AI-HED
Artificial Intelligence in Higher Education Teaching and Learning

Starter Kit

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Contents

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Glossary of Terms

As artificial intelligence (AI) continues to revolutionize fields ranging from healthcare and finance to education and the arts, a foundational understanding of its key concepts has never been more essential. In higher education, AI plays a crucial role in research and practical applications, shaping the tools we use and how we approach complex problems. Whether you're a newcomer or a seasoned researcher, this glossary guides the terminology, techniques, and core ideas that define this dynamic field.

From the basics of machine learning to the nuances of neural networks and ethical considerations, this glossary is designed to be a starting point in navigating the language of AI. Each term serves as a gateway into a specific aspect of AI, illustrating how these concepts interconnect to form the systems and technologies we engage with today. By becoming familiar with this terminology, you'll gain insight into the structure and processes that make AI a transformative force in academia and beyond.

Use this glossary as a resource for study, inspiration, or simply to deepen your understanding of the artificial intelligence landscape. Each term, while simple on its own, contributes to the broader story of AI. This field is about machines and the future of human knowledge, creativity, and discovery.

Each concept in the glossary is described using three features: a definition (🔭), a description (📜), and an example (🎴). The definition provides a concise explanation of the term, while the description offers context and insights into its applications. The example illustrates how the concept is used in practice, demonstrating its real-world relevance and impact.

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A

Adaptive learning [1], [2]

An educational approach that adjusts the pace and path of learning based on a student's performance.

Adaptive learning systems analyze a learner's interaction and performance to dynamically adjust the content and difficulty, ensuring that each learner progresses at their own pace.

Platforms like DreamBox Learning that adapt math instruction.

Artificial intelligence (AI) [3], [4]

A field of computer science focused on creating systems capable of performing tasks that typically require human intelligence.

AI encompasses a variety of technologies and methods, including algorithms, robotics, and cognitive computing, aimed at mimicking human cognitive functions such as learning and problem-solving.

AI applications in healthcare, autonomous vehicles, and finance.

AI as co-teacher [5], [6]

AI as a co-teacher assists educators by providing personalized learning, facilitating assessments, and supporting student engagement through intelligent automation.

In higher education institutions, AI as a co-teacher assists with personalized learning, grading, resource management, and real-time feedback, enhancing faculty efforts and improving student outcomes.

AI as a co-teacher in HEIs provides personalized feedback, supports teaching, and enhances student learning experiences.

AI in education [7], [8]

The application of AI technologies to enhance teaching and learning processes.

AI in education leverages various technologies to create innovative teaching tools and personalized learning experiences, improving access to education and student outcomes.

Khan Academy using AI to offer personalized practice recommendations.

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AI-ASSISTED GRADING [9], [10]

AI-assisted grading uses artificial intelligence to evaluate and score student work, automating assessments while improving consistency and efficiency.

AI-assisted grading in education streamlines the evaluation process by automatically scoring assignments, providing real-time feedback, and ensuring objective, consistent assessments to support personalized student learning.

AI-assisted grading in HEIs automates assessment, providing faster, consistent evaluations and personalized feedback for students.

AI-ASSISTED LEARNING [11], [12]

AI-assisted learning uses artificial intelligence to personalize education, adapt to student needs, automate tasks, and enhance learning experiences.

AI-assisted learning in higher education institutions personalizes education, offering adaptive learning paths, automating administrative tasks, and providing real-time feedback to enhance student engagement and academic performance.

AI-assisted learning in HEIs tailors educational content, offering personalized resources and adaptive assessments to enhance student outcomes.

AI-ENHANCED CURRICULUM DESIGN [13], [14]

Using AI to create and optimize educational curricula that meet diverse learner needs.

AI-enhanced curriculum design utilizes data analytics to inform the creation and adaptation of curricula that align with student needs and learning outcomes.

Curricula designed based on data-driven insights from previous cohorts' performance.

