



Master in Artificial Intelligence & Advanced Visual Computing



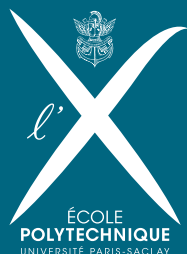
This curriculum strongly focuses on Artificial Intelligence, including statistical learning and applications to data science. It also covers the exciting, complementary field of Visual Computing, including 3D computer graphics, virtual and augmented reality, multimodal interaction, computer vision, robotics, and 3D Fabrication, which either make use, or lead to the development of novel AI methods.

Career outcomes:

Examples of industries: Digital applications for smartphones, computers, or personal assistants (Google, Facebook, Shazam, Apple, Snap); Control of autonomous vehicles, drones and robots (Valeo, Audi, Google, BMW); Virtual reality, image & video editing, design and simulation of 3D virtual worlds (Ubisoft, Dassault systems, Microsoft, Adobe, Sony, Nintendo); E-commerce and online advertisement (Criteo, Amazon, Google, Teads, Cdiscount, FNAC, eBay); Financial, banking and insurance sector (BNP Paribas, Société Générale, Barclays, HSBC, AXA).

Academic partners:

Inria, ENSTA and Telecom ParisTech.



Academic requirement

Bachelor's degree in Mathematics and Computer Science. Applicants must have followed at least one statistics course.

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual tuition fees

€15,000

Scholarships and financial aid are available for the best applicants. Please consult our website for further information:

<http://portail.polytechnique.edu/graduatedegree>



Program directors
Marie-Paule Cani
Erwan Scornet

YEAR 1

PERIOD 1 - REFRESHER IN STATISTICS

- Machine Learning I
- Constraint-Based Modeling and Algorithms for Decision Making Problems
- Image Analysis
- Digital Representation and Analysis of Shapes
- Signal and Sound Processing

PERIOD 2 - MARKETING AND STRATEGY INTRODUCTION

- Machine Learning II
- Computer Animation
- Algorithmic Geometry: From Theory to Applications
- Image Synthesis: Theory and Practice
- Statistics in Action

TECHNOLOGY-BASED ENTREPRENEURSHIP AND NEW BUSINESS CREATION

Period 3: 4 to 6-month internship

YEAR 2

Refresher in statistics: statistical analysis, introduction to machine learning techniques

Refresher in computer science: C++ programming, basics of 3D modeling, algorithmic geometry and computer animation

PERIOD 1 - SCIENTIFIC COURSES

- Deep Learning
- Data Analysis: Geometry and Topology in Arbitrary Dimensions
- Natural Language and Speech Processing: From Knowledge Modeling to Machine Learning
- Advanced 3D Graphics
- Computer Vision

PERIOD 2 - SCIENTIFIC COURSES

- Reinforcement Learning
- Robot Motion Planning, Verification and Control of Hybrid Systems
- Socio-Emotional Embodied Conversational Agents
- Soft Robots: Simulation, Fabrication, and Control
- Immersion and Interaction with Virtual Worlds

TRANSVERSE COURSES AND PROJECTS

- Seminar on Ethical Issues, Law and Novel Applications of AI
- Transverse Project in Collaboration with Companies

5 to 6-month internship, either in the R&D department of a company or in a research lab

Master in Cybersecurity: Threats and Defenses



The Cybersecurity: Threats and Defenses Master is based on École Polytechnique's trademark interdisciplinary approach, and provides you with necessary expertise in all aspects of cybersecurity – be it hardware or software.

It is a complete program for future experts in computer security, and for all activities in which protecting data or privacy is essential. Adapting to new threats and finding new defenses will be your day-to-day challenge.

Career outcomes:

Security auditor, controller or evaluator, security architect, secure systems developer, penetration test expert, security consultant, information system security manager and many more.



Academic requirement

**Bachelor's degree
in Computer Science**

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual tuition fees

€15,000

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for the best applicants. Please consult our website
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Program director
François Morain,
francois.morain@polytechnique.edu

YEAR 1

SEVEN MANDATORY COURSES

- From the Internet to the IoT: The Fundamentals of Modern Computer Networking
- Introduction to Cryptology
- A Programmer's Introduction to Computer Architectures and Operating Systems
- Disturbed Computing
- Advanced Cryptology
- Information Systems Security
- Network Security

THREE OPTIONAL COURSES

- Database Management Systems
- Machine Learning
- Introduction to Information Theory

TWO MANAGEMENT COURSES

- Introduction to Marketing and Strategy
- Case Study on Innovation

4 to 6-month research project or company internship

YEAR 2

- Formal Methods for Security
- Blockchain and Applications
- Biometry
- Steganography and Watermarking
- Network Security
- Side Channels Attacks
- Auditing Techniques
- Security of Industrial Systems

6-month internship

MSc Data Science for Business



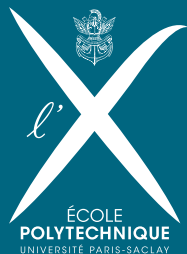
Taught jointly by École Polytechnique and HEC Paris, the MSc Data Science for Business aims at equipping students with a dual competence, in both the scientific and business fields.

