



European Association for Signal Processing

Summer school report

20th International Summer School for Advances in Biometric Authentication: 20 Years of Biometrics: Reflections and Outlooks

The 2023 Eurasip summer school on biometrics has been held on June 5th to 9th 2023 in Alghero, Italy. This was the 20th edition of a strongly established training course started in 2003 to promote knowledge dissemination and research in Biometrics and related fields. The school was technically co-sponsored by Eurasip, the European Association for Biometrics, the IAPR and IEEE.

The school main theme addressed the scientific and technological advances observed in the last 20 years, wishing to tide up the knowledge accrued over the past two decades with the current trends in AI and related fields. The school particularly addressed how the most advanced technologies for personal recognition impact now the society and how they can be applied for social good.

Several subjects were taught at the summer school forming a total of 30 hours of theoretical lectures from 20 different lecturers, two informal round tables and one panel session.

The subjects ranged from fundamentals, such as machine learning and pattern recognition techniques applied to biometrics, as well as more advanced topics such as neuroscience and applied subjects such as the design of ethical systems, large-scale evaluation and the deployment of biometrics technologies in forensic cases. This 20th edition of the summer school, featured a line-up of exceptional lecturers, selected from the editorial boards of top-level scientific journals and conferences. The opening, by **prof. Anil Jain**, among the fathers of today's Biometrics, presented an overview of the progress made in the last two decades and the current state of the art in Biometric technologies and the most promising applications for future developments. **Prof. Tomaso Poggio**, among the fathers of computational neuroscience and machine learning, presented a keynote on the most recent findings in developing a theory and a mathematical framework for deep learning. **Prof. James Haxby**, an outstanding neuroscientist from Dartmouth College, presented a lecture on the representation of visual data in the brain and the topographic mapping to design such representations from fMRI recordings. **Prof. Tal Hassner**, from Meta research labs, presented an overview of how to deploy deep learning and convolutional neural networks in biometrics. **Prof. Arun Ross**, from Michigan State University, presented a lecture on iris and periocular biometrics. **Prof. Massimo Tistarelli**, from University of Sassari, proposed a number of open and challenging scientific questions to illustrate the past and the envisioned future of face recognition research. **Prof. Anoop Namboodiri**, from IIT Hyderabad, described the scientific challenges and research outcomes resulting from the most massive deployment of biometrics: the AADHAAR system in India. **Prof. Michael King**, from Florida Tech University, well described the bias effects in the AI models currently deployed and designed for the development of biometric systems. All lecturers, among the most highly reputed experts in their fields, presented the most up-to-date view in Biometric technologies.

Given the recent Covid-19 outbreak, all school sessions were delivered in hybrid mode, allowing participants on site and connected remotely to follow all lectures. Several technological platforms have been used to facilitate the engagement of all participants and to maximize the benefits of ongoing discussions, also without the physical presence.

The complete list of lecturers and the presented lectures is as follows:

- **Monday June 5**

- **Prof. Massimo Tistarelli** (University of Sassari, Italy) *Opening and presentation of the school courses.*
- **Prof. Anil Jain** (Michigan State University, USA) *20 Years of Biometrics: Reflections and Outlooks.*
- **Prof. Alessandro Verri** (University of Genova, Italy) *Machine Learning (for Biometrics).*
- **Prof Mark Nixon** (University of Southampton, UK) *Gait and Soft biometrics and some practical issues.*
- **Prof. Tal Hassner** (Meta, USA) *Deep Learning for Biometrics.*
- **Prof. Tomaso Poggio** (Massachusetts Institute of Technology, USA) *Deep Learning: Compositional Sparsity.*

- **Tuesday June 6**

- **Prof. Nicholas Evans** (EURECOM, France) *Speaker Recognition.*
- **Prof. Davide Maltoni** (University of Bologna, Italy) *Hands on Fingerprint Recognition with OpenCV and Python.*
- **Prof. Arun Ross** (Michigan State University, USA) *Iris and Peri-ocular Recognition.*
- **Prof. Massimo Tistarelli** (University of Sassari, Italy) *30 Years of Face Recognition Research: Reflections and Outlooks.*
- **Prof. Christoph Busch** (Hochschule Darmstadt, Germany) *Morphing Attack Detection.*

- **Wednesday June 7**

- **Dr. Jonathon Phillips** (NIST, USA) *30 Years of Face Recognition Evaluations.*
- **Prof. Vishal Patel** (Johns Hopkins University, USA) *Federated Learning for Biometric Applications.*

- **Thursday June 8**

- **Prof. James Haxby** (Dartmouth College, USA) *Commonality of the Fine-Grained Structure of Neural Representations.*
- **Prof. Ida Gobbini** (University of Bologna, Italy) *Mechanisms for Face Recognition in Humans.*
- **Panel session on 20 Years of Biometrics** (*Anil Jain, Michael King, Alice O'Toole, Jonathon Phillips*) moderated by Arun Ross.