AUGMENTED REALITY (AR) [15], [16]

An interactive experience that overlays digital information onto the real world to enhance learning.

AR enhances real-world experiences by overlaying digital information onto physical environments, offering interactive and engaging learning experiences that promote deeper understanding.

IKEA Place app allowing users to visualize furniture in their homes.

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B

Blockchain

[17], [18]

The use of blockchain technology to enhance transparency and security in educational processes.

Blockchain provides a secure, decentralized way to record transactions and credentials, ensuring integrity and trust in educational records.

Decentralized systems verifying student credentials and achievements.

C

Chatbots

[19], [20]

AI programs designed to simulate human conversation and assist users with various tasks.

Chatbots can provide instant responses to user inquiries, enhancing customer service and engagement through conversational interfaces, often powered by NLP techniques.

Customer service bots answering FAQs on websites.

Collaborative learning

[21], [22]

Learning that occurs through group interactions, often enhanced by technology.

Collaborative learning facilitated by technology allows students to work together on projects, enhancing their understanding through peer interaction and shared knowledge.

Google Docs collaborative editing features for group projects.

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COMPUTER VISION [3], [23]

An AI discipline that trains computers to interpret and understand visual information from the world.

Computer vision enables machines to extract meaningful information from images and videos, playing a crucial role in applications such as facial recognition and autonomous vehicles.

Self-driving cars that interpret visual data from their surroundings.

CONTEXT-AWARE COMPUTING [24], [25]

Computing systems that sense their environment and adapt their actions based on contextual information.

Context-aware computing enhances user experience by adapting services based on the user's context, such as location, time, and user activity.

Smart assistants adjusting recommendations based on user preferences and past behaviour.

COPYRIGHT [26], [27]

AI-generated copyright refers to intellectual property rights over content created by artificial intelligence, often involving ownership and usage disputes.

Copyright in AI refers to the legal protection of AI-generated content, addressing ownership, usage rights, and ethical concerns regarding intellectual property created by artificial intelligence systems.

Copyright in HEIs protects intellectual property rights, ensuring proper use and attribution of academic materials and research.

D

DATA MINING [19], [23]

The process of discovering patterns in large data sets, often for the purpose of making decisions.

Data mining techniques are applied to uncover patterns and insights from large data sets, assisting educators in making informed decisions about curriculum and teaching strategies.

Market basket analysis in retail to understand shopping patterns.

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Data privacy in AI

[28], [29]

Ensuring privacy of personal data in AI systems.

AI ensuring student data privacy in EdTech.

Data privacy in AI for HEIs ensures secure handling of student data, maintaining confidentiality and compliance with regulations.

Deep learning

[3], [4]

A type of machine learning that uses multi-layered neural networks to analyze various factors of data.

Deep learning employs neural networks with many layers (hence 'deep') to analyze large amounts of data, making it suitable for complex tasks like image and speech recognition.

Image recognition systems used in social media platforms.

Digital twins

[24], [30]

Digital replicas of physical entities that use real-time data to improve decision-making.

Digital twins are virtual models of physical systems that use real-time data to optimize performance and predict outcomes, applied in engineering and healthcare.

Virtual replicas of cities used for urban planning and disaster management.

E

Edge computing

[24], [31]

A computing paradigm that processes data near the source rather than relying on a centralized data center.

Edge computing reduces latency and bandwidth use by processing data closer to the source, enhancing real-time data processing in IoT applications.

Smart devices processing data for real-time analytics on-site.

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Emotion recognition [32], [33]

AI systems capable of recognizing and interpreting human emotions from facial expressions or voice.

Emotion recognition uses AI to analyze human emotions through various inputs, providing insights for applications in marketing, therapy, and education.

Customer service systems adapting responses based on customer mood detected through voice.

Equitable AI [34], [35]

Equitable AI ensures fair treatment and outcomes for all individuals, addressing biases and promoting equal opportunities across diverse groups.

