Artificial Intelligence and Robotics in Education

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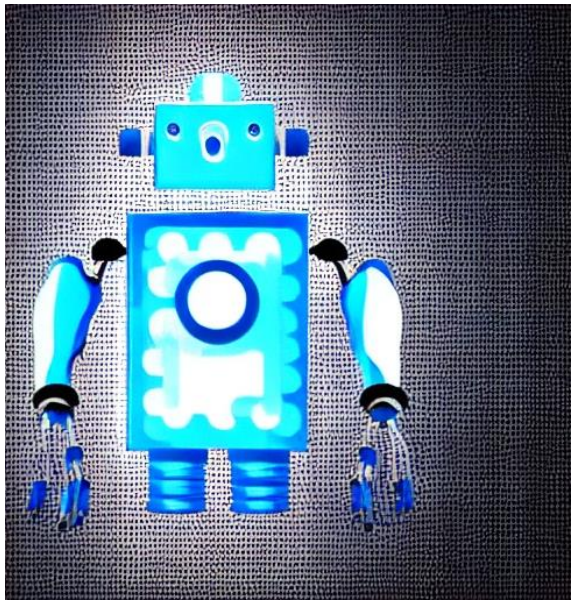
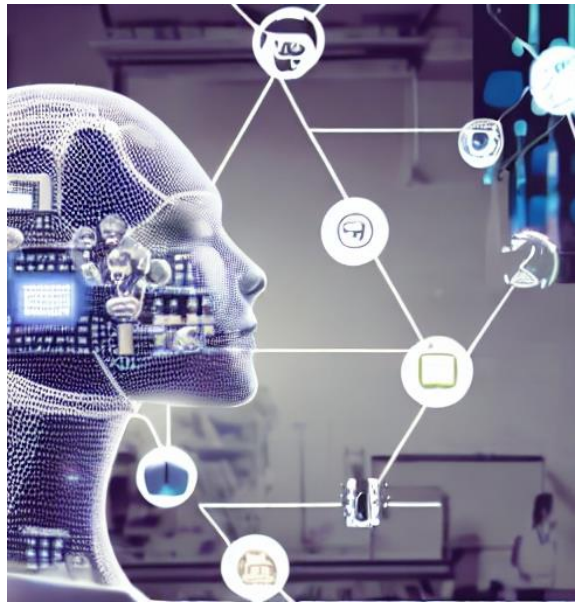
Presentation contents



Artificial Intelligence and Robotics (AIR) in Education

AIR for Learning (personalized learning and creative learning)



Learning for AIR (teaching materials and curriculum proposals)