Students will have the opportunity to broaden their knowledge in the Data Science field and to gain valuable and various skills such as:

- In-depth understanding of machine learning techniques
- State-of-the-art of data sciences programming skills
- How to make a big data project succeed in the corporate word
- Theoretical understanding of main statistical algorithms
- Real company data challenges

Career outcomes:

Financial, banking and insurance sector (BPCE, Natixis, BNP Paribas, Société Générale, Barclays, HSBC, AXA); telecommunications and digital (Orange, IBM, Google, Facebook, Criteo, start-ups); manufacturing IT industry; e-commerce and retail companies (Amazon, FNAC, Cdiscount); consultancy agencies (McKinsey, Accenture, Capgemini Consulting...) and business intelligence (Keyris, Sopra Group, Capgemini Consulting, SAP-Business Object, SAS); data-driven marketing industry; media and the leisure industry.



Academic requirement

Bachelor's degree in Science, Engineering or Economics

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€100

Annual tuition fees

€19,850

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2 REFRESHERS FOR STUDENTS WITH A BUSINESS/MANAGEMENT BACKGROUND

- Probability
- Mathematical foundations of data science

9 MANDATORY COURSES

- Statistics
- Introduction to Machine Learning
- Regression
- R for Data Science
- Data Camp Projects
- Machine Learning II
- Database Management
- Statistics in action
- Python for Data Science

Students will learn how to perform a complete data analysis, from data manipulation, exploration, visualization to analysis with powerful machine learning methods and to communicate and deploy their solution.

4-month internship in a company

Students can choose between two specializations:

1 | DATA SCIENCE FOR BUSINESS SPECIALIZATION

Introductory supercase

7 CORE COURSES

- Digital Transformation
- Making Sense of the Technology Ecosystem
- Acquisition Strategy Growth Hacking and Full Stack Marketer
- Regulations and Compliance in Data Science
- Data Analytics for Business Strategy
- Deep Learning
- Time Series and Financial Data

TWO TRACKS TO CHOOSE FROM IN THE LAST TWO MONTHS

- Digital Entrepreneurship
- Digital Transformation

Study trip to explore main data hubs

Research thesis

2 | DATA SCIENCE FOR BUSINESS SPECIALIZATION

Business game on strategic simulation

9 CORE COURSES

- Business Strategy
- Competing for Advantage
- Deciding Strategically on the Scope of the Firm
- Financial Dimension of Strategic Decisions
- Strategy Implementation
- Case Cracking
- Core Methodologies
- Research and Writing Tools for Thesis
- Strategic Analysis of Negotiation Games

Professional workshops and real case studies with consulting firm experts

Study trip in the heart of London to network and meet top companies in the strategic sector.

Research thesis

Program directors

Julie Josse, Professor of Statistics,
julie.josse@polytechnique.edu
 Vincent Fraitot, Affiliate Professor HEC Paris,
fraitot@hec.fr



Master in Ecotechnologies for Sustainability and Environment Management



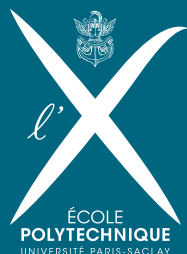
The program offers a real-world technical expertise on environmental issues including soil and water pollution diagnostic, treatment and valorization processes, along with an in-depth understanding of the economic and social challenges to their development. Some international regulatory as well as ethics insights complete the technical and management courses.

Career outcomes:

Project managers able to drive a wide variety of environmental challenges such as industrial discharge control, chemical and biological approaches for pollution diagnosis, water and soil treatment and waste valorization.

Industrial partners:

Veolia, Suez, EDF, Eaux de Paris, Arcadis and many more.



