processes.

Accordingly, the talk at the Maria Petrou Keynote, ICPR 2018, presented a journey on what has been done in the recent past, starting from the end, namely applications, to processes like re-identification, and tracking and detection. Applications such as video-surveillance, automotive, egocentric wearable systems, logistics in industry 4.0, sport and retail need vision for human analysis and now can adopt our pattern recognition results in true working systems. I presented some past milestones and some new results in the deep learning era along with what we are developing at Aimagelab, UNIMORE Italy.

Indeed, the approaches have not dramatically changed in the last twenty year, but only evolved: instead of hand-crafted features, convolutive neural features are now adopted; instead of selection of parameters, thresholds or multi-classifier models, we ask neural architectures to elicit them from us. They achieve disruptive results thanks to the data and the computational power availability. What is changed is that the annotated data creation has become itself a scientific result: AlmageLab datasets such as 3DPES 2014 for Re-id, DUKEMCMT 2017 for tracking, Dr(EYE)ve 2017 for attention in driving and JDTA 2018 for people detection by pose are some examples of semi-supervised annotated datasets which are largely exploited in our community. As well, what is changed, and is changing now, is that the tasks are difficult to be approached as separated black boxes. The rising of end-to-end networks—e.g. Dr(eye)ve for driving attention simulation—is becoming a winner model. Data can be also automatically created by simulation. The last result with the UNIMORE THOPAnet for detection and tracking people in crowd, exploits a half-million frames and more than 9 millions examples of visible and occluded body joints, generated from the GTA Video-game in the J-GTA dataset. In this approach, all the pattern recognition tradition can finds its role: joints are detected by neural classifiers and body parts are detected and tracked by graph-based approaches linking the joints in space and time. Future science always goes beyond the past, but drawing lessons from the past, uniting it with the technological opportunities of the present.



## ICPR 2018 Keynote Speakers and Talk Abstracts



**Long QUAN**  
Hong Kong  
University of  
Science and  
Technology,  
China

### The Challenges of 3D Reconstruction with Deep Learning

<http://www.icpr2018.org/index.php?m=content&c=index&a=show&catid=20&id=57>

In this talk, I will review the developments in computer vision and visual learning over the past. Then, I will turn the focus on recent exciting work in deep visual learning and 3D reconstruction breakthrough in computer vision. Here, I showcase the reconstruction approaches in large-scale of hundreds of square kilometers high-rise metropolitan areas and undeveloped rural areas from drones, and in small-scale daily objects from smartphones. I also demonstrate the online cloud platform and portal [www.altizure.com](http://www.altizure.com) with its crowd-sourced Altizure Earth, developed and funded by the HKUST team, **rivaling the popular Google Earth!**



**K. Venkatesh Prasad**  
Ford Motor  
Comany, USA

### Automobiles and Mobility Solutions

<http://www.icpr2018.org/index.php?m=content&c=index&a=show&catid=20&id=58>

As human intelligence, imagination & ingenuity continue to create advancements in machine-intelligence, we have new ways to serve the mobility needs of our planet. With a world population of about 7.6 billion and immense human and machine intelligence at our disposal, we have the opportunity to create novel experiences and related services associated with traveling from “A” to “B.” Thanks in no small part to advancements in pattern recognition, computer vision and image processing, automobiles are getting “smart” and growing more aware of their surroundings. The world is also getting “smart.” In this talk, we outline some key applications areas of machine intelligence to applications, in the context of addressing human mobility needs.



**Jianchang Mao**  
Microsoft, USA

### Achieving Human Parity Performance in Pattern Recognition and Language Understanding by Machines

<http://www.icpr2018.org/index.php?m=content&c=index&a=show&catid=20&id=35>

For more than a half century, computer scientists have been attempting to train computer systems to perform human perception and cognition tasks, such as, recognize image and speech, comprehend text, translate languages, etc. But until recently those systems were plagued with stagnated accuracies that were far below human performance. In recent years, with the breakthroughs in Deep Learning, advances in the state-of-the-art performance of those systems have gained a strong momentum, thanks to the rapid increase in computing power, big data, and advances in machine learning algorithms. Today, AI breakthroughs are coming at an accelerated pace. The performance of computer systems on several perception and cognition tasks has reached human parity. For example, in 2015 Microsoft researchers achieved 96% accuracy in the ImageNet Computer Vision Challenge, which is as good as a Stanford graduate student. Less than a year later, Microsoft's speech recognition system achieved 5.1% error rate on the Switchboard dataset, which is at parity with professionals who do transcription! In January 2018, Microsoft was the first to achieve human parity in text comprehension tasks on the Stanford Question Answering Dataset. And two months later, Microsoft announced that it reached human parity in English-to-Chinese and Chinese-to-English machine translation on the news dataset. In this talk, I will briefly describe our journey to achieving human parity on these tasks and the technologies that enabled the breakthroughs. I will also present other applications of Deep Learning, such as OCR in unconstrained environments and Advertising.



# ICPR 2018 Keynote Speakers and Talk Abstracts (continued)



**Ashok Popat**  
Google, Inc.,  
USA

## Advice to a Promising OCR Researcher

<http://www.icpr2018.org/index.php?m=content&c=index&a=show&catid=20&id=36>

Document Analysis and Recognition remains a vibrant and challenging field, spanning and touching several domains, including pattern recognition, computer vision, linguistics, digital humanities, and augmented reality. Probably most of the best work in this field remains to be done. That work will build on what came before -- in terms of techniques and understanding already achieved, but also by learning from the best practices of our colleagues and predecessors. As an OCR researcher, in this talk I'll try to reflect on some of the advice I've received from mentors, colleagues, and others in various places, including MIT, Xerox PARC, and Google. I'll present the ideas in the context of developing an Optical Character Recognition system at Google.



**Zhi-Hua  
Zhou**  
Nanjing  
University,  
China

## An Exploration to Non-NN Style Deep Learning

<http://www.icpr2018.org/index.php?m=content&c=index&a=show&catid=20&id=33>

Deep learning is a hot topic during the past few years. Generally, the word "deep learning" is regarded as a synonym of "deep neural networks (DNNs)". In this talk, we will discuss on essentials in deep learning and claim that it is not necessarily to be realized by neural networks. We will then present an exploration to non-NN style deep learning, where the building blocks are non-differentiable modules and the training process does not rely on backpropagation.



**Alison Noble**  
University of  
Oxford, UK

## Human Intelligence, Artificial Intelligence and How They Are Changing Ultrasound Image Analysis

<http://www.icpr2018.org/index.php?m=content&c=index&a=show&catid=20&id=35>

Ultrasound imaging is widely used in clinical practice but requires expertise to acquire images and interpret them. Recent advances in machine learning applied to imaging are changing the way we can analyse ultrasound images and extract clinically useful information from ultrasound images and video. Ultrasound images are, after all, "just" spatial maps of acoustic patterns so we would hope that the pattern-recognition power of machine learning would be well-suited for their analysis. In this talk I will describe some recent work of my group on machine learning applied to ultrasound image analysis, some of the interesting challenges specific to this application domain, and highlight some emerging topics of research interest.

## ICPR 2018 Workshops

[Comments from the General Chair](#)

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[Workshop Reports:](#)

[CCPR: Correspondence Problem in CV and PR](#)

[CVAUI: CV for Underwater Imagery](#)

[DLPR: Deep Learning for PR and FFER: Face and Facial Expression Recognition from Real World Video](#)

[IWCF: Computational Forensics](#)

[PRIFR: PR in Financial Analysis and Risk Management](#)

[RRPR: Reproducible Research in PR](#)

[VIAB: Vertebrate and Insect Behavior](#)

[MPRSS: Multimodal PR of Social Signals in Human Computer Interaction](#)

[DL DAR: Deep Learning for Document Analysis and Recognition](#)

[MIPPSNA: Multimedia Information Processing for Personality and Social Networks Analysis](#)

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### Workshop Organizers:

Junchi Yan, Shanghai Jiao Tong University, China

Shuhan Shen, Institute of Automation, CAS, China

Changsheng Li, Univ. of Electronic Science & Technology, China

Over 100 people (including students, faculties and industry staff) attended the workshop. The two speakers Prof. Junchi Yan (Shanghai Jiao Tong University) and Prof. Xiaowei Zhou (Zhejiang University) gave their tutorials on multiple graph matching and multiple image matching respectively. They had systematically introduced the line of work on matching multiple graphs and images whereby not only their own work but many recent works were also covered in the literature review.

Graph matching is a classic problem which in general is NP complete, and there are many relaxation techniques to mitigate the original hard problem. More recently, many researchers are paying more attention to the setting when multiple graphs are involved for joint matching, which is practically important and useful. Prof. Junchi Yan's talk began with an introduction of basic background of graph matching in the classic setting of two graphs. Then, consistency

based matching methods were presented, followed by his recent work on incremental matching of a sequence of graphs. The talk concluded with an outlook for graph matching for possible applications in social networks, protein network matching etc.

The second talk was delivered by Prof. Xiaowei Zhou who presented the state-of-the-art on matching of multiple images using different optimization techniques. Differing from graph matching that involves second-order or even higher-order edge information, the recent work on multi-image matching mainly consider the first-order information to make the algorithms more scalable for real-world applications. In particular, partial matching and distributed matching of multiple images were covered, whereby deep learning is also coupled with optimization based matching methods. Prof. Zhou also discussed the potential applications for image matching such as 3-D reconstruction, semantic flow, landmark detection etc.

## **CVAUI 2018 INTERNATIONAL CONFERENCE ON PATTERN RECOGNITION**

**3rd Workshop on Computer Vision for Analysis of Underwater Imagery**

**Beijing, China**

**An ICPR 2018 Workshop endorsed by the IAPR  
August 20, 2018**



### **Workshop Organizers:**

Alexandra Branzan Albu, University of Victoria, British Columbia, Canada  
Maia Hoeberechts, Ocean Networks Canada, Victoria, British Columbia, Canada

### **Program Committee:**

Jacopo Aguzzi, Spanish National Research Council, Spain  
Konstantinos Avgerinakis, Centre for Research & Technology Hellas, Greece  
Duane Edgington, Monterey Bay Aquarium Research Institute, USA  
Bob Fisher, School of Informatics, University of Edinburgh, UK  
Hervé Glotin, Université de Toulon, France  
Tim Nattkemper, Bielefeld University, Germany  
Timm Schoening, Helmholtz Centre for Ocean Research, Kiel, Germany

The third edition of CVAUI further consolidated the series that was started in Stockholm (CVAUI 2014), and continued in Cancun (CVAUI 2016).