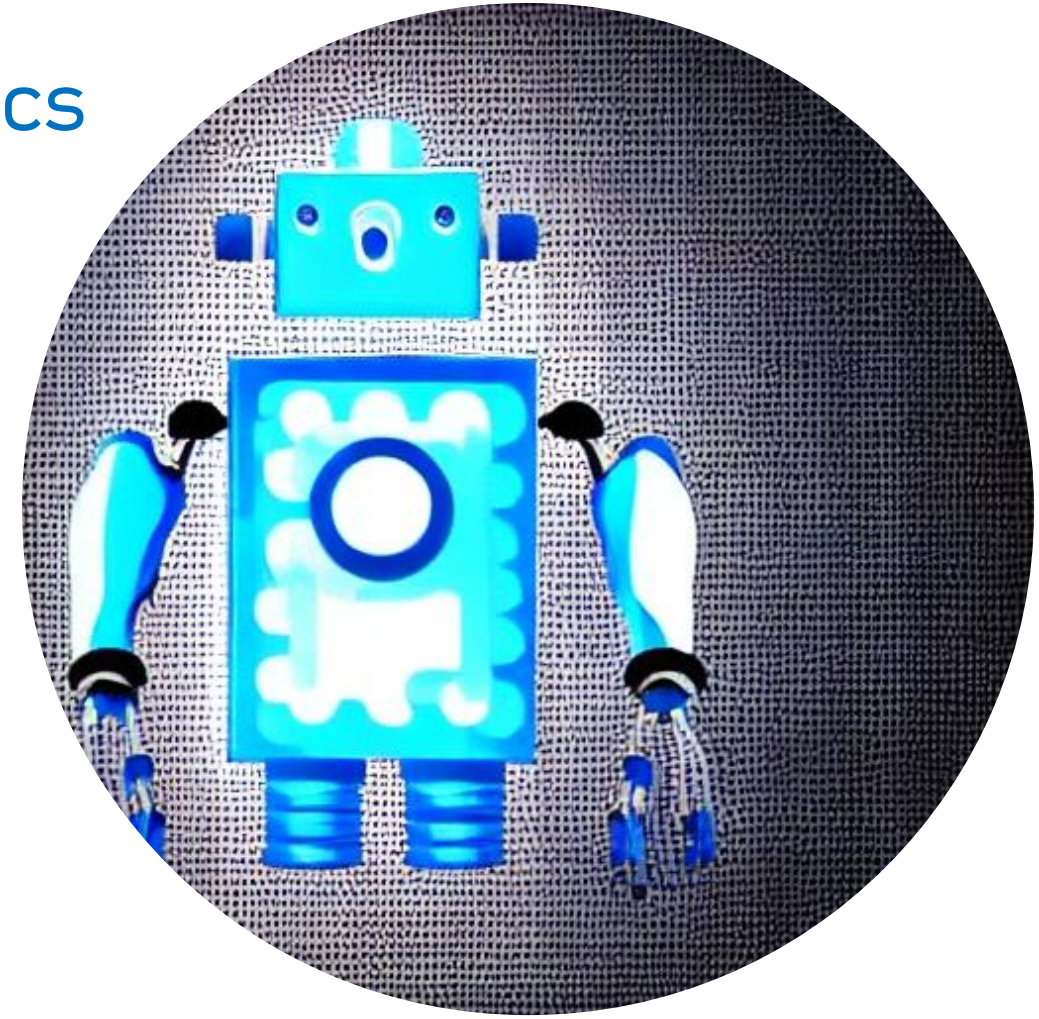
Apprendimento, robotica e intelligenza artificiale: la costruzione di conoscenza nel post digitale

- I contenuti dei contributi analizzati nell'analisi sistematica su RE e IA rimandano a 7 temi principali:
- 1. RE e IA per l'apprendimento;
- 2. Insegnanti-robot;
- 3. RE e IA per lo sviluppo di competenze nelle STEM;
- 4. Intelligenza emotiva e Social Robot;
- 5. Educazione all'IA;
- 6. RE, IA e questioni di genere.
- 7. Implicazioni culturali ed etiche dell'IA.

Panciroli, Macauda, Fabbri, 2022

Artificial Intelligence and Robotics (AIR) in Education

- Innovation of teaching and learning **methods and tools**
- Evolution of the concept of **learning environment** towards an open ecosystem in which multiple stakeholders interact



Bailey, 2019; Panciroli, Rivoltella, 2023

AIR for Learning

- To stimulate students' **interest** and **motivation** to knowledge
- To promote **interaction** with the environment through realistic challenges
- To promotes the learning of **abstract concepts** in concrete contexts of exploration and discovery
- To improve **relational skills**

AIR for personalized learning

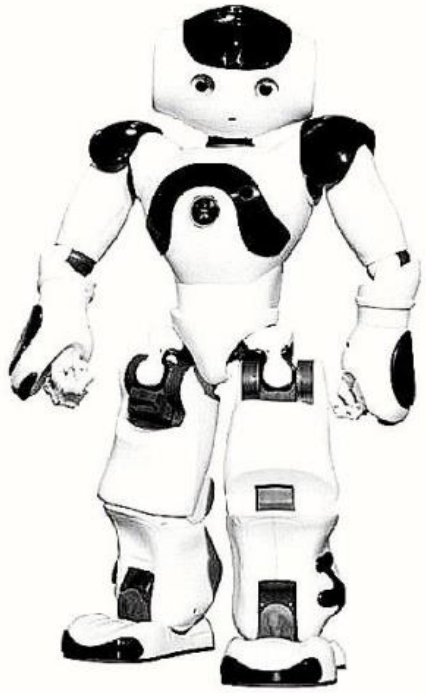
Tutoring systems based on AI and robotics for

- To focus on the specificities and needs of each student,
- To provide personalized and adaptive teaching solutions.
- To adapt the difficulty of the proposed exercises to the knowledge and skills achieved by the students

