SORBONNE UNIVERSITY ABU DHABI

scai
SORBONNE CENTER FOR ARTIFICIAL INTELLIGENCE

Technical Proposal

A GUIDED TOUR OF AI: FROM FOUNDATIONS TO LATEST APPLICATION

WHO WE ARE

Sorbonne University Abu Dhabi (SUAD) is an Emirati university delivering programmes leading to the obtainment of degrees awarded by Sorbonne University Paris. The programmes are thus accredited by the CAA in the UAE and by the French Ministry of Education. According to the Bologna process, they are recognized all over Europe.

At the heart of the strategic plan of Sorbonne University Abu Dhabi lies the development of ambitious research and education projects in the field Artificial Intelligence. The first such projects are:

- The establishment of Sorbonne Center for Artificial Intelligence in Abu Dhabi (SCAI in Abu Dhabi), a world-class interdisciplinary research-center in Artificial Intelligence, extending Sorbonne Center for Artificial Intelligence (SCAI in Paris), established in Paris in June 2019.

- The launch of several Executive Training Programmes in Machine Learning and Artificial Intelligence.

- As of September 2020, the launch of the Bachelor in Mathematics, Specialization in Data Science for Artificial Intelligence.

Operating out of its two hubs, in Paris and in Abu Dhabi, SCAI aims to contribute significantly to the excellence of interdisciplinary research and education in Artificial Intelligence, by promoting exchanges between researchers, teachers, students and the industry. The center naturally benefits from the tradition of excellence of the research teams in Mathematics, Statistics and Computer Science of Sorbonne University Paris, a tradition that is demonstrated by the fact that it counts, among its Faculty, a number of holders of prestigious international prizes as well as by the fact that it is systematically very highly ranked worldwide in these fields (for example, in 2021, it has been ranked 3rd worldwide in Mathematics and Statistics, as per the Shanghai subject Academic Ranking of World Universities).
As for the Executive Training Programmes in Machine Learning and Artificial Intelligence, they are adaptations of similar programmes, delivered in Paris. They are taught by a team of scholars and experts from the Departments of Probability and Statistics and of Computer Science of Sorbonne University Paris, as well as from the Department of Sciences and Engineering of Sorbonne University Abu Dhabi and from SCAI Abu Dhabi.
Last but not least, the Bachelor in Mathematics, Specialization in Data Science for Artificial Intelligence (launched simultaneously on the two campuses) is an intensive,

high-level programme taught in English. The programme aims to address the needs of the fourth industrial revolution, by producing 21st-century mathematicians, equipped with the necessary knowledge, and an appropriate set of skills, to start a career in Artificial Intelligence and contribute to its reshaping, be it as a modern professional or as an accomplished researcher.

ABOUT OUR ACADEMIC TRADITION OF EXCELLENCE

• The Department of Computer Science of Sorbonne University Paris (known as the LIP6), carries out research that is dedicated to the modelling and the resolution of fundamental problems driven by applications. It covers the whole range of research in Computer Science and hosts an internationally recognized team of scholars in Machine Learning and Deep Learning. In particular, this team has developed a cutting-edge expertise in the development of sophisticated models of Machine Learning for the environment, building on an acquired deep understanding of fundamental aspects of statistical modelling and of physical phenomena.

• With its more than two hundred members, the Department of Probability and Statistics of Sorbonne University Paris (known as the LPSM) is the largest such department in France and one of the most prominent worldwide. Its scientific activities focus on the modelling, the description and the estimation of random phenomena. The research fields range from pure Mathematics to high-level applications in a variety of domains, including medicine, geophysics, biology, insurance and finance.

• Within the Department of Sciences and Engineering of Sorbonne University Abu Dhabi, the Mathematics and Numerical Sciences Unit is in full development. The members of the Unit, who are carefully selected according to the standards of excellence of Sorbonne University, conduct high-level research in Machine Learning, Probability on discrete structures, Combinatorics, Computer Algebra, Cryptography and Partial Differential Equations.

OUR INSTRUCTORS

The Programme will be delivered by a team of scientists and PhD students from Sorbonne University and Sorbonne University Abu Dhabi, carefully selected for their expertise in Mathematics and Computer Science, thus representing, at its best, the high international standing of the institution.