Academic requirement

Bachelor's degree in Engineering, Chemistry, Physics or Geology, Biology

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual tuition fees

€12,000

Scholarships and financial aid are available for the best applicants. Please consult our website for further information:
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Program directors
Stéphane Bouchonnet,
stephane.bouchonnet@polytechnique.edu

YEAR 1

SIX CORE COURSES

- Environmental Chemistry
- Microbial Ecology for Environmental Sciences
- Analytical Chemistry 1
- Water Treatment
- Environmental Ecotoxicology
- Exploration and Statistical Analysis of Complex Datasets

TWO MANAGEMENT COURSES

Personal scientific project

4-month research or industrial internship

YEAR 2

SIX CORE COURSES

- Hydrology
- Solid Waste Valorization
- Analytical Chemistry 2
- Soil Pollution and Remediation
- Life Cycle Assessment and Other Tools to Ecodesign Ecotechnologies
- Regulatory and Ethics Insights in Environmental Sciences

TWO MANAGEMENT COURSES

Personal scientific project

5-month research or industrial internship

*One Foreign language module (French language module for non-speaking French students). Two modules of humanities and French culture.
Sport. Coriolis conferences. Field trip and company visits.*

Master in Energy Environment: Science Technology and Management (STEEM)



The STEEM program equips you with real-world technical expertise on environmental issues and renewable energy sources, along with an in-depth understanding of the economic, social and geopolitical challenges to their development.

You will have access to an exceptional concentration of high-level research facilities including:

- IPVF, Photovoltaic Institute of Ile-de-France, a partnership between École Polytechnique, the CNRS and global industry leaders including Total, EDF and Air Liquide
- Institut Pierre-Simon Laplace (IPSL) environmental science research network, with strong ties to the UN Intergovernmental Panel on Climate Change, and its on-site Sirta observatory
- Research laboratories, start-ups, business incubator, fab lab and experimental facilities
- EDF R&D center, a unique research environment on renewable energy sources, intermittency and smart grid management

The program is part of the European Master RENE funded by KIC InnoEnergy.

Career outcomes:

Engineer position in a variety of sectors including industry, start-ups or public organizations concerned by energy transition, energy management and environment or PhD opportunities.

Industrial partners:

Total, EDF, Saint Gobain, Air Liquide, Schneider, GE and many small companies and start-ups.



Academic requirement

Bachelor's degree in Engineering Science, Mechanical Engineering or Physics

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual tuition fees

€12,000

Scholarships and financial aid are available for the best applicants. Please consult our website for further information:

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YEAR 1

Refresher in physics

PERIOD 1 - 3 ELECTIVE COURSES TO BE CHOSEN AMONG

- Continental Hydrology and Water Resources
- Mechanics for Wind Energy
- Energy and Environment
- Photovoltaics Solar Energy
- Power Electrical Engineering for Renewable Energy

PERIOD 2 - 3 ELECTIVE COURSES TO BE CHOSEN AMONG

- Meteorology and Environment
- Fluid Structure Interactions
- Material Science for Energy
- Valuing and Managing Natural Resources
- Technology-Based Entrepreneurship and New Business Creation
- Sustainable Strategy & Business Model

ONE ELECTIVE ADVANCED COURSE TO BE CHOSEN AMONG

- Projects in Solar and Wind Energy: Resource and Performance Analysis
- Laboratory Course in Photovoltaic
- Experimental Work in Environmental Physics
- Creation of a Tech Start-up

ONE MANAGEMENT COURSE

- Energy Industry Value Chain

ONE MATHEMATICAL TRAINING

- Refresher in Mathematics and a Project on Numerical Modeling

4 to 5-month research or industrial internship

YEAR 2

ONE MANAGEMENT COURSE

- Designing Projects and Managing Operations in the Energy Industry

SIX ELECTIVES SCIENTIFIC COURSES TO BE CHOSEN

1. Atmospheric and oceanic environments in the energy context

- Energetics and Dynamics of the Earth System
- Hydro, Wind and Marine Resources
- Greenhouse Gases (GHG) Challenges and Observations
- Introduction to Atmospheric Composition: From Processes to Modeling and Air Quality Regulations
- Climate Change and Energy Transition

2. Renewable energies – scientific bases

- Thin Film Photovoltaics
- Polymers for Photovoltaics
- Photovoltaic Technology in Industry
- Wind Power
- Fluid-Structure Couplings in Offshore Wind and Marine Renewable Energies
- Laboratory Projects in Hydro, Wind and Marine Resources for Renewable Energy
- Nature-Based Solutions to Substitute Fossil Resources and Address Global Change

3. Vectors, storage and networks for energy

- Chemical Storage of Energy
- Renewable Thermal Energy
- Stochastic Optimization and Management of Energies
- Smart Grid for Renewable Energy
- Advanced Experimental Smart Grid
- Energy Economics with a Geographic Focus
- The Economics of Energy and Sustainable Development