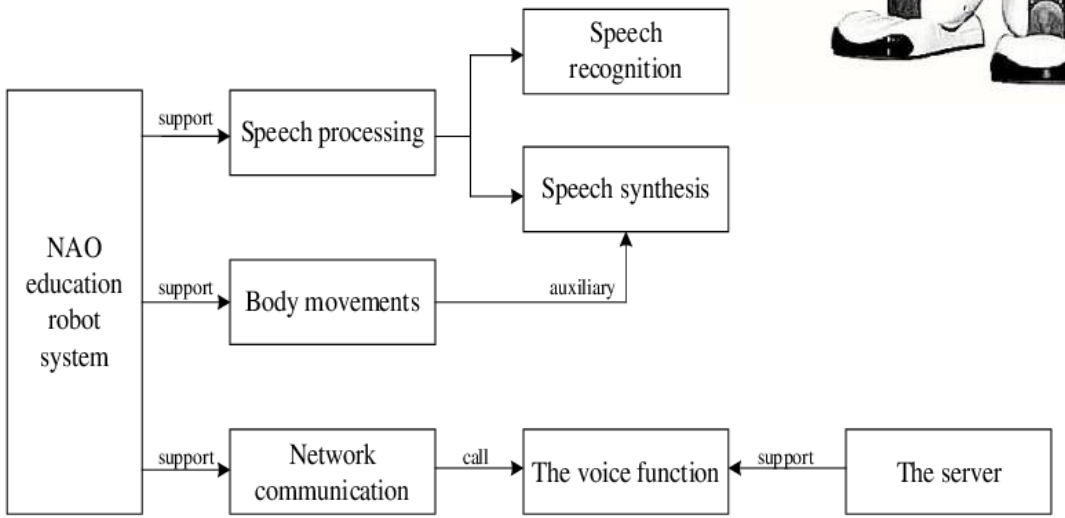
Herold 2019, Huang 2021.

CASE STUDY

Development of Educational Robot Teaching Resources Using Artificial intelligence technology



- RESEARCH OBJECTIVES - Innovate English teaching and promote the optimization and development of intelligent and innovative English teaching resources
- RESEARCH CONTEXT – Robot applied in primary school English teaching practice



Huang, 2021

FUNCTIONS AND RESULTS

Function realization of educational robot:

- English vocabulary function
- Role play function
- Dialogue function

The robot can improve:

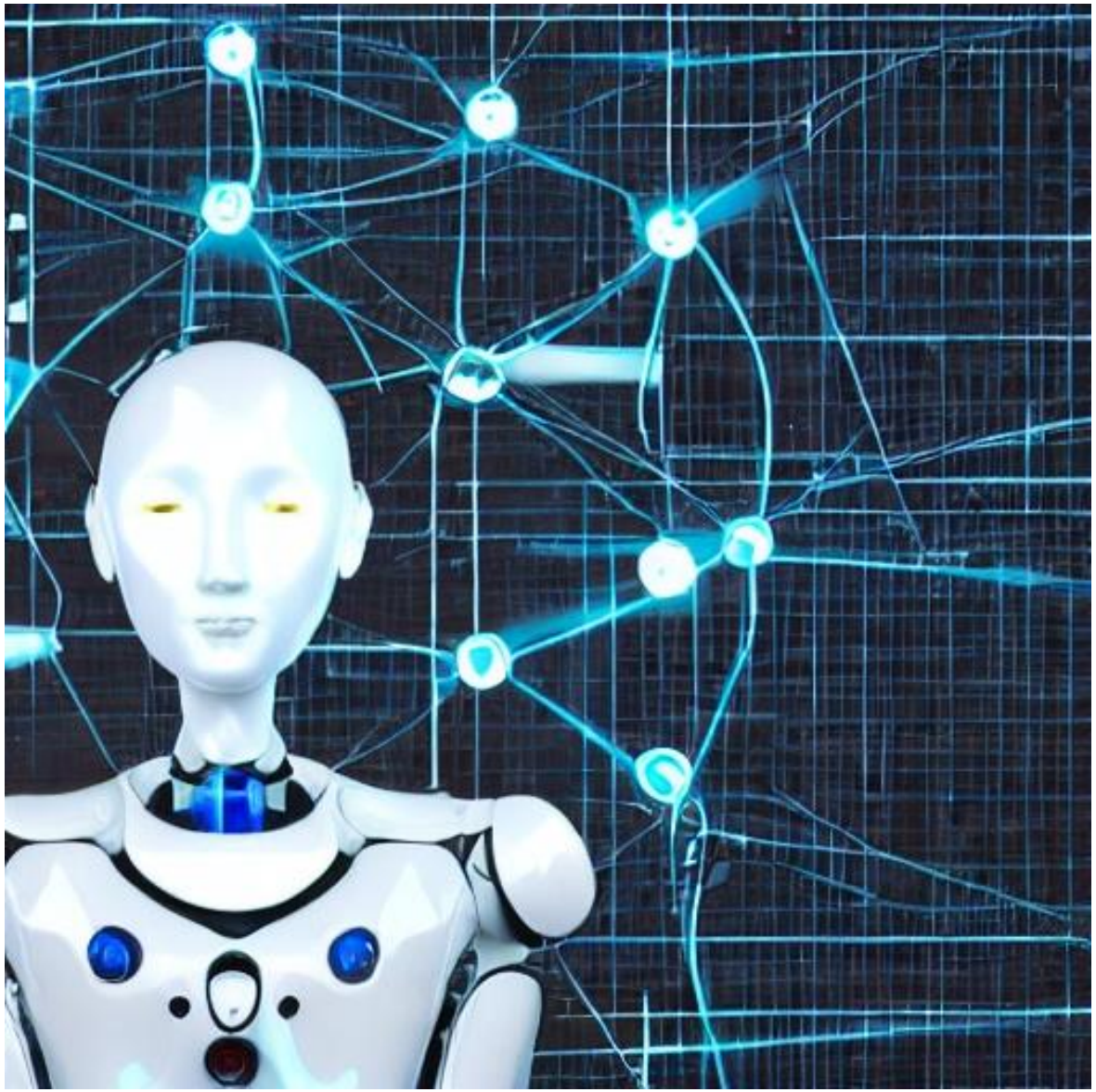
- students' attention
- initiative in classroom practice.