Monitoring marine and freshwater ecosystems is of critical importance in developing a better understanding of their complexity, including the effects of climate change and other anthropogenic influences. The collection of underwater video and imagery, whether from stationary or moving platforms, provides a non-invasive means of observing submarine ecosystems in situ, including the behaviour of organisms. Oceanographic data acquisition has been greatly facilitated by the establishment of cabled ocean observatories, whose co-located sensors support interdisciplinary studies and real-time observations.

Scheduled recordings of underwater video data and static images are gathered with Internet-connected fixed and PTZ cameras, which observe a variety of biological processes. These cabled ocean observatories, such as those operated by Ocean Networks Canada ([www.oceannetworks.ca](http://www.oceannetworks.ca)), offer a 24/7 presence, resulting in unprecedented volumes of visual data and a "big data" problem for automated analysis. Due to the properties of the environment itself, the analysis of underwater imagery imposes unique challenges which need to be tackled by the computer vision community in collaboration with biologists and ocean scientists.

This workshop provided a forum for researchers to share and discuss new methods and applications for underwater image analysis. We

received 11 submissions, out of which 8 were accepted based on a thorough peer review process. Most of the submitted papers were of excellent quality, so the high acceptance rate reflects a self-selection process performed by the authors. We thank the members of Program Committee for lending their time and expertise to ensure the high quality of the accepted workshop contributions.

The technical program covered a variety of topics, including but not limited to underwater image quality enhancement and evaluation, deep learning methods for object classification and image restoration, as well as behaviour tracking. We were also pleased to host two keynote talks given by prominent researchers from marine biology and computer science perspectives. Dr. Kim



## ICPR 2018 Highlights



Juniper, Ocean Networks Canada, talked about “*Extracting Ecological Information from Deep-Sea Imagery*,” highlighting the critical need to bridge the gap between the rapid development of tools for acquiring deep-sea imagery and accurate methods for the automatic quantitative analysis of this huge amount of

visual data. Dr. Robert B. Fisher, University of Edinburgh, Scotland, offered valuable perspectives about the impact of Big Data on the design and performance of computer vision algorithms in his presentation titled “*Collecting, Cleaning, and Analyzing a Large Fish Dataset*.”

We hope that all workshop attendees have been inspired in their research by participating in CVAUI 2018, and that this workshop will foster many fruitful conversations and open new areas for collaborative interdisciplinary research in underwater image analysis.

**Abstract: Extracting ecological information from deep-sea imagery, [Dr. Kim Juniper](#) (front row, far left in photo)**

The development of tools for the acquisition of deep-sea imagery has surpassed the development of tools for extracting biological information from growing video and photo archives. Yet these imagery archives contain a wealth of information on the spatial and temporal distribution of deep-sea species, and their natural dynamics. Ocean Networks Canada has been operating cabled deep-sea observatories in the northeast Pacific since 2006. Traditional manual extraction of biological information from ONC’s archived imagery has revealed the potential power of time series biological observations in understanding the response of deep-sea species to short- and long-term environmental variability. However, as imagery accumulates in the archive, it is becoming impossible for researchers to exploit the full potential of the thousands of hours of video from multiple deep-sea cameras connected to the network. Ocean Networks Canada has begun developing other solutions from extracting biological information from underwater imagery. This include working with computer scientists to develop machine vision tools that recognize and enumerate species, and the development of a crowd-sourcing tool that allows members of the public to annotate segments of archived video imagery, with information about species present and habitat properties. This presentation will provide an overview of recent research results that have used Ocean Networks Canada imagery combined with oceanographic sensor data to study seafloor ecosystem dynamics. The presentation will conclude with a review of a recent study that compared crowd sourcing results with expert annotation and computer algorithms to quantify the abundance of sablefish in a submarine canyon habitat.

**Abstract: Collecting, Cleaning and Analyzing a Large Fish Dataset, [Dr. Robert B. Fisher](#) (back row, fifth from the left)**

The Fish4Knowledge project captured approximately 1.4 billion images of tropical reef fish from 10 underwater cameras off the coast of Taiwan, over 2010-2013. The project investigated fish detection, tracking and species-level recognition, which ultimately led to the large database. The database was then used for further research, in particular:

1. methods for cleaning the many false positive fish detections, and
2. exploring the relation between fish swimming speed and water temperature (a big noisy data problem).

The talk will cover aspects of both the initial data collection, and also of the post-collection analysis. For fun, we’ll also present work on recognizing individual clownfish.



### Workshop Organizers:

Xiang Bai, Huazhong University Science and Technology  
Yi Fang, New York University Abu Dhabi and New York University  
Yangqing Jia, Facebook

Meina Kan, Institute of Computing Technology, Chinese Academy of Sciences  
Shiguang Shan, Institute of Computing Technology, Chinese Academy of Sciences

Chunhua Shen, University of Adelaide  
Jingdong Wang, Microsoft Research Asia  
Gui-Song Xia, Wuhan University

Shuicheng Yan, National University of Singapore  
Zhaoxiang Zhang, Institute of Automation, Chinese Academy of Sciences

Kamal Nasrollahi, Aalborg University, Denmark  
Gang Hua, Microsoft Research, USA  
Thomas B. Moeslund, Aalborg University, Denmark  
Qiang Ji, Rensselaer Polytechnic Institute, USA

Deep Learning, which can be treated as the most significant breakthrough in the past 10 years in the field of pattern recognition and machine learning, has greatly affected the methodology of related fields like computer vision and has achieved terrific progress in both academy and industry.

The major goal of the workshop was to provide a platform for researchers or graduate students around the world to report or exchange their progresses on deep learning for pattern recognition.

The two workshops were merged together for deeper communication between the researchers.

We had two fascinating invited talks. The first one was from Prof. Edwin Hancock (University of York, UK) entitled "Machine Learning with Quantum Walks".

The second one was from Prof. Xilin Chen (ICT, Chinese Academy of Sciences) with the title "Challenges in Facial Expression Understanding". These two talks gave insights into the two topics

and attracted lots of attendees.

In addition to the invited talks, seven papers were accepted for oral presentation, covering topics of histopathological images, action recognition, scene text detection, speech recognition, object classification, presentation attack detection, and driver drowsiness detection.





## IWCF 2018

### 7th IAPR International Workshop on Computational Forensics

An ICPR 2018 Workshop endorsed by the IAPR, Beijing, China, August 20, 2018

#### Workshop Chairs:

Jean-Marc Ogier, University of La Rochelle, France  
Chang-Tsun Li, Charles Sturt University, Australia and University of Warwick, UK  
Nicolas Sidère, University of La Rochelle, France



With the advent of high-end technology, fraudulent efforts are on the rise in many areas of our daily life, may it be fake paper documents, forgery in the digital domain, or copyright infringement. In solving the related criminal cases, use of pattern recognition (PR) principles is also gaining an important place because of their ability in successfully assisting the forensic experts in solving many of such cases.

IWCF 2018 aimed at addressing



the theoretical and practical issues related to this field, i.e. role of PR techniques in analyzing problems in forensics. Effort was made to bring together people who are working on these issues in different areas including document and speech processing, music analysis, digital security, forensic sciences, etc. About 25-30 people attended the workshop, resulting in valuable scientific exchanges

Like in the previous years, the workshop was a place for elaborate discussions of the academic and industrial works, documenting the advances in the related fields and creating collaborations in related areas. Interaction among practitioners and academic researchers received special attention in this edition of the workshop.

Each of the submissions was

reviewed at least three times. The program committee took into account the relevance of the papers to the workshop, the technical merit, the potential impact, and the originality and novelty. From these submissions, and taking into account the reviews, three papers were selected for presentation.

The workshop also included two keynote presentations, respectively dedicated to the academic and industrial point of view. The first one was given by Prof Chang-Tsun Li (University of Warwick, UK - Charles Sturt University, Australia) on *Applications of Multimedia Forensics in Law Enforcement*, and the second one was given by Saddok Kebairi (Yooz Company, France) on *Document Fraud : Reality And Challenge For Companies*.





## Workshop Chairs:

Lu Bai, General Chair, Central University of Finance and Economics, Beijing, China  
Jian Tang, HEC Montreal & Montreal Institute for Learning Algorithms (MILA), Canada  
Luca Rossi, School of Engineering and Applied Science, Aston University, UK  
Lixin Cui, Central University of Finance and Economics, Beijing, China

by Lu Bai, General Chair

PRIFR 2018 was the first ICPR workshop focusing on the emerging field of pattern recognition and its applications in finance and related subjects. The aim of this workshop was to bring together researchers from diverse communities concerned with this topic, including pattern recognition and machine learning techniques such as deep learning methods, kernel methods, feature selection, etc., for building intelligent solutions for financial analysis and risk-based knowledge discovery. This workshop was organized by Central University of Finance and Economics, Beijing, China, and was hosted by Co-chairs Dr. Lixin Cui and Dr. Luca Rossi.

The workshop program included six excellent invited talks.

- Dr. Lixin Cui (from Central University of Finance and Economics) presented her recent work on “Feature Selection in P2P Lending Analysis”, where she introduced a new adaptive graph-based feature selection method and its application for

credit risk analysis for P2P lending.

- Professor Edwin R. Hancock (from University of York, UK) gave an excellent talk on “Exploring the Economics of Market Networks using von Neumann Entropy”, where he discussed how the approximated expressions for the von Neumann entropy of both directed and undirected graphs can be used to build a simple thermodynamic picture of the evolution of networks representing stock market trading patterns.
- Professor Baogang Hu (from Chinese Academy of Science) gave a talk on “Information Theoretic Learning in Pattern Classification”, where he introduced the novel theory of abstaining learning for both Bayesian classifiers and mutual information classifiers, and cost-free learning from the real-world data sets in comparison with cost-sensitive learning.
- Professor Ning Zhang (from Central University of Finance and Economics) presented his

work on “The New Generation of Artificial Intelligence in Finance” and raised 15 important questions from the viewpoint of Finance. He also discussed how AI can help resolve these difficulties.

- Professor Francisco Escolano (from University of Aclante, Greece) gave a talk on “An Information-Theoretic Approach for Graphs”, where he presented how manifold alignment can be combined with copula-based entropy estimators to efficiently estimate the mutual information between graphs.
- Lastly, Dr Luca Rossi (from Aston University, UK) presented a talk on “A Preliminary Survey of Analyzing Dynamic Time-varying Financial Networks Using Graph Kernels”, where he discussed whether graph kernels can be used as a means of analyzing time-varying financial market networks.

Around fifty participants attended the workshop.