OUR PROPOSAL

Brief Description: The programme offers participants the opportunity to spend a full week on campus, where they would carry out a wide variety of activities typical of a university student: attending lectures, tutorials and computer labs, participating to workshops, assisting to conferences and, last but not least, performing and presenting a project. The main characteristic of the academic programme is, as hinted by its title, to provide participants with a simple, albeit rigorous introduction to the (mathematical) foundations of Machine Learning and Artificial Intelligence, before exposing them to various, more advanced, applications of such the methods/paradigms. This, we are convinced, will allow them to have a clearer idea of the skillset needed to develop a proficiency in this field of knowledge/array of technologies.

The academic programme is complemented by a richly varied, carefully designed sports programme. The result, we are convinced, is a well-balanced programme which participants will find particularly engaging.

Target audience: Students of the ADIA Early Preparation Programme.

Contents: Hereafter, the delivery schedule of the programme, followed by a brief description of the contents.

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<tr><th></th><th>Day 1</th><th>Day 2</th><th>Day 3</th><th>Day 4</th><th>Day 5</th><th>Day 6</th></tr>
<tr><td>9am-10am</td><td>Welcome Address</td><td></td><td></td><td rowspan="2">Workshop 1
Natural Language Processing</td><td rowspan="2">Workshop 2
Image processing</td><td rowspan="2">Hackathon Competition at SCAI Abu Dhabi</td></tr>
<tr><td>10am-11am</td><td rowspan="2">Lecture 1
Mathematics for Machine Learning</td><td rowspan="2">Lecture 2
Optimization in practice</td><td rowspan="2">Full-day session
A dive into Deep Learning and its applications</td></tr>
<tr><td>11am-12pm</td><td></td></tr>
<tr><td>12pm-1pm</td><td colspan="6">Lunch Break</td></tr>
<tr><td>1pm-2pm</td><td rowspan="3">Computer Lab 1
Introduction to Python program-ming</td><td rowspan="3">Computer Lab 2
Hands-on session : manipulating data sets</td><td rowspan="3">Full-day session
A dive into Deep Learn-ing and its applications</td><td rowspan="4">Sports</td><td rowspan="4">Movie on AI and subsequent discussions with a panel of experts from the Paris and Abu Dhabi campuses</td><td rowspan="3">Hackathon Competition at SCAI Abu Dhabi</td></tr>
<tr><td>2pm-3pm</td></tr>
<tr><td>3pm-4pm</td></tr>
<tr><td>4pm-5pm</td><td rowspan="2">Sports</td><td rowspan="2">Sports</td><td rowspan="2">Sports</td><td rowspan="2">Closing Ceremony</td></tr>
<tr><td>5pm-6pm</td></tr>
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Lecture 1: Mathematics for Machine Learning

- Functions and derivatives
- Optimization
- Examples

Computer Lab 1: Introduction to Python

- Installation
- Data structures
- Data frame, factors, lists and derivatives
- Data visualization

Lecture 2: Optimization in practice

- Simple Linear Regression
- Numerical illustration of multidimensional optimization
- Gradient Descent

Computer Lab 2: Hands-on session – manipulating datasets

- Application of the presented methods to the study of practical problems

Full Day Session: A dive into Deep Learning and its applications

- Introduction to Neural Networks
- Classification of fashion MNIST images using Neural Networks
- Further applications

Workshop 1: Natural Language Processing

- Transformers
- Attention-based models
- Real-life applications

Workshop 2: Image processing

- Image filtering
- Image compression

Hackathon @ SCAI

- The cohort will be split into small groups; each group will, under the supervision of a mentor, analyze a real-world problem using given datasets in the SCAI premises. A presentation of the obtained results will take place in the afternoon.

Sports

- Participants will have access to the campus's sports facilities at all opening times
- During dedicated sports sessions, under the supervision of 7 of our highly expert sport coaches, participants can choose to attend classes of
    - Initiation to climbing
    - Fitness
    - Team Sports (Volleyball, Basket-ball, Indoor football, etc.)
    - Martial Arts
    - Nautical activities (SUP or Canoe) and all other activities on campus

EVALUATION

SUAD will provide ADIA with a succinct individual evaluation of each student. Moreover, an overall evaluation report on the collective performance of the different groups will be provided where the particularly capable elements will be singled out and their potential commented upon.
Each student will receive, at the end of the programme, a certificate of participation from SUAD.
During the closing ceremony, the three best projects/presentations will be awarded.

ACCOMODATION

Participants will be hosted in single-occupancy accommodation within the students residence on campus..

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