ALLEGATO EN-24-ECON-M1-418

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Art. 1 - Typology of course

The University of Pavia has activated a first-level Post-bachelor Vocational Program in **eXplainable Artificial Intelligence in healthcare Management (xAIM)** at the DEPARTMENT OF ECONOMICS AND MANAGEMENT .

Edition 3

Disciplinary area SCIENCES AND TECHNOLOGY

Art. 2 - Educational aims, professional opportunities and course appeal

The goal of the xAIM (Post-Bachelor) Vocational program is to provide digital skills in the area of healthcare management by training highly skilled professionals in the healthcare area, as well as to raise learners' awareness of emerging ethical issues and the impact Artificial Intelligence (AI) is having on society.

Students will learn the fundamentals of Machine Learning and Data Science, then know how to manage and analyze large, heterogeneous, and complex amounts of data that characterize the healthcare industry. In order to enable a clear understanding of the data and proper interpretation of the results, emphasis will be placed on its impact in the healthcare sector.

The entire program focuses on the existing state of the art and possible future applications of AI in health care through the acquisition of practical knowledge as well as the development of the ability to apply the skills acquired. To complete the program, emphasis will be placed on the ethical and social implications of AI applications as well as legal considerations.

By taking part in various seminars and attending a final internship held at partner institutions throughout Europe, students will be able to develop and evaluate reliable AI solutions, as well as understand their potential, limitations, and their implications for the health professions, patients, and society as a whole.

The professional figures formed in the xAIM program can find opportunities in all job positions that require cross-functional skills between AI and health care because those who complete the program will be able to analyze and process the data needed to apply AI solutions, as well as interpret the results provided by AI by assessing their relative risks and challenges.

Healthcare facilities will be able to make use of highly specialized figures capable of working alongside physicians and professionals in the health care field, who can provide support in the implementation of intervention and diagnosis protocols based on data and empirical evidence. The same figures will be able to suggest the most effective approaches to the management of pathology, the burden of comorbidities and the variables that most influence the evolution of clinical pictures. They will also be able not only to speed up prognostic evaluations, but also to make them more accurate and precise by implementing the most suitable algorithms.

Graduates with a background in Computer Science and related subjects will be eased by a solid understanding in data analytics and computer science knowledge, while graduates with a background in health care will be able to communicate to the former the needs and requirements of patients that AI solutions are called upon to address.

The xAIM program is delivered in synergy with other European partners, namely Goethe University Frankfurt (Germany), Leibniz University Hannover (Germany), Keele University (UK), and finally the University of Ljubljana (Slovenia). The title will be awarded by the University of Pavia.

Art. 3 - Programme

The Vocational Program has a duration of annuale and provides a total of 2250 hours, divided according to the table below.

All the training activities provided correspond to the acquisition, by the students, of 90 university credits (CFU).

Teaching modules are organized as follows and will be taught in English:

Name	SSD	Language	L(h)	STD(h)	OL(h)	EX(h)	Tot(h)	CFU

1) Transforming healthcare	SECS-P/07 | ECONOMIA AZIENDALE	English	0	72	48	30	**150**	**6**
	Contents: -Management of Healthcare Organizations -Financial resources -Manage the complexity of the implementation of AI-based activities -Provide support to decision-making process in a multi-objective environment							
2) AI and healthcare workforce	SECS-P/07 | ECONOMIA AZIENDALE	English	0	72	48	30	**150**	**6**
	Contents: -Acceptance of AI by healthcare professionals/managing change; -Redesigning roles and systems; -Use of AI in Education and Training; -Patients safety and clinical governance considerations; -Who has primacy - doctor or machine? Medical-legal aspects; -AI and the clinician patient relationship - interacting with expert patients, potential disempowerment of clinicians, potential to devalue clinical roles; -New roles/professions in healthcare - bioinformaticians, data managers, informatics; -Social and psychological aspects of computer-mediated communication.							
3) Data Driven Healthcare	SECS-S/01 | STATISTICA	English	0	72	48	30	**150**	**6**
	Contents: -Information modeling (files, databases) -Data in healthcare (biological, clinical, administrative and research) -Electronic data collection -Interoperability -Descriptive statistics -Univariate analysis -Bivariate analysis -Inferential statistics							
4) Introduction to Data Science	SECS-S/02 | STATISTICA PER LA RICERCA SPERIMENTALE E TECNOLOGICA	English	0	72	48	30	**150**	**6**
	Contents: -Introduction to data science. Typical problems and applications. Introduction to supervised and unsupervised learning. -Introduction to techniques of data mining and knowledge discovery in databases, with emphasis on their application in medicine. Data preprocessing, visualizations (types and appropriate use). -Data clustering techniques, cluster explanation. -Dimensionality reduction techniques, projections. -Predictive models: classification, regression. -Overfitting. -Model evaluation. -Explanations of predictive models, SHAP values. -Practical examples of data science from medicine, bioinformatics, and healthcare.							
5) Z-Inspection®: A process to assess trustworthy AI in practice	SECS-S/02 | STATISTICA PER LA RICERCA SPERIMENTALE E TECNOLOGICA	English	0	72	48	30	**150**	**6**
	Contents: -Introduction to the EU framework for Trustworthy AI -The Z-Inspection® process -Assessment of AI use cases in healthcare							
6) Trustworthy AI	SECS-S/01 | STATISTICA	English	0	72	48	30	**150**	**6**
	Contents: -Assessment of (digital) health technologies -Framework for achieving Trustworthy AI -Trustworthy AI: principles and measurement -Statistical learning models - Machine learning models -Accuracy -Robustness -Explainability -Fairness							
Free choiche (4 modules in total)								