## RRPR 2018: 2nd Workshop on Reproducible Research in Pattern Recognition

20 Aug 2018 Beijing (China)  
An ICPR2018 workshop sponsored by the IAPR



### Workshop Chairs:

Bertrand Kerautret, main chair, LORIA, Université de Lorraine, Nancy  
Miguel Colom, CMLA, ENS Paris Saclay  
Bart Lamiroy, (LORIA, Université de Lorraine, Nancy)  
Daniel Lopresti, Lehigh University, Bethlehem, PA 18015  
Pascal Monasse, LIGM, École des Ponts Paris  
Jean-Michel Morel, CMLA, ENS Paris Saclay  
Fabien Pierre, LORIA, Université de Lorraine, Nancy  
Hugues Talbot, Center for Numerical Vision, CentraleSupélec, Paris

The second edition of the RRPR was held in the same spirit as the first edition, but with a special focus on Digital Geometry and Mathematical Morphology. It was intended as a short participative course on the RR aspects as well as on how to actually perform RR. For this second edition, a new call for short papers was proposed to the ICPR authors. The main idea was to give already accepted ICPR authors the possibility to highlight the reproducible quality of their work with a companion paper, including implementation details, source code descriptions, parameter choice etc.

The workshop received a total of 15 paper submissions covering the two main tracks of RR Framework (six papers) and RR Results (three papers). Six papers were also submitted in the new Short Paper track. All papers were reviewed by at least three reviewers for the main RR tracks and the short papers received two kinds of review: one for the short paper itself and another coming from the RR label linked to the code repository (when authors applied for the label).

A comparable number of participants was present at this workshop—as compared with the previous edition—with around 20/30 participants, and the public actively participated in the discussions with the presenters.

Two invited talks opened the workshop sessions. The first, by Miguel Colom, was related to the evolution and the future of the IPOL journal, including a new structure for machine learning applications. The second invited talk, by Miguel Colom and Bertrand Kerautret, focused on a review of reproducible research platforms with an overview of available, new ways of publication. The three main papers on RR Results were oral presentations and four short papers were oral fast track presentation. In addition to these presentations, Miguel Colom led a new type of practical session with a "Hands on IPOL Demonstration System", where users were able to construct their own online demonstration from a simple description file.

The RRPR workshop chairs made the decision to handle the edition of their own post proceedings

(in Springer LNCS) allowing the publication of carefully revised papers and integrating improved content with invited paper contributions. The proceedings will be sent to Springer for publication in November.

Finally, the "Reproducible Label in Pattern Recognition" defined to highlight the reproducible aspects of RRPR and ICPR work was once again proposed and will remain active currently with seven submissions: <https://github.com/rpr>.



*The "Reproducible Research" label was proposed by the RRPR Committee as an additional recognition of the work presented at the ICPR conference and ICPR Workshops.*

*The label is proof that your work can be reproduced from the git repository that will be indexed by RRPR. This is a major advantage for other researchers wanting to compare their work to yours: the label guarantees that the comparisons are performed with the author implementation used in the corresponding paper. Thereby, it is also a major advantage for you to be compared and cited by your colleagues.*

*Authors of accepted RRPR and ICPR papers were eligible to apply, and seven were accepted.*

## VAIB 2018

### visual observation and analysis of Vertebrate And Insect Behavior

An ICPR 2018 Workshop, Beijing, China, August 20, 2018

#### Workshop Organizers:

Robert B. Fisher, Chair, University of Edinburgh  
John Hallam, University of South Denmark  
Simone Palazzo, Universita' di Catania

#### Overview:

There has been an enormous amount of research on analysis of video data of humans, but relatively little on visual analysis of other organisms. The goal of this workshop was to stimulate and bring together the current research in this area and to provide a forum for researchers to share expertise. Since the organizers wanted to make this more of a discussion workshop, they encouraged work-in-progress presentations. Reviewing was lightweight and only abstracts were circulated to attendees.

Previous versions of VAIB are here: [2008 \(Tampa\)](#), [2010 \(Istanbul\)](#), [2012 \(Tsukuba\)](#), [2014 \(Stockholm\)](#), and [2016 \(Cancun\)](#).

The issues that the research addressed included:

- detection of living organisms
- organism tracking and movement analysis
- dynamic shape analysis
- classification of different organisms (eg. by species)
- assessment of organism behavior or behavior changes
- size and shape assessment
- counting
- health monitoring

These problems can be applied

to a variety of species at different sizes, such as fruit and house flies, crickets, cockroaches and other insects, farmed and wild fish, mice and rats, commercial farm animals such as poultry, cows and horses, and wildlife monitoring, etc. One aspect that they all have in common is video data.

#### Program:

The following papers were presented:

- F. Naiser, M. Šmíd, J. Matas; [Tracking and Re-Identification System for Multiple Laboratory Animals.](#)
- O. Mothes, J. Denzler; [Multi-view Anatomical Animal Landmark Localization using Deep Feature Regression.](#)

- A. Gostler, N. M. Artner, W. G. Kropatsch, L. Fusani; [Tracking Golden-Collared Manakins in the Wild.](#)
- M. C. Bakkay, S. Chambon, H. A. Rashwan, C. Lubat, S. Barsotti; [Support Vector Machine \(SVM\) Recognition Approach adapted to Individual and Touching Moths Counting.](#)
- L. N. Govindarajan, T. Sharma, R. Colwill, T. Serre; [Neural Computing on a Raspberry Pi: Applications to Zebrafish Behavior Monitoring.](#)
- I. F. Rodriguez, R. Mégret, R. Egnor, K. Branson, J. L. Agosto, T. Giray, E. Acuña; [Multiple Animal Tracking in Video Using Part Affinity Fields.](#)

xkcd



[HTTPS://XKCD.COM/1012/](https://xkcd.com/1012/)





### Workshop Organizers:

Friedhelm Schwenker, Institute of Neural Information Processing, Ulm University, Germany  
Stefan Scherer, Institute for Creative Technologies, University of Southern California, USA

MPRSS 2018 was sponsored by Ulm University, the University of Southern California, the Transregional Collaborative Research Center SFB/TRR 62 Companion-Technology for Cognitive Technical Systems at the Ulm University and the Technical Committee on Pattern Recognition in Human-Machine Interaction (TC9) of the International Association for Pattern Recognition (IAPR).

For the MPRSS 2018 workshop four papers were selected for oral presentation. In addition to the regular talks one invited talk, "Light weight deep neural networks with applications to pattern recognition", was given by Prof. Xiaojun Wu (Jiangnan University).

Papers presented original research in machine learning and pattern recognition in human computer interaction focusing on both

theoretical and applied aspects.

During the sessions more than 50 people attended the MPRSS workshop.

Selected and revised papers will be published in the Springer LNCS/LNAI series as postconference proceedings.

### IAPR Technical Committee 9 (TC9) Pattern Recognition in Human-Machine Interaction

Currently human-machine interaction (HMI) typically takes place on a rather crude explicit question-answer level, whereas human-human interaction is multifaceted. In order to close this gap, it is crucial for a machine to perceive and understand the user's current interaction and affective state and to register the user's social signals, which are composed of dynamic multimodal behavioral cues. Building intelligent artificial agents or companions capable to interact with humans in the same way humans interact with each other is a major challenge in HMI.

IAPR TC9 mainly focuses on pattern recognition, machine learning and information fusion methods for the perception of the user's affective state, activities and intentions.

IAPR TC9 research topics include various aspects of pattern recognition and machine learning; in particular research is focused on:

- A. Pattern Recognition and Machine Learning Algorithms to recognize emotions, affective states, pain, user activities and intentions
- B. Algorithms to combine information from multiple modalities such as (Video, Audio, psychophysiological parameters, and neural signals such as EEG or FMRI)
- C. Applications of HMI
- D. Datasets and benchmarks relevant to HMI research

If you are interested in the activities of TC9 or if you want to join the TC's mailing list please mail to [friedhelm.schwenker@uni-ulm.de](mailto:friedhelm.schwenker@uni-ulm.de) or [scherer@ict.usc.edu](mailto:scherer@ict.usc.edu).

## DAR 2018

### 1st International Workshop on Deep Learning for Document Analysis and Recognition

An ICPR 2018 Workshop, Beijing, China, August 20, 2018

#### Workshop Organizers:

Yongpan Wang, Alibaba Group, China

Xiang Bai, Huazhong University of Science and Technology, China

Cheng-Lin Liu, Institute of Automation of Chinese Academy of Sciences, China

The technology of document analysis and recognition (DAR) aims to automatically extract information from document images and handwriting by analyzing the structure and textual contents. It has tremendous applications such as digitization of books and financial notes and information extraction from Web document images.

Recognizing text from images, known as Optical Character Recognition (OCR) is the core task of DAR. Recently, OCR has achieved a great success in both scientific research and practical application for different scenes. A traditional OCR system is heavily

pipelined, with hand-designed and highly-tuned modules, usually composed of line extraction, word detection, letter segmentation, and then applying different techniques to each piece of a character to figure out what the character is.

Nowadays, we have entered a new era of big data, which offers both opportunities and challenges to the field of OCR and DAR. We should seek new OCR and DAR methods to be adaptive to big data, and also push forward new OCR and DAR applications benefited from big data.

Deep learning, which is considered as one of the most significant

breakthroughs in recent pattern recognition and computer vision fields, has greatly affected these fields and achieved impressive progress in both academy and industry. Currently, deep learning is widely accepted as an effective OCR solution, which first learns to detect text lines or words from images, then recognize the sequence of characters directly from extracted text lines or words. The hand-built and highly tuned modules are avoided in the deep learning-based OCR system. It is expected that the development of deep learning theories and applications would further influence the field of OCR and DAR.





## MIPPSNA 2018

### Multimedia Information Processing for Personality & Social Networks Analysis

<http://chalearnlap.cvc.uab.es/>

An ICPR 2018 Workshop endorsed by the IAPR, Beijing, China, August 20, 2018

#### Workshop Organizers:

Hugo Jair Escalante (Mexico)  
Bogdan Ionescu (Romania)  
Esaú Villatoro (Mexico)  
Gabriela Ramírez (Mexico)  
Sergio Escalera (Spain)  
Martha Larson (The Netherlands)  
Henning Müller (Switzerland)  
Isabelle Guyon (France)

Multimedia information processing is a fruitful research topic that has focused on a number of tasks, among them, those focusing on the analysis of human behavior. Although great advances have been obtained in the Looking At People field, it is only recently that attention from this area is targeting problems that have to do with more complex behaviors.

We organized a contest and an associated workshop focused on the multimodal analysis of personality and social networks data. The organized challenge targeted two complex behaviors, namely, social media and personality analysis. On the one hand, the DivFusion task focused on developing intelligent information fusion schemes to diversify retrieval results from social media. A novel data set was released for this task. The DivFusion task attracted more than 20 participants, although no one made it to the final phase. On the other hand, the HWxPI task aimed to develop automatic methods for recognizing the personality of subjects starting

from handwritten text. A novel data set comprising textual content, images and additional metadata was provided to participants. The challenge attracted more than 100 participants. Although the task proved to be complicated, the winning team (CIC-IPN Mexico) succeeded in beating the baseline method.