One team management project

6-month research or industrial internship

Program directors

Claude Basdevant,

claude.basdevant@polytechnique.edu

Bernard Drevillon,

bernard.drevillon@polytechnique.edu

Alexandre Stegner

Financial report

Balance sheet

Assets

Current assets
Non-current assets

1,645,921

Liabilities

Current liabilities
Non-current liabilities

166,630

110,327

56,303

Equity

Paid-in capital
Retained earnings

74,393

72,921

1,472

Income statement

Revenues

12,978,516

Net sales
Investment

12,873,892

104,624

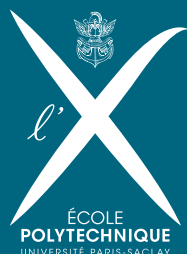
6,372,535

1,385,395

4,439,118

548,022

81



Academic requirement

**Bachelor's degree in
Economics and/or
Mathematics**

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual tuition fees

€12,000

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Master in Economics, Data Analytics and Corporate Finance



The two-year degree focuses on **three complimentary skillsets:**

- **Quantitative methods:** statistics, econometrics and data analytics
- **Microeconomics:** corporate strategy and regulation
- **Corporate finance:** project financing, portfolio optimization, firm valuation

The program combines theory and empirics. Fundamental methods and the latest academic developments are taught by our internationally recognized research faculty. Professional-oriented, real-world based case studies are introduced with the aim of uncovering the hidden trends that underlie the evolution of specific market segments and business models.

École Polytechnique's wide-reaching network of industrial partners enables to gain key industry insights from leading business figures.

Career outcomes:

From strategic business unit leaders to strategy consultants or entrepreneurs/consulting, corporate finance, data analytics.

Financial report

Balance sheet

Assets	1,734,826
Current assets	88,905
Non-current assets	1,645,921
Liabilities	166,630
Current liabilities	110,327
Non-current liabilities	56,303
Equity	74,393
Paid-in capital	72,921
Retained earnings	1,472

Equity statement

Current year	1,774,576
Comprehensive income	15,897
Issue of share capital	88,905
Dividends	23,853
Previous year	166,630
Comprehensive income	110,327
Issue of share capital	56,303
Dividends	67,676

Income statement

Revenues	12,978,516
Net sales	12,873,892
Investment	104,624
Expenses	6,372,535
Research and Development	1,385,395
Operating expenses	4,439,118
Marketing	548,022
Income	6,505,981

Cash flow statement

Operations	12,978,516
Earnings	12,873,892
Depreciation	104,624
Investing	6,372,535
Real estate	1,385,395
Equipment	4,439,118
Financing	6,505,981
Debt	6,505,981

Program director
Marie-Laure Allain

YEAR 1

SIX MANDATORY COURSES

- Industrial Organization
- Econometrics I
- Corporate Finance
- Econometrics II
- Business Economics
- Advanced Corporate Finance

TWO ELECTIVE COURSES TO BE CHOSEN AMONG

- Market Design
- Environmental Economics & Policy in Cities
- Financial Decisions Under Risk I
- Urban Economics & Housing Market
- Behavioral Finance
- Case Studies in Finance
- Digital Economics
- Competition Policy
- Financial Decisions Under Risk II
- Bitcoin and Fintech
- Supply Chains

INNOVATION, MANAGEMENT AND ENTREPRENEURSHIP COURSE TO BE CHOSEN AMONG

- Fundamentals of Strategy & Innovation
- Marketing & Strategy Introduction

Two Mandatory Business Games

Lecture series in Finance and Economics

4-month Internship

YEAR 2

SIX MANDATORY COURSES

- Firms and Markets
- Econometrics of Competition
- Valuation of Start-ups
- New Technologies and the Sharing Economy
- Financial Markets
- Big Data

TWO MANDATORY INNOVATION, MANAGEMENT AND ENTREPRENEURSHIP COURSES

- Business Model in Digital Era
- Case Studies on Innovation

TWO ELECTIVE COURSES TO BE CHOSEN AMONG

- Urban Eco. & Housing Market
- Environmental Economics & Policy in Cities
- Financial Decisions Under Risk I
- Market Design
- Case Studies in Corporate Finance
- Competition Policy in Practice
- Bayesian Methods for Marketing
- Quantitative Marketing
- Competition Policy
- Digital Economics
- Bitcoin & Fintech
- Supply Chains

Lecture series in finance and economics

6-month internship in France or abroad

Master in Smart Cities and Urban Policy



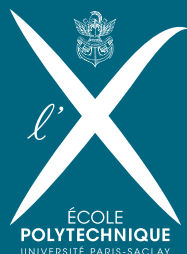
This degree provides the know-how to navigate the trends shaping the 21st metropolitan economies. It involves applying advanced quantitative methods to the study of new and transforming metropolitan areas and their competitive environments.