An educational artificial intelligence robot based on **voice interaction** to promote the development of personalized, accurate and intelligent teaching.

Teaching result detection of educational robot:

- Achievement of teaching objectives
- The design of teaching content
- The generation of teaching resources:
- Fluency of teaching links
- The innovation of teaching process

Huang, 2021



AIR for creative learning

Focus

- AIR to promote and develop creativity
- AIR to study and understand the creative process embodied in artificial agents

Ineia et al. 2022; Gubenko et al. 2021; Ali, 2019

CASE STUDY

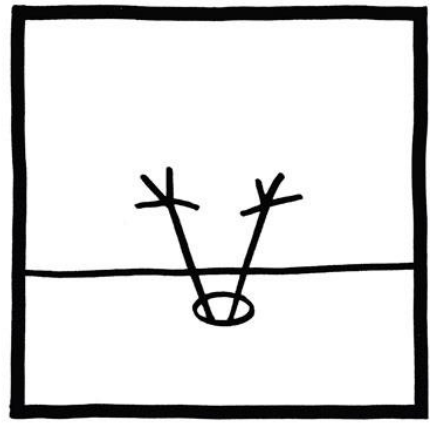
A SOCIAL ROBOT'S AND CHILDREN'S FIGURAL CREATIVITY

AIMS

- to explore how a social robot's **co-presence** and **creativity demonstration** influences children's **creative expression** during collaborative gameplay.
- to understand the effect of the robot's co-presence on **children's creativity**

FOCUS

- Robot's behavior **to express and model figural creativity** during gameplay



Children played a digital drawing game that afforded **figural creativity** with a social robot (Jibo)