In addition to the contest, we organized a workshop focusing on related topics. Five outstanding contributions were accepted and presented in the half-day workshop. The workshop also included a very interesting talk on Personality Analysis by Sergio Escalera (President of the [IAPR TC12](#) committee on Multimedia and Visual Information Systems). The workshop was attended by about 50 participants.

In general terms, we can confirm that the goals of the organized events were fulfilled, although a greater effort is required in order to further motivate participation from the IAPR community. In this regard, we are assessing the feasibility of organizing a second

round on the DivFusion and HWxPI tasks.



Finally, we are guest-editing a special issue on **Looking At People: Analyzing Human Behavior from Social Media Data in the**

**prestigious International Journal of Computer Vision (IF: 11.5), Deadline March 15, 2019** <https://tinyurl.com/y8hgqe4m>.

These events were supported by three organizations with vast experience and prestige in the organization of academic contests, namely: ChaLearn Looking at People (<http://chalearnlap.cvc.uab.es/>), MediaEval, and ImageCLEF.

The events were supported by the IAPR TC-12 on Multimedia and Visual Information Systems and endorsed by the IAPR.



IAPR Technical Committee 12



# ICPR 2018 Tutorials

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## Active Authentication in Mobile Devices

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Julian Fierrez and Vishal Patel

Over 30 people attended the tutorial.

Recent developments in sensing and communication technologies have led to an explosion in the use of mobile devices such as smartphones and tablets. With the increase in use of mobile devices, one has to constantly worry about security and privacy, as the loss of a mobile device would compromise the personal information of the user. To deal with this problem, active authentication (also known as continuous authentication) systems have been proposed in which users are continuously monitored after the initial access to the mobile device.

Two speakers Prof. Julian Fierrez (Universidad Autonoma de Madrid, Spain) and Prof. Vishal Patel (Johns Hopkins University, USA) gave this tutorial. In particular, the speakers provided an overview of different continuous authentication methods on mobile devices, discussed merits and drawbacks of available approaches, and identified promising avenues of research in this rapidly evolving field.

Prof. Vishal Patel, in the first half of the tutorial, developed the motivation and general aspects for mobile active authentication. He then concentrated on specific methods based on face biometrics and discussed some advanced topics applicable to this problem such as domain adaptation and multi-user active authentication.

Prof. Julian Fierrez then concentrated on touch-based gestures for mobile active authentication. From past developments in handwriting biometrics, he outlined recent advances and future trends that exploit various input signals originated in touchscreens, namely: graphical passwords, swipes, key taps, and finally other signals originating from mobile sensors such as orientation and acceleration of the device. He also discussed operational aspects for practical developments such as protection against attacks and variability of the biometric information across time.

The tutorial was finalized with a discussion of emerging and potential research topics around mobile active authentication.

## Deep Metric Learning for Pattern Recognition

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Jiwen Lu, Yueqi Duan, and Hao Liu

The tutorial attracted over 100 people.

The three speakers, Prof. Jiwen Lu (Tsinghua University), Yueqi Duan (Tsinghua University), and Dr. Hao Liu (Ningxia University) gave their talks on the topics of Mahalanobis deep metric learning, Hamming deep metric learning and sampling for deep metric learning.

Over the past decade, deep metric learning has been developed as one of the basic techniques in machine learning and successfully applied to a wide range of pattern recognition tasks. In this tutorial, the speakers gave overviews of the trends in deep metric learning techniques and discussed how they are employed to boost the

performance of various pattern recognition tasks.

Prof. Jiwen Lu presented the background and introduction of deep metric learning. He started with the question, "Why should we measure the similarity between samples?" and showed some examples. Then, he talked about the fundamental definition of metric learning and summarized the key challenges and possible solutions of this area.

Dr. Hao Liu focused on Mahalanobis deep metric learning. Compared with conventional shallow model based metric learning, he showed the strong discriminative power of deep metric learning due to the hierarchical

nonlinear projections. He introduced several new methods and discussed relevant tasks such as order-preserving deep metric learning, deep structural metric learning and deep transfer metric learning.

Yueqi Duan first introduced a special type of Hamming deep metric learning that aimed to learn a binary embedding for efficient storage and matching. He summarized the existing methods in two categories—unsupervised and supervised—and showed some recent approaches. Then, he emphasized the importance of training data mining. Lastly, he gave a conclusion of the tutorial and showed some future directions.

## Finding Correspondences across Multiple Graphs or Images

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Junchi Yan and Xiaowei Zhou

There were over 100 people attending the tutorial.

Prof. Junchi Yan (Shanghai Jiao Tong University) and Prof. Xiaowei Zhou (Zhejiang University) discussed multiple graph matching and multiple image matching respectively. They systematically introduced the line of work on matching multiple graphs and images whereby not only their own work but many recent works were covered in the literature review.

Graph matching is a classic problem which in general is NP complete, and there are many relaxation techniques to mitigate the original hard problem. More recently, many researchers pay

more attention to the setting when multiple graphs are involved for joint matching, which is practically important and useful.

In Prof. Junchi Yan's talk, first basic background of graph matching in the classic setting of two graphs are introduced. Then, consistency based matching methods are presented, followed by his recent work on incremental matching of a sequence of graphs. The talk ended with an outlook for graph matching for possible applications in social networks, protein network matching etc.

Prof. Xiaowei Zhou showed the state-of-the-art in matching of multiple images using different

optimization techniques. Differing from graph matching that involves second-order or even higher-order edge information, the recent works on multi-image matching mainly consider the first-order information to make the algorithms more scalable for real-world applications. In particular, partial matching and distributed matching of multiple images are covered, whereby deep learning is also coupled with optimization based matching methods. Prof. Zhou also discussed the potential applications for image matching such as 3-D reconstruction, semantic flow, landmark detection etc.

## Graph-based Methods for Learning and Inference Problems in Pattern Analysis

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Antonio Robles-Kelly and Francisco Escolano

The tutorial on Graph-based Methods for Learning and Inference Problems in Pattern Analysis provided a detailed study of graph-based methods in pattern recognition.

It aimed at covering the fundamental principles of stochastic, spectral, probabilistic and manifold-based methods

related to graphs and their applications to segmentation and grouping, matching, classification and recognition.

The tutorial also covered recent trends and developments related to deep networks and link inference in the structural pattern analysis space.

The tutorial was designed to

give attendees who are working in problems akin to pattern recognition, computer vision and artificial intelligence an insight into the concepts, methods and tools essential for conducting effective research in graph-based methods.

This tutorial was endorsed by IAPR TC2 on Structural and Syntactical Pattern Recognition.

## Human Identification at A Distance By Gait And Face Analysis

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Yongzhen Huang, Daoliang Tan, Man Zhang, and Liang Wang

There were over 100 people (including students, faculties and industry staff) attending the tutorial.

The three speakers Prof. Liang Wang (Institute of Automation Chinese Academy of Sciences), Dr. Yongzhen Huang (Institute of Automation Chinese Academy of Sciences) and Dr. Man Zhang (Watrix Technology) respectively gave their tutorials on the overview of gait recognition, new methods of gait recognition, and face recognition at a distance and their applications. They systematically introduced the line of work on human identification at a distance by gait and face analysis, including the past 20 years' research and related breakthroughs in their literature.

Human identification at a distance is a very challenging task, which has long been a popular research topic in the field of computer vision. The gait sequences of different people can be very distinctive, which make gait an important body

characteristic that can be used for human identification. Prof. Liang Wang's talk introduced the history of gait recognition and the traditional methods (i.e. model-based and appearance-based ones).

Dr. Yongzhen Huang discussed their efforts in deep learning based methods for cross-view gait recognition, GaitNet for segmentation and recognition, uniform model for gait recognition and so on. Especially, Dr. Huang introduced three network architectures on for cross-view gait recognition, which is the most difficult problem in gait recognition.

Dr. Man Zhang introduced face recognition at a distance and the fusion of face and gait recognition. Moreover, she showed the real applications of gait and face recognition in public security industry and smart home.

At the end of the tutorial, they showed the real gait recognition

system and invited several listeners to experience it. After registration, the individuals can be recognized immediately even with the change of clothes and view.

The organizers from the Institute of Automation of the Chinese Academy of Sciences and Watrix Technology have more than 20 years' in-depth research on gait recognition and computer vision. Watrix Technology is so far the only commercialized gait recognition company in the world. Watrix Technology applied gait recognition and face recognition in many areas: (1) Smart Government: People and ID consistency check-in, etc., (2) Security and Anti-terrorism: Suspect identification and searching for danger warnings, etc., (3) Smart home: Enhanced interactions with smart household appliances to better perceive user attributes, (4) Public Transportation: Security control, card-free access control, crowd warning, etc.



## Person Re-identification: State of the Art and Future Trends

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Liang Zheng, Yang Yang, and Shengcai Liao

Person re-identification is a hot topic in the computer vision community, and the tutorial drew over 100 participants. The interaction between presenter and the audience was effective. The event covered important aspects of the person re-identification task: history, popular feature designs and metrics, as well as deep learning architectures and domain adaptation schemes.

Prof. Shengcai Liao introduced the task—history, current development, and future directions. This task has a history of over 13 years and it was surprising to see that this field has over 30 papers accepted

to CVPR 2018, and over 15 papers in ICPR 2018. Moreover, the development of deep learning techniques looks very encouraging. It already surpasses the human performance and has been deployed in the industry.

In the second and third parts, Dr. Yang Yang first provided a detailed presentation on the popular person descriptors and distance metrics within the framework of traditional machine learning. He demonstrated some mathematical formulation of the research problem such as discriminative subspace learning. The mathematical formulations

provided the audience a scientific perspective to understanding the problem at hand. Then, Dr. Liang Zheng showed the recent advances in this research community, especially the advance of deep learning structures and domain adaptation methods. The presenters summarized some commonly used techniques towards a ready-to-use baseline and showed the unique challenges of domain adaptation in the person re-identification problem. Finally, future research possibilities were introduced, such as understanding to what extent various factors affect a person re-identification system.

## Practical Data Complexity Analysis in Pattern Recognition

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by Tin Kam Ho

In many studies of classifier methods, a typical demonstration of merit for a newly proposed method is by showing experimental results where the method's accuracy is compared to those by the prior art for a set of publicly available datasets. However the claim of merit is often limited to counting how many such datasets the method wins on, with little further analysis into why it wins. While such a demonstration can convey some sense of robustness of a method, it does not give much insight on the conditions under which its merits are expected. To predict the method's success or failure on unseen classification tasks, it requires a leap of faith.

