

ARTIFICIAL INTELLIGENCE FOR BUSINESS

International MBA IMBA-EN SEP-2024 S-DBA

Area Information Systems and Technology

Number of sessions: 15

Term: Concentrations

Category: regular

Language: English

Professor: **DAVID GORDO GÓMEZ**

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Dr. David Gordo Gómez is a seasoned professional with a strong background in machine learning, data science, and statistical modeling. He holds a PhD and MSc in Theoretical Physics from the Autonomous University of Madrid and a Bachelor's degree in Physics from the Universidad de Salamanca. He has a strong background in theoretical particle physics and has conducted research in this field, utilizing large data sets generated by the Large Hadron Collider at CERN, Switzerland.

As the Co-founder and CEO of [Komorebi AI](#), Dr. Gordo Gómez brings a wealth of expertise in developing real-world solutions using machine learning and data science techniques. He has a track record of solving complex problems related to data analysis and has extensive experience machine learning. He is focused on exploring frontier techniques in natural language processing and computer vision, and their applications to industrial problems.

In addition to his leadership role at Komorebi AI, Dr. Gordo Gómez is also a sought-after educator, serving as a lecturer in in programming and Machine Learning at IE University and IE Business School.

He has a passion for imparting his knowledge and skills, and regularly teaches programming, natural language processing, and reinforcement learning in the Executive and MSc in Data Science programs at the Madrid Internet of Things Institute (MIOTI).

Office Hours

Office hours will be on request. Please contact at:

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SUBJECT DESCRIPTION

How did Google searches predict the spread of the H1N1 flu outbreak? How can a retailer predict when one of its customers is pregnant before her family even knows it? How can you predict someone's political affiliation analysing the songs he plays at home? The key to answering these questions, and many others, is Artificial Intelligence and Machine Learning.

Welcome to the age of data!

Machine Learning is a rapidly growing field that is transforming industries and businesses across the world. It is a subfield of artificial intelligence that allows computers to learn from data and make predictions or take actions without being explicitly programmed. The ability of machines to learn and make decisions based on data is providing new and innovative solutions to problems that were once thought to be unsolvable.

In today's rapidly changing business environment, companies are looking for ways to increase efficiency, automate processes, and make better decisions. Machine Learning is playing a critical role in helping businesses to achieve these goals. By providing valuable insights into complex data sets, Machine Learning is enabling companies to make data-driven decisions, improve customer experiences, and increase operational efficiency. The demand for Machine Learning skills is only going to increase in the future, making it an essential tool for anyone looking to advance their career in technology or business. Whether you are a seasoned professional or just starting out, learning Machine Learning will give you the skills you need to succeed in the rapidly changing landscape of technology and business.

LEARNING OBJECTIVES

Unlock the power of Machine Learning and AI, no technical background required!

This course is perfect for anyone looking to stay ahead in today's rapidly changing business environment. You don't need a technical background to join us on this exciting journey.

By the end of this course, you will:

- **Have a Comprehensive Understanding of Machine Learning and AI**

From the basics to the latest developments, this course covers everything you need to know about this rapidly growing field.

- **Know Your Algorithms**

Learn about the different types of machine learning algorithms and how to determine the best approach for various business challenges.

- **Develop Critical Thinking Skills**

Gain insight into the use, limitations, and ethical considerations of these technologies and develop your critical thinking skills.

- **Experience Data-Driven Decision Making**

Through hands-on activities, you'll experience the complexity of data-driven decision making and appreciate the importance of human intervention.

- **Launch Your Journey to Understand what is AI and Machine Learning**

With practical, real-world applications and a participant-centered learning methodology, you'll be well on your way to becoming a decision maker that understands the capabilities of Machine Learning and AI.

TEACHING METHODOLOGY

IE University teaching method is defined by its collaborative, active, and applied nature. Students actively participate in the whole process to build their knowledge and sharpen their skills. Professor's main role is to lead and guide students to achieve the learning objectives of the course.

Basic knowledge of Excel is required. Practices will be carried out with the use of no-code tools such as BigML or through the use of Python combined with ChatGPT.

Practices won't require technical background, but knowledge of tools such PowerBI, Tableau or any programming language will be beneficial.

This is done by engaging in a diverse range of teaching techniques and different types of learning activities such as the following:

| Learning Activity | Weighting |
|---|------------------|
| Lectures | 30.0 % |
| Discussions | 10.0 % |
| Exercises in class, Asynchronous sessions, Field Work | 20.0 % |
| Group work | 20.0 % |
| Individual studying | 20.0 % |
| TOTAL | 100.0 % |

AI POLICY

Encouraged in individual and group assignments. Forbidden in exams.