Equitable AI promotes fairness by addressing biases, ensuring diverse representation, and creating inclusive systems that provide equal opportunities and outcomes for all individuals, regardless of background.

Responsible AI in HEIs ensures ethical AI development, prioritizing fairness, transparency, and student privacy in educational applications.

Ethical AI [36], [37]

Ethical AI refers to the development and deployment of artificial intelligence systems that prioritize fairness, accountability, transparency, and respect for human rights.

Ethical AI focuses on developing systems that prioritize fairness, transparency, accountability, and respect for human rights, ensuring AI applications benefit society while minimizing potential harm.

Training data in HEIs helps AI models personalize learning, improve assessments, and enhance research outcomes effectively.

Ethics in AI [4], [29]

The study of moral implications and societal impact of AI technologies.

The ethical considerations in AI encompass fairness, accountability, transparency, and the potential impacts on employment, privacy, and society.

Debates on bias in algorithmic decision-making in hiring practices.

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Expert systems [3], [24]


AI systems that mimic the decision-making abilities of a human expert in a specific domain.


Expert systems use rule-based logic to solve complex problems, providing explanations and reasoning akin to a human expert in fields like medicine or finance.


IBM Watson providing diagnostic support in healthcare settings.

Explainable AI (XAI) [3], [38]


AI techniques that provide transparent and understandable insights into how AI models make decisions.


XAI focuses on making AI systems more interpretable and understandable, enabling users to grasp the reasoning behind automated decisions.


AI models explaining their predictions in loan approval processes.

F

Federated learning [3], [29]


A machine learning method that allows training on decentralized data without compromising privacy.


Federated learning enables collaborative model training across multiple devices or servers while keeping data localized, ensuring privacy and security.


Collaborative models trained on data from smartphones for predictive typing without data leaving the device.

Fuzzy logic [3], [24]


A form of many-valued logic that deals with reasoning that is approximate rather than fixed and exact.


Fuzzy logic offers a way to deal with uncertainty and imprecision, allowing systems to reason with approximate values, which is useful in control systems.


Temperature control systems that adjust settings based on changing conditions.

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G

Gamification [39], [40]

The use of game design elements in non-game contexts to enhance engagement and motivation.

Gamification in education incorporates game-like elements such as points, badges, and leaderboards to motivate students and increase participation in learning activities.

Duolingo incorporating points and levels to motivate language learners.

General Data Protection Regulation (GDPR) **Regulation2016679**, [41]

GDPR (General Data Protection Regulation) is a European Union regulation that governs data protection and privacy for individuals within the EU.

GDPR in education ensures that institutions protect students' personal data, maintain privacy, and comply with regulations by implementing secure data handling practices and fostering transparency.

GDPR in HEIs ensures compliance with data protection laws, safeguarding student information and promoting privacy rights.

Generative adversarial network (GAN) [3], [19]

A class of machine learning frameworks where two neural networks compete against each other to generate new data.

GANs consist of a generator and a discriminator that work against each other, leading to the creation of realistic data such as images and videos.

Deepfakes used in video content creation and entertainment.

Generative pre-trained transformer (GPT) [42], [43]

GPT (Generative Pre-trained Transformer) is an AI model that generates human-like text by understanding context from large datasets.

GPT is used for generating human-like text, language translation, content creation, answering questions, summarizing information, and assisting in various natural language processing applications across industries.

GPT in HEIs assists with content generation, personalized learning, tutoring, and automating administrative tasks efficiently.

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H

Human-computer interaction (HCI) [3], [44]

The design and study of user interfaces that facilitate effective interaction between humans and computers.

HCI examines how people interact with computers and designs technologies that let humans communicate with computers in novel ways.

User-friendly interfaces for software applications improving user satisfaction.

I

Intelligent tutoring systems [45], [46]

AI systems that provide personalized feedback and guidance to learners based on their individual needs.