Data complexity analysis was motivated by the realization of this

unsatisfactory state of affairs. We developed a number of measures that can highlight the differences between easy classification tasks and difficult ones. These measures thus give a "feature space" where the complexity of classification tasks can be analyzed with the tasks taken as points in this space.

In this measurement space, we found that real-world classification problems span structures that are significantly different from randomly labeled point sets (noisy patterns that have no regularity to be learned). Distributions of real-world problems in this space show that there exist several independent factors affecting a problem's difficulty. In the space one can map the position of each classification task and compare

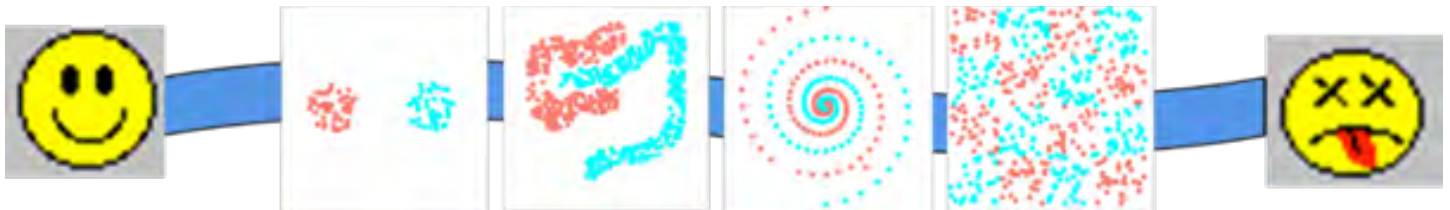
its position to others, thereby drawing some expectation of how a classifier may perform on that task from the known records of other neighboring tasks. One may also compare the regions that contain the tasks for which one classification method consistently outperforms others, and thereby mapping the "domain of competence" of the classification method. This can guide static and dynamic selection of classifiers for specific problems as well as for the variations of the same problem that are formed by confinement, projection, and transformation of the feature vectors.

In an application context where the definitions of the classes are changeable, one may use the complexity measures to guide

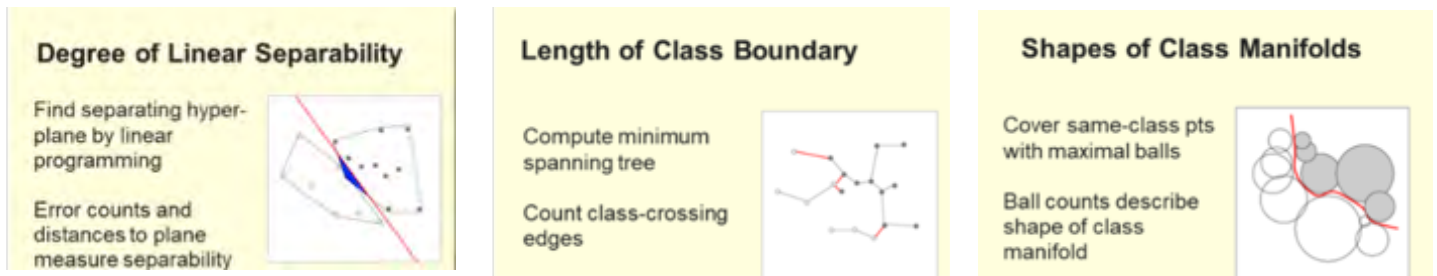
the choice on alternative definitions so as to optimize prediction accuracy for the resultant classification task. This allows for better tradeoff in the relevant context, e.g., between the precision of the prediction and the confidence of the prediction.

Recent interests in meta-learning and transfer learning seek to retain reusable learned knowledge (e.g. feature extractors, parameters of mapping functions) from one classification task to another. One way to make the decision to switch to a different parameter or configuration choice for each task is to leverage some measures of the geometrical characteristics of the data. Similarly, recent research on "AutoML" (automated machine learning) seeks to automatically tune the classifier parameters to adapt to each task, or even to tune the learning process end-to-end where the choice of the classifier is also automated. There is a good chance that data complexity analysis can contribute towards these goals.

In the tutorial, a review was given on the motivation, concepts, methods, benefits, and limitations in this area of work. Practical examples were shown using publicly accessible implementations. The 3-hour tutorial was attended by 27 from both academia and industry. After the review lecture, materials useful for starter experimentation were introduced and distributed (<http://datacomplexity.org>).



Classification tasks fall on a continuum between very easy and very hard ones.



Example measures that characterize classification complexity.



A map of classification tasks in two complexity dimensions: easy, linearly separable problems (green), randomly labeled points (red), 10 classes of handwritten digit images (black), and a collection of synthetic datasets representing many other realizations of complexity (light gray).

## Subspace Clustering: Recent Advances in Algorithms, Theories and Applications

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by **Chun-Guang Li, Chong You, Guangcan Liu , and Risheng Liu**

The tutorial was divided into four parts, covering preliminary concepts and modeling for subspace clustering, scalable subspace clustering, low-rankness based modeling, and optimization algorithms for solving the relevant problems. There were over 50 participants

Dr. Chun-Guang Li (Associate Professor, Beijing University of Posts and Telecommunications), reviewed subspace clustering and representative subspace clustering methods. The methods are sorted into two groups: two-step modeling and joint optimization modeling. In two-step modeling, the representative methods (e.g., SSC, LRR, LSR, EnSC) are presented in a unified formulation with their respective theoretical guarantee for obtaining the subspace-preserving solution. In joint optimization modeling, a unified optimization framework is presented with varieties of possible extensions for handling missing

entries, with side-information, partial labels, etc.

Chong You (Johns Hopkins University) introduced the recent advances in scalable subspace clustering methods. Specifically, two representative methods SSC-OMP and EnSC are introduced, with their theoretical guarantees and performance evaluations on image clustering task.

Dr. Guangcan Liu (Professor, Nanjing University of Information Science and Technology) covered the recent advances in low-rankness based methods for learning and recovering low-rank structures, including recovery of subspace structures under column-wise corruption, recovery of coherent data and mixture data via dictionary pursuit, recovery of low-rank data under non-uniform sampling, and their representative applications.

Dr. Risheng Liu (Associate

Professor, Dalian University of Technology) presented the recent advances in non-smooth optimization algorithms, covering convex optimization and non-convex optimization, especially a promising direction of learning optimization algorithms from data.

Subspace clustering refers to the problem of learning a set of low-rank structures from high dimensional unlabeled data, and increasingly becomes an indispensable tool for learning from high dimensional datasets. In the past few years, subspace clustering has been successfully applied to many tasks in computer vision (e.g., image representation and compression, motion segmentation, and temporal video segmentation), in control (e.g., hybrid system identification), in social networks (e.g., community clustering) and in bioinformatics (e.g., genes expression profiles clustering).

## Toward Interpretable Deep Learning Via Fuzzy Logic

An ICPR 2018 Tutorial, Beijing, China, August 20, 2018

by **Lixin Fan, Fei-Yue Wang, and Chee Seng Chan**

Professor Fei-Yue Wang (Institute of Automation, Chinese Academy of Science) reviewed the early history of AI development, discussed the fundamental problems for AI studies, and predicted the directions for breakthrough in future.

Assoc. Prof. Chee Seng Chan (University of Malaya ) introduced, from a beginner's point of view, the

basic principles of fuzzy logic and its applications.

Then, through a concrete example, Dr. Lixin Fan (Nokia Technologies) established the intrinsic connection between fuzzy logic and deep neural networks. Dr. Fan also demonstrated how to exploit logic inference rules to explain and improve the learning of neural networks.

More than 50 participants attended the tutorial. The mission of the tutorial to bridge the gap between connectionist and symbolic approaches of AI was much appreciated. Many participants found the tutorial inspiring and helpful, especially for those young researchers who had never been exposed to a wealth of different viewpoints on AI developments.



## ICPR 2018 Contests

### **Fraud Detection Contest: Find It!**

An ICPR 2018 Contest, Beijing, China, August 20, 2018

**Organizers: Chloé Artaud, Nicolas Sidère, Antoine Doucet, Jean-Marc Ogier, Vincent Poulain d'Andecy**

Since the last decades, the explosion of the volume of digital document images and the development of consumer tools to forge these images has led to a huge increase of corrupted documents. The development of many tools and methods to detect modifications has also increased, but benchmarking has remained a challenge.

Forensics research is quite a sensitive topic. Data are either private or unlabeled, and most of the related works are evaluated on private datasets with restricted access. This restriction has two major consequences: results can't be reproduced and benchmarking can't be done between every approach. Furthermore, recent research in document forensics has mostly focused on the analysis of images of documents. However, we believe that Natural Language Processing (NLP) and Knowledge Engineering (KE) could be used to improve the performance of fraudulent document detection. A document is not only an image: it contains textual information that can be processed, analyzed and verified.

Based on receipt images, this contest was conceived in order to address these drawbacks. First, a database containing no private information was assembled so that it can be publicly spread and used with no constraints (blurring, masking or anything else). Second, we provided an Image-Text parallel corpus and a unique benchmark to test and evaluate image-based and text-based methods for forged document detection.

The contest had two main goals: (1) to detect documents containing at least one forgery in a flow of genuine documents. (2) to spot and localize these forgeries in documents.

The contest was appealing for numerous researchers working on detection of corruptions in documents. In total, 36 teams registered; 5 of them submitted results to Task 1, while 2 did so for Task 2. One third of the participants did not come from academic research, but from industry, police, forensics laboratory... This proves the attractiveness of the topic and the need in datasets and methods to detect forged documents.

We want to congratulate the winning team of the first task composed of : Markos Zampoglou, Olga Papadopoulou, Akis Papadopoulos, Ioannis Kompatsiaris and Chryssanthi Iakovidou, from CERTH-ITI (Greece), and the winning team of the second task : Luisa Verdoliva's team from the University Federico II of Naples (Italy). We would also like to thank the teams of Alexandre Fabre, Francisco Cruz and Christian Clausner for their participation and motivated implication.

The details of dataset, ground truth, evaluation tools and results are presented and freely available on the website of the contest: <http://findit.univ-lr.fr/>.

