COURSE DETAILS

"LIVESTOCK FARMING THROUGH ARTIFICIAL INTELLIGENCE"

DEGREE PROGRAMME: PRECISION LIVESTOCK FARMING

ACADEMIC YEAR 2025-2026

GENERAL INFORMATION – TEACHER REFERENCES

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GENERAL INFORMATION ABOUT THE COURSE

INTEGRATED COURSE: BIG DATA APPROACH AND ANALYSIS
MODULE: LIVESTOCK FARMING THROUGH ARTIFICIAL INTELLIGENCE
SSD OF THE MODULE: IINF-05/A
TEACHING LANGUAGE: ENGLISH
CHANNEL: -
YEAR OF THE DEGREE PROGRAMME (I, II, III): I YEAR
SEMESTER (I, II, ANNUAL): I SEMESTER
CFU: 3

REQUIRED PRELIMINARY COURSES (IF MENTIONED IN THE COURSE STRUCTURE "REGOLAMENTO")

None

PREREQUISITES (IF APPLICABLE)

No specific prerequisites are required. However, it is assumed that the student is familiar with calculus and has basic knowledge of computer science.

LEARNING GOALS

The course aims to provide students with an integrated overview of the potential of artificial intelligence (AI) applied to livestock farming, with the goal of improving production efficiency, animal welfare, and environmental sustainability.
Focusing on data analysis from sensors, images, and management systems, students will acquire skills in the use of machine learning techniques (supervised and unsupervised learning for classification and regression tasks). The teaching approach will be practice-oriented, with case studies based on real-world scenarios and group project activities.
Learning will be supported by open-source tools, with particular attention to platforms and programming languages such as R and Python. Emphasis will be placed on understanding models, interpreting their outputs, and adapting AI solutions to the specific needs of the livestock sector.

EXPECTED LEARNING OUTCOMES (DUBLIN DESCRIPTORS)

Knowledge and understanding
Acquire a solid understanding of the fundamental principles of artificial intelligence, with particular focus on data representation and machine learning models (both supervised and unsupervised).
Understand the theoretical foundations of the main machine learning and deep learning methods, the logic behind the algorithms used, the results obtained, as well as the criteria for evaluating model performance.

Applying knowledge and understanding
The training program is designed to develop the ability to manage data flows, apply preprocessing strategies, and build machine learning pipelines consistent with the objectives of the analysis.
Furthermore, the student is expected to demonstrate a critical approach to the use of AI, recognizing the limitations, assumptions, and methodological implications of different techniques, with particular attention to the reliability and generalizability of the developed models.

COURSE CONTENT/SYLLABUS

[4 hours] Introduction to artificial intelligence: *Definitions; AI taxonomies; AI history timeline and current developments; ethics in AI; Preliminary definitions: informatics, algorithms, AI, ML, DL, data-driven philosophy, learning paradigms: supervised learning, unsupervised learning, reinforcement learning.*
[10 hours] Supervised learning classification: *Binary classification; multiclass classification; classification performance (true/false positives/negatives, accuracy, ROC curve, confusion matrix, precision, recall, sensitivity, macro-averaging and micro-averaging, overfitting and underfitting, non-functional requirements; classification algorithms (KNN, Tree-based classifiers, Naive Bayes, Neural Networks).*
[4 hours] Unsupervised Learning*: clustering; dimensionality reduction.*
[4 hours] Deep Learning: *Deep FeedForward Networks, Convolutional Neural Networks, Recurrent Neural Networks, Large Language Models;*
[8 hours] Case Studies: *Data analysis and examination of real-world case studies. Group activities and projects.*

READINGS/BIBLIOGRAPHY

The teaching material consists of slides, handouts, and articles provided by the teacher

TEACHING METHODS

Lectures (60%).

Laboratory-based teaching with active student participation (40%).

The teacher will use a student-centered method; tutorials; Practical lessons, learning by doing method. The lessons will be supported by multimedia teaching material available to students on the teacher's website, after registering for the course.

EXAMINATION/EVALUATION CRITERIA

a) Exam type:

*For **integrated courses**, there should be one exam.*

Exam type	
written and oral	
only written	
only oral	
project discussion	X
other	

b) Evaluation pattern:

The final grade will be weighted according to credits (CFUs) of each module and will be composed as follows: "Statistical Process Control" module – 5 CFUs: 62.5%; "Livestock Farming through Artificial Intelligence" module – 3 CFUs: 37.5%.

For the evaluation, the “Regulation for Guidelines_for_exams_management” approved by the Didactic Coordination Committee of the Master Degree in Precision Livestock Farming will be considered