7) Advanced AI Assessment	SECS-P/07 | ECONOMIA AZIENDALE	English	0	72	48	30	**150**	**6**
	Contents: -HTA principles -Implementation of HTA in different healthcare systems -AI assessment							
8) Introduction to healthcare management	SECS-P/07 | ECONOMIA AZIENDALE	English	0	72	48	30	**150**	**6**
	Contents: -Quality in Healthcare Organizations -Performance Management -Financial Management in Health -Commissioning and Licensing -Project management -Leadership in Healthcare -International competition and cross-border healthcare services							
9) Coding in Python		English	0	72	48	30	**150**	**6**
	Contents: -What is a programming language and what can it be used for; -Python essential syntax -Variables and data structures: basic data types, strings, tuples, lists, and dictionaries; -Control structures: conditionals, loops, functions; -Intro to Object Oriented Programming: classes, objects and methods; -Leveraging external libraries: installing, importing and usage							
10) Computer Vision and Deep Learning	SECS-S/02 | STATISTICA PER LA RICERCA SPERIMENTALE E TECNOLOGICA	English	0	72	48	30	**150**	**6**
	Contents: Image processing; Image classification -Multi-layer perceptrons + gradient descent -Deep learning -Convolutional neural networks and advanced architectures -Object detection -Image Segmentation -Recurrent neural networks -Video Analysis							
11) Advanced topics in AI	SECS-S/02 | STATISTICA PER LA RICERCA SPERIMENTALE E TECNOLOGICA	English	0	0	0	0	**0**	**0**
	Contents: -Search, MDPs, CSPs - introduction to probability theory and Bayes' Nets, -Decision Networks -Value of Perfect Information Reinforcement Learning -HMMs -Particle Filtering and Machine Learning							
12) AutoML	SECS-S/02 | STATISTICA PER LA RICERCA SPERIMENTALE E TECNOLOGICA	English	0	0	0	0	**0**	**0**
	Contents: -Hyperparameter Optimization, -Neural Architecture Search, -Bayesian optimization, -Evolutionary algorithms, -Multi-fidelity optimization and gradient-based optimization, -Useful meta strategies for speeding up the learning itself or AutoML							

13) Text Mining	SECS-S/02 | STATISTICA PER LA RICERCA SPERIMENTALE E TECNOLOGICA	English	0	0	0	0	**0**	**0**
	Contents: -Dealing with unstructured data in healthcare -Text preprocessing, concordances and collocations -Clustering and cluster exploration on medical texts -Word enrichment and keyword techniques -Vector presentation of documents -Predictive modeling on text data -Topic modeling -Semantic analysis and document summarization -Sentiment analysis							
14) Information Ethics and legal aspect	SECS-P/07 | ECONOMIA AZIENDALE	English	0	0	0	0	**0**	**0**
	Contents: Module A -What is information ethics? Why is it useful? -Introduction to ethical theories and frameworks. -Information ethics applied to specific issues, e.g., human rights, information access, privacy, cybersecurity, etc. -Scholarly and media literature on generally discussed/documented issues with AI/ML, including AI/ML causing/being used in ethically problematic situations with a progressive focus on medical applications. -Thought experiments and trolley problems, whose reasoned analysis will draw on information ethics principles. Module B -Digital Rights and Data ownership -Right to privacy and its legislation (GDPR) -Informed consent and patient autonomy -Legal design techniques in health -Data-driven decisions in health and AI and actors liability -Re-use of personal data in healthcare and research -Medical Device Regulation							
		PARTIAL	**0**	**720**	**480**	**300**	**1500**	**60**
Internship/Stage		English					**450**	**18**
Final exam							**300**	**12**
						TOTAL	**2250**	**90**
DF *Didattica frontale;* STD *Studio;* DAD *Didattica a distanza;* ES *Esercitazione;*								