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## Contest on Multimedia Information Processing for Personality & Social Networks Analysis Challenge

An ICPR 2018 Contest, Beijing, China, August 20, 2018

Please see related workshop report, [MIPPSNA 2018](#)

## Contest on Object Detection in Aerial Images (ODAI 2018)

An ICPR 2018 Contest, Beijing, China, August 20, 2018

<https://captain-whu.github.io/ODAI/index.html>

**Organizers:** Gui-Song Xia (LIESMARS, Wuhan University, China), Xiang Bai (Huazhong University of Science and Technology, China), Serge Belongie (Cornell University, United States), Jiebo Luo (University of Rochester, United States), Mihai Datcu (German Aerospace Center (DLR), Germany), Marcello Pelillo (Ca' Foscari University of Venice, Italy), Liangpei Zhang (LIESMARS, Wuhan University, China), and Qikai Lu (Wuhan University, China)

The ODAI contest focused on object detection in aerial images, which is an essential problem that has many practical applications, such as dynamic monitoring of vehicles at public locations and instant numbering of objects for statistics etc. With the rapid development of remote sensing technologies and computer vision algorithms, it has received tremendous attention in these years.

The contest used a large-scale dataset with 2000 large images (~ 4k x 4k pixels), which is composed of 15 categories and 211,581 instances. Based on the observation that an object instance in the aerial image can be arbitrarily oriented, the contest provided label of each instance by using an arbitrary (8 d.o.f.) quadrilateral.

The contest proposed two tasks named the object detection with oriented bounding boxes (OD-OBB) and object detection with horizontal bounding boxes (OD-HBB). The contest opened on February 7, 2018, when the

website was public online. It released the images and ground-truths of training and validation, test images at the same time. The submission server was open for participants to send their results from March 16, 2018 to April 25, 2018.

In total, it received 60 registrations altogether, coming from China, German, South Korea, Singapore and the United States, such as DLR, Satreci, NTU and NT concepts.

Finally, eight teams successfully submitted results on Task1, and nine teams successfully submitted results on Task2 before the deadline.

The USTC-NELSLIP team with members Y. Zhu, C. Ma and J. Du from Univ. Sci. Tech. China (USTC) won both the OD-HBB task and the OD-HBB task.

For more details on the competition please refer to <https://captain-whu.github.io/ODAI/index.html>.



ODAI 2018 Award Ceremony

# "Summaries for Dummies"

*Editor's note:*

*Authors of ICPR 2018 Best Paper Awards were invited to submit to this issue of the Newsletter summaries of their winning papers written for a general audience (a.k.a. "for dummies"). These submissions are published in this section of the ICPR 2018 Highlights. Let us know what you think...should we do this again for ICPR 2020?*

*~ Arjan Kuijper, Editor-in-Chief*

Summary of Best Scientific Paper for Track 2: Computer Vision

## ***"Scalable Monocular SLAM by Fusing and Connecting Line Segments with Inverse Depth Filter"***

**by Jiyuan Zhang, Gang Zeng, and Hongbin Zha**

Simultaneous Localization And Mapping (SLAM) is an important application in computer vision. It can be seen as a specialized form of the Structure from Motion (SfM) problem, where a 3D map of the scene is reconstructed from a collection of images at different viewpoints. SLAM pays more attention to sequential input and fast processing, at the cost of coarse reconstructed map.

Classic SLAM pipelines use feature points in image and thus sparse 3D points in map. However in manmade environments other features such as lines are commonly available, and useful. Using lines as additional

features in SLAM improves the performance of the system in the sense that camera localization is more precise and the map is more visually plausible.

Using line as feature requires matching them in different views. Line tracking is employed to take advantage of continuous input video in SLAM. In order to track line efficiently not only image information but also 3D estimation is used.

Inspired by inverse depth tracking of feature points, a novel inverse depth parameterization of line is proposed in this paper. The depth information of a line is represented by 2-dimensional

Gaussian distribution which is trackable by classic Kalman filter at minimal cost. Every point on the line contributes to the filter, so the line tracker is not severely damaged by a few missing points. With successfully tracked lines the line features are matched across views just like feature points. All features are then optimized with combination of camera poses in the manner of conventional bundle adjustment. Real world monocular sequences have demonstrated that the proposed SLAM system outperforms the state-of-the-art and produces accurate results in both indoor and outdoor scenes.



## "Learning Graph Distances with Message Passing Neural Networks"

by Pau Riba, Andreas Fischer, Josep Lladós, and Alicia Fornés

Graph representations have been widely used in pattern recognition thanks to their powerful representation formalism and rich theoretical background. Since graphs are symbolic representations, they are more complex than vectorial representations such as SIFT or HOG, where simple mathematical operations can be applied. Lots of effort has been made in the direction of defining error-tolerant or inexact graph matching algorithms to cope with deformations between graphs. Graph edit distance (GED) [1] algorithms have been widely proposed, however the time complexity—which is exponential with respect to the number of nodes of the input graphs—makes it unfeasible in a real application. Several algorithms have been proposed to cope with this complexity [2,3]. However, these approximate algorithms only consider very local node structures in their computation. In this paper, we propose an efficient graph distance based on the emerging field of geometric deep learning.

**Geometric deep learning**<sup>1</sup> deals with the extension of Deep Learning techniques to graph/manifold structured data. Specifically on graphs, the framework proposed by Gilmer et al. [4] has been used. In this approach, **Message Passing Neural Networks** are defined as a single common framework which is able to reformulate the existing deep learning models in the literature dealing with graphs. The

<sup>1</sup><http://geometricdeeplearning.com>

proposed approach propagates node and edge information among the graph using learnable functions. Finally, a feature vector is computed from the set of learned node labels. In this way, a network can be trained end-to-end dealing with structured data.

Our method employs a Message Passing Neural Network to capture the graph structure in an enriched graph representation. However, instead of learning a final graph embedding in order to map a structural representation to a vectorial space, we propose to learn a Hausdorff-based metric following a siamese neural network approach. Therefore, the proposed method is learning a metric space where graphs belonging to the same class are close in the space and graphs from different classes are separated enough. The performance of the proposed graph distance is validated in two application cases, graph classification and graph retrieval

of handwritten words, and shows promising performance when compared with (approximate) graph edit distance benchmarks.

[1] X. Gao, B. Xiao, D. Tao, and X. Li, "A survey of graph edit distance," PAA, vol. 13, no. 1, pp. 113–129, 2010.

[2] K. Riesen and H. Bunke, "Approximate graph edit distance computation by means of bipartite graph matching", IVC, vol. 27, no. 7, pp. 950 –959, 2009

[3] A. Fischer, C. Y. Suen, V. Frinken, K. Riesen, and H. Bunke, "Approximation of graph edit distance based on Hausdorff matching", PR, vol. 48, no. 2, pp. 331 – 343, 2015.

[4] J. Gilmer, S. S. Schoenholz, P. F. Riley, O. Vinyals, G. E. Dahl, "Neural Message Passing for Quantum Chemistry", ICML 2017



**Coprocessing.**

Summary of Best Scientific Paper for Track 6: Biomedical Imaging and Bioinformatics

## *"Interactive Segmentation of Glioblastoma for Post-Surgical Treatment Follow-Up"*

**by Ashis Kumar Dhara, Erik Arvids, Markus Fahlström, Johan Wikström, Elna-Marie Larsson, and Robin Strand**

The most common malignant tumours of the brain are gliomas, and they account for more than 80% of all primary brain malignancies. Time-efficient, accurate, precise and reproducible segmentation and volumetric quantification of the most aggressive form of glioma, glioblastoma, in Magnetic Resonance Imaging (MRI) of brain is very important for post-surgical treatment follow-up. Volumetric quantification is typically done by measuring diameters. More precise manual quantification is time consuming and subject to high inter-observer variability. Fully-automated segmentation of glioblastoma is difficult due to poor contrast, the presence of necrosis and post-operative hemorrhage. Therefore, interactive segmentation is essential

for postsurgical analysis and understanding treatment response of glioblastoma patients.

In this paper, we build on our previous knowledge of interactive image processing and deep learning and present a method for interactive refinement of automatically generated segmentations. A U-net based fully convolutional network is combined with an interactive refinement technique. Initial segmentation of brain tumor is performed using U-net, and the result is further improved by including complex foreground regions or removing background regions in an iterative manner. The method is evaluated on a research database containing post-operative glioblastoma of 15 patients. Radiologists can refine initial segmentation results in about 90 seconds, which is

well below the time of interactive segmentation from scratch using state-of-the-art interactive segmentation tools.

The combination of the power of convolutional neural network and interactive feedback from expert users has the potential to become a valuable tool for treatment follow-up analysis in neuroradiology. The enormous amount of information in a typical MRI brain volume scan, and difficulties such as partial volume effects, noise, artifacts, etc., puts very high demands on the radiologists. In the future, interactive feedback from expert neuroradiologists will be used to train convolutional neural networks. Such systems will be used for treatment follow-up analysis in neuroradiology and will have a potentially high impact on the clinical routine.

Summary of Best Student Paper Track 1: Pattern Recognition and Machine Learning

## *"A Linear Incremental Nyström Method for Online Kernel Learning"*

**Student Author: Shan Xu; Co-authors: Xiao Zhang, and Shizhong Liao**

Online kernel learning has been used in machine learning and pattern recognition, such as recommendation system, text classification and face recognition, but it requires to update incrementally the classifier in a low time complexity with theoretical guarantees. To address

these issues, we propose a novel incremental Nyström method suitable for online kernel learning, which incrementally maintains matrix updates, reduces the time complexity from cubic to linear at each round, and enjoys a relative approximation error and sublinear regret bound. The formulation and

implementation of the proposed incremental Nyström method are promising for large-scale matrix computation and online learning.