Ali, Park, Breazeal, 2021

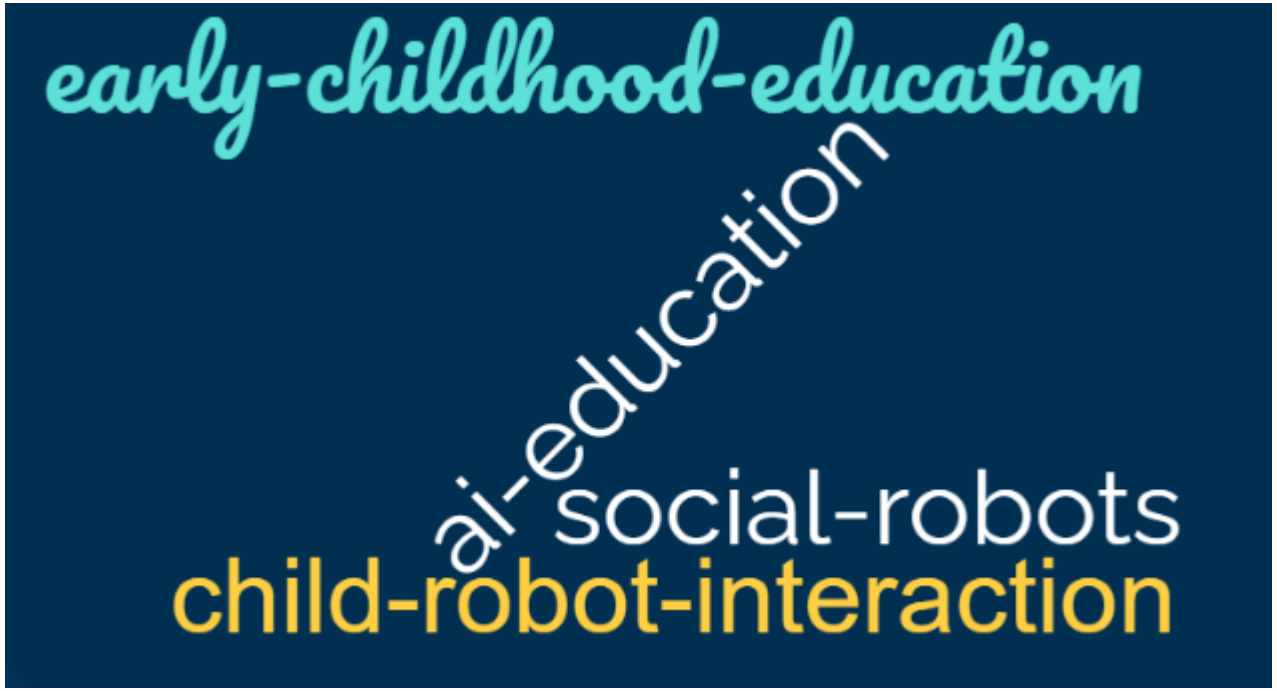
Learning for AIR

- Development of innovative teaching materials for AI and Robotics Education.
- Development of proposals for integration into the school curriculum

CASE STUDY

PopBots - proposal of an early childhood AI curriculum based on knowledge of AI principles through the construction and programming of robots

- To teach children about AI concepts through the Preschool-Oriented Programming (PopBots) Platform



Williams, Won Park, Oh and Breazeal 2019

PopBots

Preschool children train and interact with social robots to learn three AI concepts:

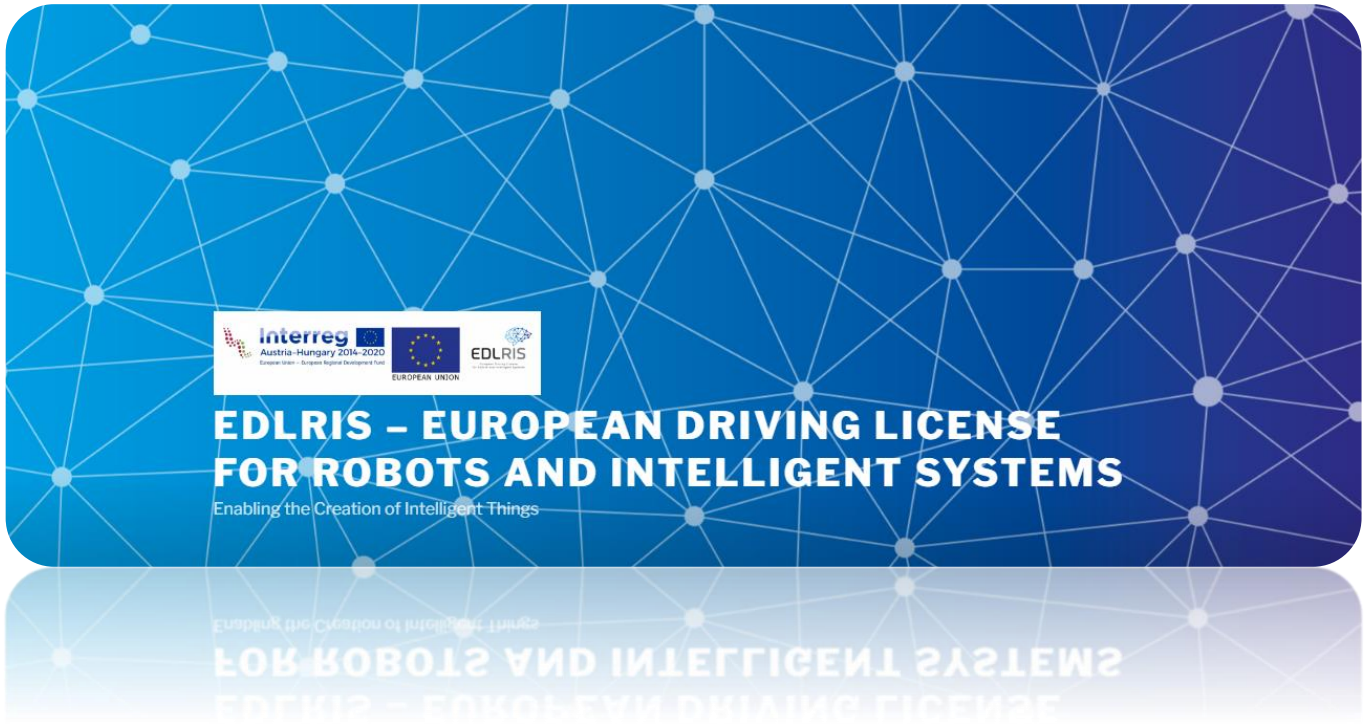
- knowledge-based systems,
- supervised machine learning,
- generative AI.