PROGRAM

SESSION 1 (LIVE IN-PERSON)

Introduction to AI and Course Overview

- What is AI?
- What is Machine Learning?
- How can it be valuable for business?
- Understanding the role of AI in combination with large data sets
- Introduction to the course, syllabus and assignments

Practical Case : Dominant Needs: Self-Assessment Tools (HRO010018-U-ENG-WOD)

Technical note & tutorials: Conflict Handling Styles (HRO020136-U-ENG-WOD)

SESSION 2 (LIVE IN-PERSON)

Machine Learning Taxonomy

- Supervised learning
- Unsupervised learning
- Reinforcement learning
- Get started with BigML (Important, bring laptop to class)

Before the class:

Multimedia Material: BigML (BIG)

Article: Key ML Terminology (Google)

Technical note & tutorials: What is Big Data? (ENT020210-U-ENG-VID)

Technical note & tutorials: The Fraud Analyst: Humans Vs. Machine Learning (ENT020206-U-ENG-

VID)

Technical note & tutorials: Types of Algorithms (ENT020208-U-ENG-VID)

Technical note & tutorials: What is Reinforcement Learning? (ENT020207-U-ENG-VID) (Optional)

SESSION 3 (LIVE IN-PERSON)

Machine Learning Taxonomy - Continuation

Before the session:

Data Science - AI and ML for Business: Online Learning Journey

- This session includes the completion of an online learning journey on Data Science and Machine Learning
- The online learning journey includes articles, videos, multimedia tutorials, feedback and it is a self-paced learning experience
- Instructions on how to register and access the online learning journey will follow in class
- Students must successfully complete the online learning journey and obtain the **Certificate of Successful Completion**
- **Successful completion requires taking an online evaluation included in end of the Online Learning Journey**

SESSION 4 (LIVE IN-PERSON)

Supervised Learning: Classification

- What is classification?
- Practical examples
- Performance metrics
- Unbalance datasets

Before the session: Watch the two videos about the BigML Interface and How to add Sources (just up to minute 9:00).

Multimedia Material: VIDEO - Introduction to the BigML Interface (Youtube.com)

Multimedia Material: VIDEO - Sources (Add data into BigML) (Up to 9:00) (Youtube.com)

Technical note: Logistic Regression (HBS UV6767-PDF-ENG)

SESSION 5 (LIVE IN-PERSON)

Supervised Learning: Model selection

- No-free lunch theorem
- Overfitting
- Cross-validation
- Hyper-parameter tuning

Before the session: Watch Logistic Regression video (just first 10:20 minutes)

Multimedia Material: VIDEO - Logistic Regression in BigML (up to 10:20) (Youtube.com)

Article: Bored? This App Already Knows—and Has a Solution (Vice) (Optional)

SESSION 6 (LIVE IN-PERSON)

Supervised Learning: Classification cont

Other algorithms: Support vector machines, Decision trees, Ensemble methods: Random Forests
Practical examples

Before the session: Watch the BigML video about Ensembles of Decision Trees (a particular ML model)

Multimedia Material: VIDEO - Random Forest (Ensemble) in BigML (Diabetes detection Case) (Youtube.com)

SESSION 7 (LIVE IN-PERSON)

Learning Milestone 1: Supervised Learning Hands-on

SESSION 8 (LIVE IN-PERSON)

Supervised Learning: Regression

- What is a regression task?
- Linear regression
- Performance metrics
- Practical examples
- Other algorithms: Decision trees, KNN, Random Forests...
- Time Series as a Regression Problem

Technical note & tutorials: Regression analysis main concepts (BAN020041-U-ENG-VID)

Article: A Refresher on Regression Analysis (HBS H02GBP-PDF-ENG)

SESSION 9 (LIVE IN-PERSON)

Unsupervised Learning

- Clustering algorithms
- Anomaly detection
- Dimensionality reduction
- Generative Models
- Practical examples

Before the session: watch the two BigML Videos:

Multimedia Material: VIDEO - Supervised vs Unsupervised in BigML (Youtube.com)

Multimedia Material: VIDEO - Clustering in Big ML (up to 9:30) (Youtube.com)

Multimedia Material: VIDEO - Anomaly Detection in BigML (Youtube.com) (Optional)

Multimedia Material: VIDEO - Association Rules in BigML (Market-Basket Analysis Case Study as Demo) (Youtube.com) (Optional)

SESSION 10 (LIVE IN-PERSON)

Learning Milestone 2: Traditional ML Hands-on

Asynchronous learning applying some of the techniques discussed in the previous classes. Details about this will be given in class.