# 2018 IAPR Fellows



**Michael Bronstein (Switzerland)**

*For contributions to 3D data acquisition, processing, representation and analysis*

**Andrea Cavallaro (UK)**

*For contributions to image processing and multi-sensor scene understanding*

**C. L. Philip Chen (Hong Kong)**

*For contributions to machine learning algorithms and applications to image processing, security, recognition, and classification*

**Songcan Chen (China)**

*For contributions to fuzzy clustering, feature extraction, and pattern classification*

**Sven J. Dickinson (Canada)**

*For contributions to shape perception, object recognition, perceptual organization, and graph-based methods in computer vision*

**Jean-Luc Dugelay (France)**

*For contributions to face recognition and soft biometrics*

**Janne T. Heikkilä (Finland)**

*For contributions to 3D computer vision and image analysis*

**Ujjwal Maulik (India)**

*For contributions to pattern recognition and machine learning, with applications to image analysis and computational biology*

**Javier Ortega-Garcia (Spain)**

*For contributions to biometric recognition, especially in behavioral traits including speech and handwritten and human-device interactions*

**Paul L. Rosin (UK)**

*For contributions to image processing and computer vision*

**Arun A. Ross (USA)**

*For contributions that significantly advance biometric technologies; extend considerably its infrastructure; and enable its continuing scientific advances*

**Bernt Schiele (Germany)**

*For contributions to large-scale object recognition, human detection and pose estimation*

**Ling Shao (UK)**

*For contributions to human action recognition and video understanding*

**Dinggang Shen (USA)**

*For contributions to biomedical applications of pattern recognition and medical image analysis*

**Richa Singh (India)**

*For contributions to face recognition and pattern classification*

**Jingdong Wang (China)**

*For contributions to multimedia search, similarity search, attention analysis, and video surveillance*

**Yunhong Wang (China)**

*For contributions to biometrics, computer vision, and pattern recognition*

**Junsong Yuan (Singapore)**

*For contributions to human action and gesture analysis*

**Pong Chi Yuen (Hong Kong)**

*For contributions to subspace learning and information fusion for visual recognition*

**Huaguang Zhang (China)**

*For contributions to stability analysis of recurrent time-delay neural networks and identification of weak signals*



# Congratulations!

ICPR 2018 Award Winners

## ICPR 2018 Best Paper Awards

Best Industry Related Paper Award

presented to

Zhengyuan Yang, Yixuan Zhang, Jerry Yu,  
Junjie Cai and Jiebo Luo

for the 24th ICPR paper

*"End-to-end Multi-Modal Multi-Task Vehicle Control  
for Self-Driving Cars with Visual Perceptions"*



Piero Zamperoni Best Student Paper Award

presented to

Kunkun Pang

for the 24th ICPR paper

*"Dynamic Ensemble Active Learning:  
A Non-Stationary Bandit with Expert Advice"*

authors: Kunkun Pang, Mingzhi Dong, Yang Wu,  
and Timothy Hospedales

**NOTE:**

Kunkun Pang is the author of the [IAPR...The Next Generation](#) column in this issue of the IAPR newsletter.

~A. Kuijper, EiC, IAPR Newsletter

# ICPR 2018 Best Scientific Paper Awards



Track 1: Pattern Recognition and Machine Learning

**Zhihong Zhang, Da Zhou, Chuanyu Xu, Beizhan Wang, Dong Wang, Guijun Ren, Edwin Hancock, Lu Bai, and Lixin Cui**

*"Depth-Based Subgraph Convolutional Neural Networks"*



Track 2: Computer Vision

**Jiyuan Zhang, Gang Zeng, and Hongbin Zha**

*"Scalable Monocular SLAM by Fusing and Connecting Line Segments with Inverse Depth Filter"*

Please see the ["Summaries for Dummies"](#) section of the ICPR Highlights.

~A. Kuijper, EiC, IAPR Newsletter



Track 3: Speech, Image, Video, and Multimedia

**Jiedong Hao, Jing Dong, Wei Wang, and Tieniu Tan**

*"DeepFirearm: Learning Discriminative Feature Representation for Fine-Grained Firearm Retrieval"*



Track 4: Biometrics and Human Computer Interaction

**Qin Xu, Yifan Sun, ; Yal Li, and Shengjin Wang**

*"Attend and Align: Improving Deep Representation with Feature Alignment Layer for Person Retrieval"*



Track 5: Document Analysis and Recognition

**Pau Riba, Andreas Fischer, Josep Lladós, and Alicia Fornés**

*"Learning Graph Distances with Message Passing Neural Networks"*

Please see the ["Summaries for Dummies"](#) section of the ICPR Highlights.

~A. Kuijper, EiC, IAPR Newsletter



Track 6: Biomedical Imaging and Bioinformatics

**Ashis Kumar Dhara, Erik Arvids, Markus Fahlström, Johan Wikström, Elna-Marie Larsson, and Robin Strand**

*"Interactive Segmentation of Glioblastoma for Post-Surgical Treatment Follow-Up"*

Please see the ["Summaries for Dummies"](#) section of the ICPR Highlights.

~A. Kuijper, EiC, IAPR Newsletter

## ICPR 2018 Best Student Paper Awards



Track 1: Pattern Recognition and Machine Learning

**Shan Xu**

*"A Linear Incremental Nyström Method for Online Kernel Learning"*

Authors: Shan Xu, Xiao Zhang, and Shizhong Liao

Please see the ["Summaries for Dummies"](#) section of the ICPR Highlights.

~A. Kuijper, EiC, IAPR Newsletter



Track 2: Computer Vision

**Doris Antensteiner**

*"Variational Fusion of Light Field and Photometric Stereo for Precise 3D Sensing within a Multi-Line Scan Framework"*

Authors: Doris Antensteiner, Svorad Štolc, and Thomas Pock



Track 3: Speech, Image, Video, and Multimedia

**Pramuditha Perera**

*"In2I: Unsupervised Multi-Image-to-Image Translation Using Generative Adversarial Networks"*

Authors: Pramuditha Perera, Abavisani Mahdi, and Vishal Patel



Track 4: Biometrics and Human Computer Interaction

**Vishwanath Sindagi**

*"GP-GAN: Gender Preserving GAN for Synthesizing Faces from Landmarks"*

Authors: Vishwanath Sindagi, Vishal Patel, and Xing Di



Track 5: Document Analysis and Recognition

**Shailza Jolly**

*"Variational Fusion of Light Field and Photometric Stereo for Precise 3D Sensing within a Multi-Line Scan Framework"*

Authors: Shailza Jolly, Brian Kenji Iwana, Ryohei Kuroki, and Seiichi Uchida



Track 6: Biomedical Imaging and Bioinformatics

**Daniel López Martínez**

*"Multi-Task Multiple Kernel Machines for Personalized Pain Recognition from Functional Near-Infrared Spectroscopy Brain Signals"*

Authors: Daniel López Martínez, Ke Peng, Sarah Steele, Arielle Lee, David Borsook, and Rosalind Picard



## IAPR Service Award



IAPR Certificate of Appreciation

presented to

Rangachar Kasturi

*for his outstanding work as Chair of the 2016-18 Advisory Committee and for his essential service to the IAPR*



ELSEVIER

## Elsevier Awards presented at ICPR 2018

Elsevier Journal of the Pattern Recognition Society

Pattern Recognition Best Paper Award for 2015

presented to

Shengyong Ding, Liang Lin, Guangrun Wang, and Hongyang Chao

for the paper entitled

"Deep feature learning with relative distance comparison for person re-identification"

*Pattern Recognition*. Volume 48 (2015), pp. 2993-3003.



Elsevier Journal of the Pattern Recognition Society

Pattern Recognition Best Paper Award for 2016

presented to

Sarah M. Erfani, Sutharshan Rajasegarar, Shanika Karunasekera, and Christopher Leckie

for the paper entitled

"High-dimensional and large-scale anomaly detection using a linear one-class SVM with deep learning"

*Pattern Recognition*. Volume 58 (2016), pp. 121-134.

# The 2018 Meeting of the IAPR Governing Board

The IAPR Governing Board meets every two years during the ICPR conference. Representatives from all of the IAPR's member societies get together to discuss and vote on matters of high importance to the governance of the IAPR.

Some of the key outcomes of the 2018 Governing Board meeting are listed below. (See the [IAPR News](#) at the [IAPR website](#) and future issues of the [IAPR Newsletter](#) for more information as it becomes available.)

- A new member society from Indonesia was approved by a unanimous GB vote (See [related article](#) on the Indonesian Association for Pattern Recognition in this issue.)
- A new Technical Committee, IAPR TC5 on Computer Vision for Underwater Environmental Monitoring was approved.
- The venue of ICPR 2022 will be Montreal, Canada. This venue was selected by vote from between two competing bids of excellent quality.
- The Governing Board was also reminded that the IAPR levy (for IAPR-sponsored conferences that take place after June 30, 2019) will increase from US \$20 to US \$30 per participant. This increase will provide additional funding for IAPR activities aimed at benefiting the community (e.g., IAPR Summer Schools). Conferences can still request to use a portion of the levy for IAPR-related activities, e.g., IAPR Best Paper Awards, and IAPR Invited Speakers.

## IAPR Executive Committee for the 2018-2020 Term



(left to right) President Apostolos Antonacopoulos, First Vice-President Alexandra Branzan-Albu, Second Vice-President Lale Akarun, Treasurer Dan Lopresti, Secretary Arjan Kuijper, and Past President Simone Marinai

# BOOKSBOOKSBOOKS

## First Course in Machine Learning, Second Edition

by Simon Rogers and Mark Girolami

CRC Pres, Taylor and Francis Group, 2017

<https://www.crcpress.com/A-First-Course-in-Machine-Learning-Second-Edition/Rogers-Girolami/p-book/9781498738484>

Reviewed by Prof. Tanish Zaveri, Professor, EC Department, Institute of Technology, Nirma University, Ahmedabad, Gujarat, India

The book has a companion site hosted by authors where you can get supplementary material. Refer following link: <http://www.dcs.gla.ac.uk/~srogers/firstcourseml/>.

This book requires basic mathematical prerequisites and is suitable for undergraduate engineering or physics students. The practical implementation of various algorithms and concepts, including source scripts, are provided, and the reader can understand coarser details when they will go through all three aspects (equation to algorithm to scripts) of any algorithm in this book. An extensive collection of MATLAB/Octave/R/Python scripts is available on book's website.

The book has 10 chapters, and most of the basic machine learning topics are covered well, suitable for teaching an undergraduate level machine learning course. The core areas of machine learning like classification, clustering, and projections are presented in this book, and additional core mathematical and statistical methods are also described. In

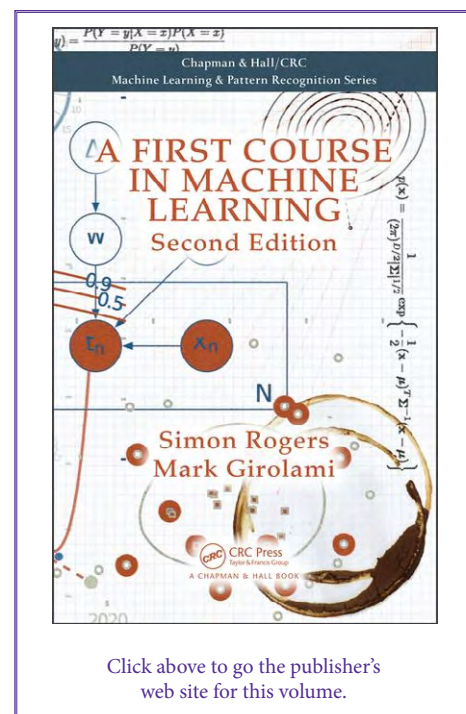
the Second Edition, three more chapters were added in Section II, where advanced machine learning methods: Probabilistic – Gaussian Process, Markov Chain Monte Carlo Sampling, and Mixture Modeling are included.