- **Dr. Fernando Ducay** (Armatura, USA) *AI in Security fo Biometrics*
 - **Prof. Alice O'Toole** (University of Texas at Dallas, USA) *Understanding face representations in deep CNNs: Turning the Black Box White.*
 - **Dr. Laurent Kazdaghi** (Idemia, France) *Exploiting biometrics: An Industrial Perspective.*
- **Friday June 9**
 - **Prof. Didier Meuwly** (Netherlands Forensic Institute, Netherlands) *Forensic biometrics: the use of biometric data and databases in forensic applications.*
 - **Prof. Michael King** (Florida Tech University, USA) *Understanding Bias in Biometrics.*
 - **Prof. Emilio Mordini** (Responsible Technology, France) *Biometrics, Ethics and Algorithms.*
 - **Prof. Massimo Tistarelli** (University of Sassari, Italy) *Concluding remarks and discussion.*

The school program was enriched by 2 **round tables**, hold on Tuesday and Thursday evening, on the impact of current concerns in the application of AI and the need for the development of ethical systems. On Thursday afternoon, a **panel** on the last 20 years of biometrics research, moderated by prof. Arun Ross, involved a stimulating discussion with 4 panelists: prof. Anil Jain, prof. Michael King, prof Alice O'Toole, Dr. Jonathon Phillips. All participants greatly appreciated these additional sessions and actively contributed to the discussion.

A particular effort was devoted to choose the applications for lecturing and to share data:

- Zoom Meetings was selected as the main platform to broadcast and record the lectures, as it allows to fully control the audio and video of the lecturers and of the participants. The technical staff carefully monitored all sessions and facilitated the participation of the audience, both on site and online, by enabling the audio-video resources whenever needed at the end of each lecture, or during the lecture.
- Slack has been used to provide a fast communication channel among all participants and the lecturers. Everybody could exchange documents, send messages and make quick calls for discussion, without the need to explicitly exchange personal data such as the phone number or the email.

Thanks to the Zoom platform, remote participants could not only directly ask questions, but also submit questions and statements online. In this way, also the most shy students could be actively involved and well interact with the lecturers.

In order to allow all participants to follow all lectures, despite of the large time differences due to the different time zones, all lectures were recorded and made available at the end of each day for two weeks.

The school participants were offered the possibility to display a poster on their research activity (posted for the entire week) and to submit a research paper to be orally presented at the special session organized on Monday evening.

56 participants, mainly from European countries, but also from India and Africa, attended the school lectures. The class was formed by students, researchers, professionals and officers,

coming from different universities, research centres, private companies and public offices in the following 11 different countries (in brackets is the number of participants):

- Africa (25), Belgium (1), France (5), India (2), Italy (12), Norway (1), Rwanda (23), Singapore (1), Switzerland (5), UK (5), USA (1).

The availability of a remote connection allowed many students from underdeveloped countries, such as Africa, to participate to the school defraying the travel costs.

This year's students demonstrated a strong interest in the impact of AI models in the development of novel biometric technologies. Most of them are either working directly in the design of biometric systems, for the deployment in the society or pursuing high-level scientific research in the field. This not only facilitated the interaction between students and lecturers, but also stimulated and challenged even the most experienced lecturers with questions and requests for explanations in the course of almost all presentations. As a result, both the students and lecturers have been much involved in technical discussions and plans for collaborations.

A unique introductory keynote has been delivered by Prof. Anil Jain, possibly the most outstanding and highly reputed scientist in the field of biometrics. The discussion was actively fostered by Prof. Anil Jain. The students actively participated to the discussion and very interesting conclusions were drawn on several aspects of biometrics and the application to forensic science, as well as to other scenarios involving the greater public.

Out of the 56 participants, **29 students could benefit of a full or partial scholarship** to cover the registration fees, thanks to the financial support generously provided by Eurasip, IAPR, IDEMIA and the IEEE Biometrics Council. All sponsorship support has been widely advertised during the school week.

For the future editions of the school we plan to continue the open evening discussions. These informal meetings were very much appreciated and provided several promising hints for further research and discussion.