Intelligent tutoring systems adapt the instructional content and feedback based on learners' performance and preferences, aiming to enhance individualized learning experiences.

Knewton and Carnegie Learning providing personalized learning paths.

K

Knowledge representation [3], [24]

A field of AI concerned with how knowledge can be represented and manipulated by machines.

Knowledge representation involves various forms and structures, such as semantic networks and ontologies, that enable machines to simulate human understanding.

Knowledge graphs used in search engines to provide contextually relevant information.

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L

Learning analytics [47], [48]

The measurement and analysis of data related to learners and their contexts to improve learning outcomes.

Learning analytics involves the collection and analysis of student data to inform teaching strategies, improve student engagement, and enhance educational outcomes.

Tools like Blackboard Analytics to assess student performance.

Large language model (LLM) [49], [50]

LLM (Large Language Model) is an AI model trained on vast text data to generate, understand, and manipulate natural language.

LLMs (Large Language Models) in AI process vast amounts of text data to generate, understand, and manipulate human language, enabling applications like text generation, translation, and summarization.

LLMs in HEIs support research, generate content, assist in tutoring, and enhance personalized student learning experiences.

M

Machine learning (ML) [3], [4]

A subset of AI that enables systems to learn from data, identify patterns, and make decisions with minimal human intervention.

ML algorithms improve automatically through experience. Techniques include supervised, unsupervised, and semi-supervised learning, enabling computers to analyze data and make predictions or decisions without explicit programming.

Email filtering, fraud detection, and recommendation systems like Netflix.

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MULTIMODAL LEARNING [51], [52]

Learning that integrates multiple modes of input (e.g., text, audio, video) to enhance comprehension.

Multimodal learning combines information from various sources to improve learning outcomes, allowing for richer and more engaging educational experiences.

Speech recognition systems that integrate audio and text input to enhance understanding.

N

NATURAL LANGUAGE PROCESSING (NLP) [3], [4]

A branch of AI that focuses on the interaction between computers and humans through natural language.

NLP combines linguistics and AI to enable machines to understand, interpret, and respond to human language, facilitating applications like translation services and sentiment analysis.

Voice-activated assistants like Siri or Google Assistant.

NEURAL NETWORKS [3], [19]

Computational models inspired by the human brain that are designed to recognize patterns and classify data.

Neural networks consist of interconnected nodes (neurons) that process data in layers, effectively allowing the system to learn complex patterns and representations of data.

Facial recognition systems used in security and social media.

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O

Online assessment tools [53], [54]

Tools and platforms that facilitate assessment and feedback in online learning environments.

Online assessment tools facilitate the evaluation of student learning through quizzes, exams, and peer assessments, enhancing feedback mechanisms.

Automated grading systems that provide instant feedback on student submissions.

P

Parameter [55], [56]

In AI, parameters are internal variables in models, such as weights and biases, adjusted during training to optimize performance.

Parameters in AI models, such as weights and biases, are adjusted during training to optimize performance, helping models recognize patterns and make accurate predictions or decisions.

Parameters in AI for HEIs are adjusted to optimize models for grading, personalized learning, and data analysis.

Personalized learning [57], [58]

Tailoring educational experiences to meet the individual needs of students.

Personalized learning utilizes data to adapt educational content to meet individual students' needs, enhancing engagement and efficiency in learning processes.

Online learning platforms like Coursera tailoring course suggestions.

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Predictive analytics [23], [29]

The use of statistical techniques to analyze historical data to predict future outcomes.

Predictive analytics uses historical data, statistical algorithms, and machine learning techniques to identify the likelihood of future outcomes, widely used in business for market forecasting.

Customer relationship management systems predicting sales trends.

Prompt [59], [60]

A prompt in AI is an input or instruction given to a model to guide its response or generate output.

In AI, a prompt is an input or instruction given to a model, guiding it to generate specific responses, solve tasks, or produce meaningful output.