The first chapter, Linear Modelling: A Least Squares Approach, provides details about learning and inferring a functional relationship between a set of attribute variables and product responses. Various linear and nonlinear modelling techniques are explained in this chapter with essential mathematical details and examples. All the chapters in this book end with exercises and references.

In the second chapter, Linear Modelling: a Maximum Likelihood Approach, the basics of random variables and probability theory are explained, providing the foundation to model errors due to noise between data and the proposed deterministic model. Theoretical properties of maximum likelihood parameters and their effects are explained with examples.

*“The book is useful for both undergraduate and postgraduate students and faculty members who want to learn concepts with minimal math. The authors have used examples to explain different topics so that the reader can critically think, analyze, and compare the different algorithms. Programming examples help readers formulate their research problems and select the appropriate model.”*

*- Tanish Zaveri, Professor, Nirma University, Gujarat, India*



Click above to go the publisher's web site for this volume.

The third chapter describes how to use the Bayesian approach to perform machine learning tasks by treating all of the parameters as random variables. The posterior distribution for three different scenarios are described with coin examples. For each scenario, the expected probability of winning is computed and circumstances are inferred. The Olympic 100m data is used to compute posterior to make predictions for the new Olympic years. The next chapter introduces three approximation methods that are point estimates, Laplace approximations and Markov Chain Monte Carlo.

The aim of Bayesian Inference chapter is to demonstrate how to use Bayesian framework when the distribution of interest cannot be represented analytically. The three approximation approaches were described in detail.

Four popular classification algorithms are described



in Chapter 5. Concepts of probabilistic and non-probabilistic classification are introduced, and the authors present two algorithms for each. Two challenging examples of automatic disease diagnosis and text classification are discussed. The assessment parameters like accuracy, sensitivity and specificity, ROC curve and confusion matrix are described in brief to analyze the performance of classification algorithms.

The next chapter describes two families of clustering algorithms: K means and mixture models to find global optima or the overall best solution of objective function. The models are explained with mathematical equations and case studies.

In Chapter 7, unsupervised projection methods, mainly Principle Component Analysis and its probabilistic variants are described. The PCA, which is the most widely used statistical method for projecting data into lower dimension space, is described. The procedure to compute PCA, with examples and limitations, is also described. It is shown with empirical evidence that Variational Bayes is an increasingly popular inference technique in machine learning as it provides good balance between tractability and accuracy.

Section II of the book has three chapters on advance topics.

The Gaussian Process Models are presented in Chapter 8. This chapter is a quick tour of Gaussian Process Models for regression and classification. Both point parameter estimates and Laplace approximation to the posterior methods are explained in detail in this chapter.

The theory behind Markov Chain Monte Carlo (MCMC) is explained

in Chapter 9. The first part of the chapter introduces Gibb's Sampling and demonstrates its use through sampling from Gaussian Process (GP) as well as GP classification model. The other part of the chapter explains advanced sampling techniques and practical issues of assessing convergence and reducing sample dependence.

Mixture models as statistical methods for clustering were introduced in Chapter 6, and this mixture allows modelling of complex distributions. In Chapter 10, advanced mixture models are described, introducing infinite mixture models, Dirichlet processes, and Latent Dirichlet

Allocation.

This book provides necessary background to explore and understand the theory behind fundamental and advanced machine learning methods. The language is simple and point-to-point explanations with examples make this book different from other reference books. The unsolved problems and references are also useful for the reader to go into the details of the individual algorithms that are explained in the book.

I really enjoyed reading this book, and I found that it is suitable for beginners and also for experienced researchers for hands-on reference.



Permanent link to this comic: <https://xkcd.com/1838/>

Image URL (for hotlinking/embedding): [https://imgs.xkcd.com/comics/machine\\_learning.png](https://imgs.xkcd.com/comics/machine_learning.png)

# FREE BOOKS / eBOOKS

Various publishers have partnered with the IAPR Newsletter to offer free books/ebooks to reviewers. If you have interest in and some knowledge of the topic, email us. Depending upon the publisher's availability, you will get an ebook or a hardcopy book or both. In some cases, the publisher may send the ebook first and the hardcopy after review. In future issues of the Newsletter, we may publish a list of pending reviews.

~[Owais Mehmood](#), Associate Editor for Book Reviews



We are offering the following Springer titles for review:

- \* **"Denoising of Photographic Images and Video"** by Marcelo Bertalmio (Ed.): <https://www.springer.com/book/9783319960289>
- \* **"Composing Fisher Kernels from Deep Neural Models"** by Tayyaba Azim and Sarah Ahmed: <https://www.springer.com/book/9783319985237>
- \* **"Nonlinear Eigenproblems in Image Processing and Computer Vision"** by Guy Gilboa: <http://www.springer.com/book/9783319758466>
- \* **"Domain Adaptation in Computer Vision Applications"** by Gabriela Csurka (Ed.): <http://www.springer.com/book/9783319583464>
- \* **"Deep Learning for Biometrics"** by Bir Bhanu et al. (Eds.): <http://www.springer.com/book/9783319616568>
- \* **"Decision Forests for Computer Vision and Medical Image Analysis"** by Antonio Criminisi and J. Shotton (Eds.): <http://www.springer.com/gb/book/9781447149286>



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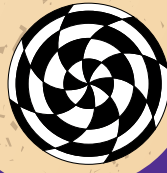
- \* **Image Operators: Image Processing in Python** by Jason M. Kinser: <https://www.crcpress.com/Image-Operators-Image-Processing-in-Python/Kinser/p/book/9781498796187>
- \* **A Beginner's Guide to Image Pre-processing Techniques** by Jyotismita Chaki and Nilanjan Dey: <https://www.crcpress.com/A-Beginners-Guide-to-Image-Pre-processing-Techniques/Chaki-Dey/p/book/9781138339316>
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- \* **Remote Sensing Time Series Image Processing** by Qihao Weng: <https://www.crcpress.com/Remote-Sensing-Time-Series-Image-Processing/Weng/p/book/9781138054592>
- \* **Remote Sensing and Cognition: Human Factors in Image Interpretation** by Raechel A. White, Arzu Coltekin, and Robert R. Hoffman: <https://www.crcpress.com/Remote-Sensing-and-Cognition-Human-Factors-in-Image-Interpretation/White-Coltekin-Hoffman/p/book/9781498781565>
- \* **High Spatial Resolution Remote Sensing: Data, Analysis, and Applications** by Yuhong He and Qihao Weng: <https://www.crcpress.com/High-Spatial-Resolution-Remote-Sensing-Data-Analysis-and-Applications/He-Weng/p/book/9781498767682>
- \* **Image Processing and Data Analysis with ERDAS IMAGINE®** by Stacy A. C. Nelson and Siamak Khorram: <https://www.crcpress.com/Image-Processing-and-Data-Analysis-with-ERDAS-IMAGINE/AC-Nelson-Khorram/p/book/9781138034983>



We are offering any of the following from Sebtel Press, Sheffield, UK:

- \* **Principles of Neural Information Theory: Computational Neuroscience and Metabolic Efficiency** by Dr. James V. Stone: <http://jim-stone.staff.shef.ac.uk/BookNeuralInfo/NeuralInfoMain.html>

# IAPR



This bulletin board contains items of interest to the IAPR Community



Don't miss these important items in this issue:

[New IAPR Technical Committee on Computer Vision for Underwater Environmental Monitoring](#)

[New IAPR Member Society from Indonesia](#)

[ICPR 2018 Highlights!](#)



Springer



Through an agreement with Springer, IAPR members can get discounted electronic subscriptions to the [International Journal on Document Analysis and Recognition \(IJ DAR\)](#) and [Machine Vision & Applications \(MV&A\)](#).

**Deadline to subscribe: March 31, 2019**

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# Meeting and Education Planner

The IAPR web site has the most up-to-date information on IAPR events. Click [here](#).

NOTE: Highlighting indicates that the paper submission deadline is still open.

\* Asterisks denote non-IAPR events \*

	Meeting	Report on previous edition	Venue
2018	<a href="#">ISAIR 2018</a> : 3rd Intl. Symposium on Artificial Intelligence and Robotics		China
	<a href="#">IVCNZ 2018</a> : Image and Vision Computing New Zealand 2018	<a href="#">IVCNZ 2016</a>	New Zealand
	<a href="#">CIARP 2018</a> : 23rd Iberoamerican Congress on Pattern Recognition	<a href="#">CIARP 2017</a>	Spain
	<a href="#">DICTA 2018</a> : Digital Image Computing: Techniques and Applications	<a href="#">DICTA 2017</a>	Australia
2019	<a href="#">ICPRAM 2019</a> : 8th International Conference on Pattern Recognition Applications and Methods	<a href="#">ICPRAM 2018</a>	Czech Republic
	<a href="#">DGCI 2019</a> : 21st International Conference on Discrete Geometry for Computer Imagery	<a href="#">DGCI 2017</a>	France
	<a href="#">CCIW 2019</a> : 2019 Computational Color Imaging Workshop	<a href="#">CCIW 2017</a>	Japan
	<a href="#">IWFBI 2019</a> : 7th International Workshop on Biometrics and Forensics	<a href="#">IWFBI 2017</a>	Mexico
	<a href="#">PRIP 2019</a> : 14th Intl. Conf. on Pattern Recognition and Information Processing	<a href="#">PRIP 2016</a>	Belarus
	<a href="#">MVA 2019</a> : 16th International Conference on Machine Vision Applications	<a href="#">MVA 2017</a>	Japan
	<a href="#">ICB 2019</a> : 12th IAPR International Conference on Biometrics	<a href="#">ICB 2018</a>	Greece
	<a href="#">SCIA 2019</a> : 21st Scandinavian Conference on Image Analysis	<a href="#">SCIA 2017</a>	Sweden
	<a href="#">GbR 2019</a> : 12th International Workshop on Graph-based Representation	<a href="#">GbR 2017</a>	France
	<a href="#">IbPRIA 2019</a> : 9th Iberian Conf. on Pattern Recognition and Image Analysis		Spain
	<a href="#">CAIP 2019</a> : 18th Intl. Conf. on Computer Analysis of Images and Patterns		Italy
	<a href="#">MedPRAI 2019</a> : 3rd Mediterranean Conference on Pattern Recognition and Artificial Intelligence	<a href="#">MedPRAI 2016</a>	Turkey
	2020	<a href="#">ICFHR 2020</a> : 25th International Conference on Pattern Recognition	<a href="#">ICFHR 2016</a>
ICPR 2020: 25th International Conference on Pattern Recognition		<a href="#">ICPR 2018</a>	Italy

The *IAPR Newsletter* is published in association with the IAPR website, [www.iapr.org](http://www.iapr.org)  
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Deadline for the next issue: January 4, 2018

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