The training period may not be suspended.

Transfers to similar Vocational Programs at other universities are not allowed.

Art. 4 - Assessment of ongoing learning

Ongoing assessment for each course/module is carried out through an intermediate test and/or at the end of the module itself in the forms of multiple-choice tests, exercises, reports, workshops or project work.

Art. 5 - Final exam and achievement of qualification

The final test will consist in the discussion of a thesis related to a project carried out under the supervision of a member of the program teaching staff. This will be based on the issues tackled during the course, in the practical sections and during the internship.

At the end of the Vocational Program, participants who have carried out all the activities and fulfilled the obligations, upon passing the final exam will be awarded the first-level Post-bachelor Vocational Program's Diploma in "eXplainable Artificial Intelligence in healthcare Management (xAIM)"

Art. 6 - Faculty

Teaching will be held by faculty from the University of Pavia, and from other universities e as well as by highly-qualified professional experts.

Art. 7 - Admission requirements

The program is aimed at those who have obtained a Bachelor's Degree, pursuant to D.M. n. 270/04, in one of the following classes:

- (L-2) Classe delle lauree in Biotecnologie
- (L-7) Classe delle lauree in Ingegneria civile e ambientale
- (L-8) Classe delle lauree in Ingegneria dell'informazione
- (L-9) Classe delle lauree in Ingegneria industriale
- (L/SNT2) Classe delle lauree in Professioni sanitarie della riabilitazione
- (L/SNT1) Classe delle lauree in Professioni sanitarie, infermieristiche e professione sanitaria ostetrica
- (L/SNT3) Classe delle lauree in Professioni sanitarie tecniche
- (L-13) Classe delle lauree in Scienze biologiche
- (L-16) Classe delle lauree in Scienze dell'amministrazione e dell'organizzazione
- (L-18) Classe delle lauree in Scienze dell'economia e della gestione aziendale
- (L-27) Classe delle lauree in Scienze e tecnologie chimiche
- (L-29) Classe delle lauree in Scienze e tecnologie farmaceutiche
- (L-31) Classe delle lauree in Scienze e tecnologie informatiche
- (L-35) Classe delle lauree in Scienze matematiche
- (L-41) Classe delle lauree in Statistica

The program is aimed, also, at those who have obtained a Bachelor's Degree, pursuant to D.M. n. 509/99, in one of the following classes:

- (1) Classe delle lauree in biotecnologie
- (8) Classe delle lauree in ingegneria civile e ambientale
- (9) Classe delle lauree in ingegneria dell'informazione
- (10) Classe delle lauree in ingegneria industriale
- (SNT/2) Classe delle lauree in professioni sanitarie della riabilitazione
- (SNT/1) Classe delle lauree in professioni sanitarie, infermieristiche e professione sanitaria ostetrica
- (SNT/3) Classe delle lauree in professioni sanitarie tecniche
- (12) Classe delle lauree in scienze biologiche
- (19) Classe delle lauree in scienze dell'amministrazione
- (17) Classe delle lauree in scienze dell'economia e della gestione aziendale
- (21) Classe delle lauree in scienze e tecnologie chimiche
- (24) Classe delle lauree in scienze e tecnologie farmaceutiche
- (26) Classe delle lauree in scienze e tecnologie informatiche
- (32) Classe delle lauree in scienze matematiche
- (37) Classe delle lauree in scienze statistiche

The program is also aimed to those who obtained a Master's Degree in:

- Diploma di laurea specialistica/magistrale a ciclo unico e previgente ordinamento in Medicina e chirurgia LM41, 46/S

and degrees in accordance with the previous regulations in:

- Biotecnologie
- Ingegneria civile e ambientale
- Ingegneria dell'informazione
- Ingegneria industriale
- Scienze delle professioni sanitarie della riabilitazione
- Scienze infermieristiche e ostetriche
- Scienze delle professioni sanitarie tecniche
- Scienze biologiche
- Scienze dell'amministrazione
- Scienze dell'economia e della gestione aziendale
- Scienze e tecnologie chimiche
- Scienze e tecnologie farmaceutiche
- Scienze e tecnologie informatiche

- Scienze matematiche
- Scienze statistiche

The maximum number of places available is 35.

The minimum number of participants to activate the course is 25.

The Academic Board will also be able to assess whether the conditions for expanding the maximum number of participants are met.

Should the number of applicants exceed the maximum number allowed, a Commission composed of the Coordinator and two Faculty members will make a selection and formulate a merit ranking, expressed in hundredths, which takes into account the following evaluation criteria:

- Up to a maximum of **20 points** for the **graduation mark** (referred to the admission requirement), as follows:

  equal to 110/110 e lode 20 points
  between 105/110 and 110/110 15 points
  between 99/110 and 104/110 12 points
  between 90/110 and 98/110 9 points
  under 90/110 5 points

- Up to a maximum of **5 points** for any other post graduation title concerning the themes of the program, as follows:

  - 5 points for PhD and/or Medical Specialization Diploma and/or Post-bachelor Vocational Program and/or Master Degree (except for Medicine and Surgery LM41,46/S), concerning the themes of the program.

- Up to a maximum of **15 points** for **professional experience** related to the topics of the program, which will be evaluated as follows:

- 15 points if more than 2 years

- 10 points if between 1 and 2 years

- 8 points if under a year

- Up to a maximum of **10 points** for the **letter of reference**, which will be evaluated as follows:

- 5 points awarded to the relevance to the xAIM program topics of the research topics/experience professional experience of the reference person;

- 5 points assigned to the relevance of the referee's institution in reference to the themes of the xAIM program.

The candidate will be admitted to the interview with a score of **20 or higher**.

The interview has a maximum score of 50 points and is aimed at assessing the motivation and knowledge of English.

It is considered passed with a minimum score of 30.

In case of equal merits, young age will prevail in the ranking. In case of withdrawal of one or more candidates, the vacant place/places will be made available to the next candidate in the ranking, up to the coverage of all available places.

Art. 8 - Deadline for admission application

Applicants must submit their application for admission in accordance with the procedures, set out in the Call for Admission, from 26/07/2024 and by the deadline of 29/11/2024. The requirements of the Call fo admission and this Attachment, must be held by the deadline for application.

Art. 9 - Attachments to upload for the admission application

Candidates must attach, during the online application procedure, the scan of the following documentation:

1. a **curriculum vitae** with an indication of the admission requirements and for eventual selection (degree mark, publications,

postgraduate qualification and professional experience);
2. a **reference letter**.

Art. 10 - University tuition and fees

Enrolment

For the l'a.a. 2024/25, those enrolled in the course must pay the sum of **€ 4.900,00**, inclusive of: € 16,00 (stamp duty tax) € 142,00 (Administrative fees).

This amount will be paid in 3 installments:
- installment 1 of € **2.500,00**, to be paid **at the time of enrollment**
- installment 2 of € **1.200,00**, to be paid before **28/02/2025**
- installment 3 of € **1.200,00**, to be paid before **31/05/2026**

Bodies or national/international subjects can contribute to the functioning of the Vocational Program by providing scholarships aimed to enrollment/internships attendance. In the event of finalization of the aforementioned agreements, they will be publicized on the relevant website with the eventual award criteria.

Final exam

In order to be admitted to the final exam, candidates must submit a specific application form along with the payment of 116,00 as a fee for the issuance of the Vocational Program's Diploma (including n° 2 stamp duty tax of 16,00 paid virtually: one for the parchment and one for the application). The cost of the parchment could be updated by resolution of the Board of Directors after the publication of this notice.

Art. 11 - Web site and Organizational Secretary

Any communication and important information regarding candidates and students will be published on the following website: https://xaim.eu

For information regarding the course organization:

Organizational Secretary

E: info@xaim.eu

The person of reference is Prof.ssa Valentina Beretta