

## Syllabus

### Course description

<b>Course title</b>	AI Applications in Industry
<b>Course code</b>	47566
<b>Scientific sector</b>	ING-IND/16
<b>Degree</b>	Master in Industrial Mechanical Engineering
<b>Semester</b>	1
<b>Year</b>	II
<b>Academic year</b>	2024/25
<b>Credits</b>	5
<b>Modular</b>	no

<b>Total lecturing hours</b>	24 hrs
<b>Total lab hours</b>	
<b>Total exercise hours</b>	24 hrs
<b>Attendance</b>	Highly recommended
<b>Prerequisites</b>	none
<b>Course page</b>	<a href="https://www.unibz.it/en/faculties/engineering/master-industrial-mechanical-engineering/course-offering/?academicYear=2024">https://www.unibz.it/en/faculties/engineering/master-industrial-mechanical-engineering/course-offering/?academicYear=2024</a>

<b>Specific educational objectives</b>	<p>The course belongs to the class of characterizing courses in the Master in Industrial Mechanical Engineering. It aims at introducing Artificial Intelligence to students by teaching fundamentals, scientific foundations and especially practical methods and industrial applications of AI to develop specific professional skills.</p> <p>The course is structured in 3 parts:</p> <ul style="list-style-type: none"> <li>• Part 1 gives a general introduction in AI and its trends.</li> <li>• Part 2 provides theoretical fundamentals and practical methods for implementing AI applications in industry.</li> <li>• Part 3 covers the exercise part where students will gain insight in realized AI solutions in Industry by excursions, external experts as well as individual practical project work to apply the learned methods from Part 2 in practice.</li> </ul>
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<b>Lecturer</b>	Dr. Ing. Andrea Giusti + Dr. Matteo De Marchi
<b>Teaching language</b>	English
<b>Office hours</b>	By appointment
<b>Teaching assistant (if any)</b>	/
<b>Office hours</b>	By appointment
<b>List of topics covered</b>	<u>Part 1 - Introduction to AI and its trends:</u> 1. Short introduction to the history of AI.

	<ol style="list-style-type: none"> <li>2. How intelligent is AI really?</li> <li>3. Basics of machine learning.</li> <li>4. Neural networks - on the way to the artificial brain.</li> <li>5. Deep Learning - The new highlight of AI.</li> <li>6. AI changes our world.</li> <li>7. Ethical questions of AI.</li> </ol> <p><u>Part 2 - Fundamentals and methods of AI for applications in industry:</u></p> <ol style="list-style-type: none"> <li>8. Basic concept of intelligent agents and their categorization.</li> <li>9. <u>Search and constraint satisfaction problems</u> with example application to scheduling and routing.</li> <li>10. <u>Reasoning</u> under uncertainty with example application to state estimation and prediction.</li> <li>11. <u>Rational decisions</u> under uncertainty with example application to decision support.</li> <li>12. <u>Learning from examples</u> and from reinforcement with example application to classification.</li> </ol> <p><u>Part 3 – Exercises and external experts</u></p> <ol style="list-style-type: none"> <li>13. Excursion and lab demos (Fraunhofer ARENA)</li> <li>14. Industrial solutions and cases presented by external experts</li> <li>15. Individual/group project work (assignment).</li> </ol>
<b>Teaching format</b>	Frontal lectures and exercises with computer

<b>Learning outcomes</b>	<p><u>Knowledge and understanding</u></p> <ol style="list-style-type: none"> <li>1. The student knows the historical development as well as basics of modern methods and techniques of artificial intelligence.</li> <li>2. Knowledge of the potential of AI in industrial applications.</li> <li>3. Knowledge of risks and limitations of AI.</li> <li>4. Knowledge of ethical questions concerning AI.</li> </ol> <p><u>Applying knowledge and understanding</u></p> <ol style="list-style-type: none"> <li>5. The student applies and practices theoretical contents through exercises and project work.</li> </ol> <p><u>Making judgements</u></p> <ol style="list-style-type: none"> <li>6. Ability to correctly classify and assess the advantages and disadvantages, potentials and limitations, as well as the opportunities and risks of AI.</li> <li>7. Ability to independently analyse application areas with regard to the possible use of methods and techniques from the field of AI.</li> </ol>
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	<p><u>Communication skills</u></p> <p>8. Ability to discuss complex and innovative issues in a structured manner.</p> <p><u>Learning skills</u></p> <p>9. Ability to autonomously extend the knowledge acquired during the study course by reading and understanding scientific and technical documentation. The student is able to enlarge his knowledge through self-study and consultation of scientific and technical texts.</p>
<b>Assessment</b>	<p><u>Knowledge and understanding:</u> written exam</p> <p><u>Applying knowledge and understanding, Making judgements, Communication skills:</u> Individual/group project work (assignment) with short report and presentation.</p>
<b>Assessment language</b>	English
<b>Evaluation criteria and criteria for awarding marks</b>	<p>Final evaluation by a single final grade.</p> <p>The final grade is calculated from the results of the written exam (50%) and the results of individual/group project work with short report and presentation (50%).</p> <p>Criteria for the evaluation of the written examination: completeness and correctness of the answers.</p>
<b>Required readings</b>	Lecture notes and documents for exercises will be available online.
<b>Supplementary readings</b>	Stuart Russell, Peter Norvig (2021). Artificial Intelligence: A Modern Approach, Global Edition. Pearson Higher Ed.- 1167 pages.