Figure 1: The *PopBots* platform consists of a smartphone-based social robot, LEGO blocks, LEGO WeDo motors, and a block-based programming interface on a tablet.

The platform consists of a **social robot toolkit**, a **programming interface on a tablet computer**, and **three hands-on activities** with assessments for young children to **explore machine learning algorithms**.

Williams, Won Park, Oh and Breazeal 2019

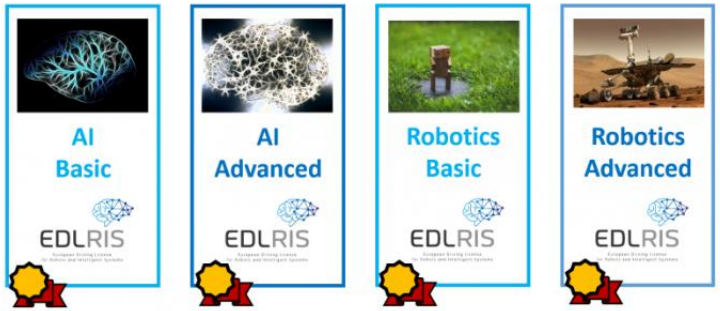
CASE STUDY



European Driving License for Robots and Intelligent Systems (EDLRIS)

- A standardized and internationally recognized certification system for AI and Robotics
- The EDLRIS certification system aims to promote AI and robotics literacy among teachers and students.

EDLRIS comprises 4 modules for trainers and trainees:



AI Basic

- ethical and social aspects
- AI introduction and definition
- AI in daily life
- identifying / recognizing AI systems
- programming basics
- practical AI project
- solving problems by search (DFS, BFS, Greedy)
- principles and applications of computer vision, machine learning
- basics of propositional logic
- fundamental data structures in AI

AI Advanced

- ethical and social aspects
- AI definitions, applications and history of AI
- working with common AI frameworks and tools
- fundamental mathematical concepts in AI
- properties of problem representations
- practical AI project
- solving problems by fundamental AI concepts: search, declarative, data driven
- principles of knowledge based systems, natural language processing, CSP, machine learning
- modeling and analyzing problems

Robotics Basic

- ethical and social aspects
- Robotics history and terminology
- use cases and robotics applications in our everyday life
- robotics components (actuator, sensor, controller)
- practical robotics project
- principles of robotics and intelligent systems (sense-plan-act)
- building and programming mobile robots
- modeling of robotics systems (flowchart)

Robotics Advanced

- ethical and social aspects
- overview robotics systems
- principles of robot manipulators and mobile robots
- linear algebra, CS, physics
- practical robotics project
- geometrical and kinematical models of robot manipulators and mobile robots
- systematic engineering approach
- sensor fusion and state estimation (e.g. Kalman filter)

OPEN PERSPECTIVES

Designing and construction of curriculum proposals that refer to ethical, cultural and social aspects and that promote an **AI culture**.

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