

FINAL REPORT

CIMPA Research School 2025

Control, Optimization and Model Reduction in Machine Learning

Hammamet & Sousse, 18 - 28 February 2025

This data science research was organized by the Pristini School of Artificial Intelligence in association with the Laboratory of Mathematical and Numerical Modeling in Engineering Sciences (LAMSin-ENIT) and Bordeaux INP. This research school was organized on the sidelines of the conference « Mathematics, Artificial Intelligence and applications », which is intended to become a periodic event, organized every two years under the auspices of the African Society of Data Science (ASDS).

Administrative and Coordinators : Maher Moakhar (ENIT-LAMSin, Tunisia), Mejd Azaiez (INP Bordeaux, France).

Scientific Committee :

Naceur Ammar (Pristini, Tunisia), Francisco Chinesta (ENSAM-France), Nabil Gmati (ENIT-Tunisia), Mohamed Jaoua (Pristini, Tunisia), Mohamed Masmoudi (Adagos-France), Paula Moraga (Kaust-KSA), Enrique Zuazua (FAU-Germany, UD and UAM – Spain).

Organizing Committee : Hend Ben Ameer (ENIT-LAMSin), Sabeur Amdouni (ENIT-LAMSin), Radhia Bessi (ENIT-LAMSin), Meriem Youssef (Pristini).

Project Description :

1 - Scientific content

Lectures:

L1 : Bessem ben Hamed, TUN (Introduction to Machine Learning and Deep Learning) . (6h00)

L2 : Imen Jendoubi, TUN (Reinforcement Learning for decision-making problems) . (6h00)

L3 : Angelo Iollo, FR (Model Reduction and Projection-Based Techniq) (6h00)

L4 : Clément Royer, FR (Optimization for Machine Learning) (6h00)

L5 : Enrique zuazua, ES (Control and Machine Learning) (6h00)

L6 : Hachem Kadri, FR (Quantum machine learning). (6h00)

Training :

**T1 : " Sequence-to-Sequence Deep Learning Models for Time Series Forecasting".
Marwa Hasni (TUN) & Meriem Youssef (TUN). (6h00)**

T2 : Sample Selection theory. Ikram Chairi (MAR). (6h00)

Professional Conferences :

-) **Hatem Zaag** (Université de Sorbonne Paris Nord, France). How can mathematics help with Inflammatory Bowel diseases (IBD) ?
-) **Elyes Ben Rayana** (BIAT ,Value, Tunisia). Finance and Artificial Intelligence.
-) **Wiem Dali**, Senior data Scientist, Cap GemA detailed description of the conference will be added later.ini, France).
-) **Nejib Zemzemi** (Research scientist INRIA Bordeaux Sud-Ouest). Data science for solving real-world clinical problems in Academia and Industry: Challenges and New regulations..
-) **Yann Ferguson** (LaboIA, INRIA, France). The unexpected advances of artificial intelligence.
-) **Khaled Ben Driss** (Wevioo, TUN). How we use and transmit the power of artificial intelligence.

Debate :

- 1) AI in business, technological change, human transformation.

Panel: Khaled Ben Driss, Yann Ferguson, Mohamed Larbi Rouis.

Debate :

- 2) In the age of AI, new professions, new skills, new learning paradigms.

Panel: Naceur Ammar, Mohamed Jaoua, Hatem Zaag.

2 - Participants

The school had 20 African participants from six different countries (Morocco 11, Algeria 3, Niger 2, Burkina Faso 2, Benin 1, South Africa 1). Aside from two Moroccan participants who were supported by their institutions, the other 19 were funded by the school's budget. Three French participants also took part in the event (two students and one research professor), while the three French participants were supported by their institutions.

There were also 51 Tunisian participants, 15 of whom came from the LAMSIN organizing laboratory at the National School of Engineering of Tunis, while the rest came from other Tunisian institutions, with the organizers' desire for territorial distribution (Bizerte, Greater Tunis, Sousse, Sfax, Kairouan, etc.). The total number of participants, including organizers and speakers (excluding those who participated in the professional sessions held in Sousse), was 92.

3 – Budget

The total budget was €33,931, broken down as follows:

Cimpa : 15053 euros.

INP-Bordeaux : 1000 euros.

LAMSIN : 5000 euros.

Pristini : 4991 euros.

Autres financements : 7887 euros.

The budget does not include support for speakers who participated in the “Mathematics, Artificial Intelligence and Applications” conference and who are not part of the research school.

4 – Scientific repercussions :

The scientific benefits are numerous:

- 1) Creation of an expanded committee to coordinate upcoming events related to the mathematics of artificial intelligence. This committee primarily brings together stakeholders from the CIMPA research schools organized in Tunisia on this topic (2019, 2023, 2025).
- 2) Project to create an international master's degree in mathematics and human and machine learning. Project in collaboration with at least 3 Tunisian universities and one French university (Cergy Pontoise).
- 3) Submission of a federated research project in March 2025, with Bessem Ben Hamed, one of the speakers at the research school. Project title: "Towards an Efficient and Explainable AI for the Multimodal Classification of Breast Tissues", in collaboration with the University of Sfax and the Radiology Department of the Sfax University Hospital.
- 4) Project between the Faculty of Sciences of Tunis, the Faculty of Sciences of Sfax and the National School of Engineers of Tunis (Project in development).