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  - AI4T
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WHAT TYPES OF AI APPLICATIONS IN EDUCATION

Among the possible classifications of AI scientific domains, the following table presents an AI taxonomy[1] according to the family functions possibly performed by AI.

	AI taxonomy	
	AI domain	**AI subdomain**
Core	**Reasoning**	Knowledge representation
		Automated reasoning
		Common sense reasoning
	Planning	Planning and Scheduling
		Searching
		Optimisation
	Learning	Machine learning
	Communication	Natural language processing
	Perception	Computer vision
		Audio processing
Transversal	**Integration and Interaction**	Multi-agent systems
		Robotics and Automation
		Connected and Automated vehicles
	Services	AI Services
	Ethics and Philosophy	AI Ethics
		Philosophy of AI

Figure: AI taxonomy - AI scientific domains and subdomains (from Samoili & al., 2021 JRC report[1]).

Let's see which AI techniques are used in the AI-based education-oriented applications proposed by Holmes & al. in 2019[2].

Student teaching	Student supporting	Teacher supporting	System supporting
Intelligent Tutoring Systems (ITS) (inc. automatic question generators)	Exploratory learning environments	ITS & learning diagnostics	Educational data mining for resource allocation
	Formative writing evaluation	Summative writing evaluation, essay scoring	
	Learning network orchestrators	Student forum monitoring	
Dialogue-based tutoring systems	Language learning applications	AI teaching assistants	Diagnosing learning difficulties
	AI collaborative learning	Automatic test generation	
	AI continuous assessment	Automatic test scoring	
	AI learning companions	Open Education Resources (OER) content recommendation	Synthetic teachers
Language learning applications (inc. pronunciation detection)	Course recommendation	Plagiarism detection	
	Self-reflection support (learning analytics, meta-cognitive dashboards)	Student attention and emotion detection	AI as a learning research tool
	Learning by teaching chatbots		

Figure: Different types of current AI-based systems for Education (from Holmes & al. 2019[2]).

Each AI-based educational tool or resource has its own specific techniques. However, it is sometimes possible to guess which ones are likely to be used for a given resource.

Let's take some examples:

- **Dialogue-based tutoring system**, as a student teaching service Such systems are likely to use: **communication** techniques such as natural language processing for speech and language understanding and generation and **reasoning** techniques for tutoring purposes
- **Course recommendation**, as a student supporting service As for personalised marketing offers and recommendations functions that can be found on the Internet, course recommendation systems are probably based on **machine learning** techniques by analysing relevant current data related to the student learning path and identifying similarities to previous generalised student learning paths.
- **Student attention and emotion detection**, as a teacher supporting service Such a system is likely to use **perception** techniques (computer vision for facial recognition for example) and **machine learning** techniques to analyse the student's facial expressions or behaviour if such information are collected and analysed.

1. AI Watch - Defining Artificial Intelligence - 2.0. Towards an operational definition and taxonomy for the AI landscape - Samoili, S., López Cobo, M., Delipetrev, B., Martínez-Plumed, F., Gómez, E., and De Prato, G. - EUR 30873 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-42648-6, doi:10.2760/019901, JRC126426. ↩↩
2. Artificial Intelligence In Education: Promises and Implications for Teaching and Learning - Wayne Holmes, Maya Bialik, Charles Fadel - Boston, MA, Center for Curriculum Redesign, 2019. ↩↩