Career outcomes:

Managerial positions in various industries such as transportation, energy, environment, commercial real estate, urban and infrastructure management and services; economic advisory positions in local, regional, governmental and international institutions or consultancy positions.

Industrial partners:

Mairie de Paris, Institut Pasteur, EDF, SNCF, ADEME, AFD, Schneider Electric, and many others.



Academic requirement

Bachelor's degree in Economics, Mathematics, Civil Engineering and/or Transportation Studies

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual tuition fees

€12,000

Scholarships and financial aid are available for the best applicants. Please consult our website for further information:
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Program director
Patricia Crifo

YEAR 1

SIX MANDATORY COURSES

- Urban Economics and Real Estate
- Environmental Economics and Policies in Cities
- Econometrics 1
- Environment and Local Development Economics
- Traffic and Transportation Systems in Urban Contexts
- Applied Econometrics

TWO ELECTIVE COURSES TO BE CHOSEN

- Corporate Finance
- Industrial Organization
- Economics of Energy Sectors
- Business Economics

ONE INNOVATION, MANAGEMENT AND ENTREPRENEURSHIP COURSE TO BE CHOSEN

- Case studies of Innovation
- Technology-Based Entrepreneurship and New Business Creation
- Sustainable Strategy and Business Model

4-month research project or internship

YEAR 2

- Training in Geographical Information Systems
- Urban Economics
- Housing Economics
- Economics of Land Use
- Real Estate Finance
- The Spatial Dimension of Public Policies: Urban Planning
- Energy, Environment, and Sustainability
- Urban Growth in Developing Countries
- Discrete Choice Econometric
- Transportation Economics
- Climate Change and the Future of Cities
- Economic Geography and Aggregation of Cities
- Network Economics with Applications to Cities and Transportation Systems
- Big Data

6-month (at least) research or industrial internship

Lecture series in finance and economics
Capstone project

*One Foreign language module (French language module for non-speaking French students).
Two modules of humanities and French culture.
Sport. Company visits.*



Master in Internet of things: Innovation and Management



The Internet of Things: Innovation and Management Master aims to provide an understanding through the study of six thematic pillars and how they apply specifically to the world of connected objects.

This degree, based on the Ecole Polytechnique's trademark multidisciplinary approach, provides you with the necessary knowledge and expertise of the entire connected objects' ecosystem - from the electronics to economics of connected objects.

It is a research-based training, combined with innovation management & entrepreneurship.

Career outcomes:

IoT startup, leading technology company, consultant, digital divisions of multinational companies.

Industrial partners:

EDF, ERDF, Cisco Systems



Academic requirement

Bachelor's degree in Science, Technology, Engineering or Mathematics

Candidates with other degrees may be considered, provided that they have a strong background in the above-mentioned subjects.

Application fee

€80

Annual Tuition fees

€12,000

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SIX MANDATORY CORE COURSES

Practical C & Java prog, Algo & Data Structures

From the Internet to the IoT:

- Fundamentals of Modern Computer Networking
- Fundamentals of Strategy & Innovation
- Technology, the culture of Modernity and Globalization
- IoT Workshops - Mobile Code Crunch
- Humanities and French Culture + Foreign language and sport

ENTREPRENEURSHIP TRACK

- Analog and Digital Electronics
- Sensor Devices and Transducers
- Business Case and Innovation
- 2-year Graduate Project

STRATEGIC MANAGEMENT TRACK

- Business Models
- Corporate Finance for the Entrepreneur
- 2-year Graduate Project

Internship

The program may be subject to change

COMPUTER SCIENCE FUNDAMENTALS

- C & Java Programming
- Computer Networking
- Computer Architectures & Operating Systems

HARDWARE FUNDAMENTALS

- Analog and Digital Electronics
- Platforms
- Software Engineering Practices
- Network Security

SENSOR NETWORKING

- Sensor Devices
- IoT Communications Protocols

"THE CLOUD" AS BACKEND

- Data Storage
- Big Data
- Intellectual Property Workshops
- Distributed Computing

THE DIGITIZED SOCIETY

- Protocol and Technology Success
- New Economic Models
- Perception of "Small Devices as Big Brother"

"PULLING IT ALL TOGETHER"

- Safe Systems Engineering
- Protocol verification and Validation
- Business, Management of Technological Innovation & Entrepreneurship

2-year Graduate Project