Prompts in HEIs guide AI models to generate responses, aiding in personalized learning and automated grading.

R

Reinforcement learning (RL) [3], [4]

A learning paradigm where an agent learns to make decisions by taking actions in an environment to maximize cumulative reward.

In reinforcement learning, an agent learns by receiving feedback from its actions, optimizing strategies through trial and error to achieve maximum reward in dynamic environments.

Gaming AI that adapts difficulty based on player performance.

Responsible AI [61], [62]

Responsible AI ensures that artificial intelligence is developed and used ethically, with accountability, transparency, fairness, and consideration for societal impact.

Responsible AI ensures ethical development and use of AI technologies, prioritizing fairness, accountability, transparency, and minimizing negative societal impacts.

Example of usage Training Data in HEI's in 15 words

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Robotics [3], [63]


Machines that can be programmed to carry out a variety of tasks, often mimicking human behaviour.


Robotics integrates AI with mechanical systems to create machines capable of performing tasks autonomously or semi-autonomously in diverse environments.


Robotic vacuum cleaners that navigate and clean autonomously.

S

Secure multi-party computation (SMPC) [64], [65]


A cryptographic technique to securely compute data.


SMPC used to analyze research data securely.


SMPC in HEIs enables secure data sharing across institutions, preserving privacy while collaborating on research and analysis.

Self-directed learning [66], [67]


An approach where learners take initiative and responsibility for their learning journey.


Self-directed learning empowers students to take control of their learning process, setting their own goals and identifying resources for knowledge acquisition.


Learning platforms encouraging students to pursue topics of interest independently.

Social learning analytics [68], [69]


The analysis of social interactions and behaviours using learning analytics to improve education.


Social learning analytics focuses on analysing interactions within social learning environments to foster collaboration and improve learning outcomes.


Analysis of forum interactions to improve online collaboration in courses.

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SOCRATIC DIALOGUE [70], [71]

Socratic dialogue in AI involves using questioning techniques to stimulate critical thinking, promote reflection, and guide AI-driven learning processes.

Socratic dialogue in AI involves using questioning methods to promote critical thinking, reflection, and deeper understanding, guiding AI systems to assist learning and problem-solving effectively.

Socratic dialogue in HEIs encourages critical thinking, fostering interactive discussions that deepen student understanding and engagement with complex topics.

SWARM INTELLIGENCE [3], [72]

An AI approach that uses the collective behaviour of decentralized and self-organized systems.

Swarm intelligence draws inspiration from social organisms, like ant colonies or flocks of birds, to solve problems collaboratively through decentralized control.

Robotic swarms used in search and rescue missions or agriculture.

T

TOKEN [3], [55]

In AI, tokens are the smallest units of text processed by models, representing words, characters, or subwords for analysis.

Tokens in AI are used to represent units of text, such as words or characters, enabling models to process, analyze, and generate language-based data for various tasks.

Tokens in AI for HEIs represent text units for processing and analysing student feedback, essays, and research.

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TRAINING DATA [73], [74]

Training data for AI models consists of labelled examples used to teach algorithms patterns, enabling them to make predictions or decisions.

Training data in AI consists of labelled examples used to train models, enabling them to recognize patterns, make predictions, and improve accuracy through iterative learning.

Example of usage Copyright in HEI's in 15 words

TRANSFER LEARNING [3], [23]

A technique that reuses a pre-trained model on a new but related problem, improving efficiency.

Transfer learning accelerates the training of machine learning models by leveraging knowledge from previously learned tasks, applicable in various domains like image classification.

Image classification models adapted from general datasets to specific medical imaging tasks.

V

VIRTUAL REALITY (VR) [75], [76]

An immersive experience that uses computer-generated simulations to enhance learning.

VR technology immerses learners in a 3D environment, providing experiential learning opportunities that can enhance understanding of complex concepts and scenarios.

Google Expeditions offering virtual field trips.

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