SESSION 11 (LIVE IN-PERSON)

Quick Intro to Neural Networks & the last GenAI Revolution

The basic principles of Neural Networks
The importance of the Deep Learning Revolution
Deep learning vs Traditional Machine Learning
Transfer learning and its practical importance
Foundations of the GenAI revolution
Dealing with unstructured data: Computer Vision & Natural Language Processing
Practical Examples

Multimedia Material: VIDEO - Deep Learning In 5 Minutes (Youtube.com)

Article: Deep Learning Review (Nature) (CED)

Other / Complementary Documentation: GPT-3 Demo Showcase, 300+ Apps, Examples, & Resources (gpt3demo.com)

Multimedia Material: VIDEO - AlphaFold: The making of a scientific breakthrough (Youtube.com) (Optional)

Multimedia Material: VIDEO - OpenAI GPT-3 - Good At Almost Everything! (Youtube.com) (Optional)

Multimedia Material: VIDEO - The Smartest Machine On Earth - IBM Watson (Youtube.com) (Optional)

SESSION 12 (LIVE IN-PERSON)

Learning Milestone 3: Deep learning hands-on

Asynchronous learning applying some deep learning technique. Details about this will be given in class.

SESSION 13 (LIVE IN-PERSON)

Group Project Presentations

Students will present their group projects in class. Details about the format of this session will be given in class.

SESSION 14 (LIVE IN-PERSON)

The Machine Learning Lifecycle or How to organize ML projects in Business

If times allows:

Last advances in ML / Ethical and Accountability Considerations of Machine Learning

- Machine learning bias coming from data and/or model selection
- Algorithmic accountability
- Explainable models
- Risks and limits of machine learning algorithms

Technical note: Ethical Implications of Artificial Intelligence, Machine Learning, and Big Data (HBS W21095-PDF-ENG)

Article: Top 9 ethical issues in artificial intelligence (World Economic Forum)

Article: DALL·E: Creating Images from Text (Openai) (Optional)

Article: DALL·E 2 is a new AI system that can create realistic images and art from a description in natural language. (Openai) (Optional)

SESSION 15 (LIVE IN-PERSON)

Final Exam & Wrap-up

Details about the format of the exam will be given in class.

EVALUATION CRITERIA

| criteria | percentage | Learning Objectives | Comments |
|---------------------|------------|---------------------|---|
| Final Exam | 40 % | | The materials for the exam are all slides, readings, videos, and exercises covered throughout the course. |
| Class Participation | 20 % | | Class participation is evaluated in the scale 1-5, with 1 meaning the student is present in class but without any involvement and 5 meaning the student has an excellent participation. Class participation is evaluated with 0 when the student is absent. |
| Group Project | 30 % | | |
| Intermediate Test | 10 % | | Multiple Choice Quiz to test your knowledge. |

FAILING GRADE AND REASSESSMENT

When students receive a Fail in a course, they have the opportunity to present themselves for reassessment in order to earn the necessary credits toward graduation.

The reassessment of students should be scheduled between 5 and 10 working days after the review session takes place.

Grades for the reassessment are limited to a Low Pass and Fail.

Both, the initial Fail as well as the grade of the reassessment remain on the transcript. For the purpose of calculating the GPA however, only the grade of the reassessment is to be considered. Students receiving a failing grade in the reassessment of a course will not be able to continue in the program.

PARTS

- The **Final Exam** will take place on Session 15, is expected to be completed individually and details/examples about it will be given in class. The materials for the exam are all the slides, readings, videos, and exercises covered throughout the course.
- The **Class Participation** assesses your participation during the classes. It consists of (i) your attendance, (ii) your participation in class and (iii) the quality of your participation. Because of the practical nature of this course, good class participation means both participating in the class discussion but also completing successfully the practical exercises conducted in class. Class participation is evaluated in the

scale 1-5, with 1 meaning the student is present in class but without any involvement and 5 meaning the student has an excellent participation. Class participation is evaluated with 0 when the student is absent. It will be given Importance to the quality of contributions, and not quantity of them.

- The **Group Project** has the form of capstone project that runs throughout the whole duration of the course. It is to be conducted in groups and its deliverables are a **written report and a presentation**. The presentation will be given during Session 13 in class, whereas the report is to be submitted via Blackboard. The detailed description of the Group Project will be given in Session 1.
- The **Individual Work** will consist in a set of questions (Multiple Choice, Fill in the blank, computations), in a similar fashion of the final exam.

BIBLIOGRAPHY

Compulsory

- Andriy Burkov. *The Hundred-Page Machine Learning Book*. Andriy Burkov (13 enero 2019). ISBN 9781999579500 (Printed)

General technical overview of the different Machine Learning concepts and algorithms

- Simon Thompson. (2023). *Managing Machine Learning Projects: From design to deployment*. Manning. ISBN 9781633439023 (Printed)

Managing Machine Learning Projects is an amazing source of battle-tested techniques for effective delivery of real-life machine learning solutions. The book is laid out across a series of sprints that take you from a project proposal all the way to deployment into production

Recommended

- Andriy Burkov. *Machine Learning Engineering*. ISBN 978199957957 (Digital)

From the author of a world bestseller published in eleven languages, The Hundred-Page Machine Learning Book, this new book by Andriy Burkov is the most complete applied AI book out there. It is filled with best practices and design patterns of building reliable machine learning solutions that scale. Andriy Burkov has a Ph.D. in AI and is the leader of a machine learning team at Gartner. This book is based on Andriy's own 15 years of experience in solving problems with AI as well as on the publis

- Galit Shmueli, Peter C. Bruce, Peter Gedeck, Nitin R. Patel. (2019). *Data Mining for Business Analytics_ Concepts, Techniques and Applications in Python*. Wiley-Blackwell. ISBN 9781119549840 (Digital)

It gives the technical and business vision of ML algorithms. A bit old-school language. Readers will learn how to implement a variety of popular data mining algorithms in Python to tackle business problems and opportunities.

- Bernard Marr. (2016). *Big Data in Practice: How 45 Successful Companies Used*

Big Data Analytics to Deliver Extraordinary R. Wiley. ISBN 1119231388 (Digital)
- Daniel Kahneman, Olivier Sibony, Cass R. Sunstein. (2021). *Noise: A Flaw in Human Judgment*. Little, Brown Spark. ISBN 978031645140 (Digital)

General public. Explores the role of noise in decision-making and how it affects our judgments and choices. Kahneman argues that random fluctuations, or noise, in our environment can significantly impact our perceptions and lead to errors in judgment and decision-making. The book provides insights into how we can better understand and mitigate the effects of noise in our lives.

- Ajay Agrawal, Joshua Gans, Avi Goldfarb. (2018). *Prediction Machines: The Simple Economics of Artificial Intelligence*. Harvard Business Review Press. ISBN 1633695670 (Printed)

- Foster Provost, Tom Fawcett. (2013). *Data Science for Business*. O'Reilly Media, Inc.. ISBN 9781449361327 (Printed)

- O'Neil, Cathy. (2016). *Weapons of math destruction: How big data increases inequality and threatens democracy*. Penguin Books. ISBN 978014198541 (Printed)

Describe the importance of ethics and how biases can impact model's outcomes in real life.

- Stuart J. Russell. (2019). *Human Compatible: Artificial Intelligence and the Problem of Control*. Viking. ISBN 978052555861 (Digital)

General public. Explores the challenges posed by artificial intelligence and argues for a rethinking of AI objectives to ensure that AI systems are aligned with human values. The book covers the history of AI, current research, and the ethics and safety of AI systems and is intended for a general audience interested in the future of AI.

- Thomas H. Davenport. (2019). *The AI Advantage: How to Put the Artificial Intelligence Revolution to Work*. The MIT Press. ISBN 0262538008 (Printed)

- Thomas H. Davenport. (2017). *Competing with Analytics*. Harvard Business Review Press. ISBN 9781633693722 (Printed)

- Holmes, Dawn. *Big data: a very short introduction*. ISBN 0198779577 (Printed)

- Domingos, Pedro. *The Master Algorithm*. ISBN 1501299387 (Printed)

For non-experts. Not-technical. It does a great job of introducing not just the concepts in machine learning, but also statistical ideas like variance, over-fitting, and even principal components.

- Chip Huyen. *Introduction to Machine Learning Interviews Book*. NA. ISBN 0000000000 (Digital)

Books with recommendations about the ML Interviews process. Recommended either if you are hiring or applying for job positions in the field.

BEHAVIOR RULES

Please, check the University's Code of Conduct [here](#). The Program Director may provide further indications.

ATTENDANCE POLICY

Please, check the University's Attendance Policy [here](#). The Program Director may provide further indications.

ETHICAL POLICY

Please, check the University's Ethics Code [here](#). The Program Director may provide further indications.

