

Glossary

Empowering AI Leadership

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Glossary of terms

A

Algorithm – Series of instructions for performing a calculation or solving a problem, especially with a computer. They form the basis for everything a computer can do, and are therefore a fundamental aspect of all AI systems.

Artificial intelligence (AI) – Systems designed by humans that, given a complex goal, act in the physical or digital world by perceiving their environment, interpreting the collected structured or unstructured data, reasoning based on the knowledge derived from this data and deciding the best action(s) to take (according to predefined parameters) to achieve the given goal. AI systems can also be designed to learn to adapt their behaviour by analysing how the environment is affected by their previous actions.

As a scientific discipline, AI includes several approaches and techniques, such as machine learning (of which deep learning and reinforcement learning are specific examples), machine reasoning (which includes planning, scheduling, knowledge representation and reasoning, search and optimization) and robotics (which includes control, perception, sensors and actuators, as well as the integration of all other techniques into cyber-physical systems). (See the European Commission’s High-Level Expert Group on AI.)

Artificial neural network (ANN) – Algorithm that attempts to mimic the human brain, with layers of connected “neurons” sending information to each other. (See also Neural network)

Audio and signal processing – Machine learning that can be used to analyse audio and other digital signals, especially in high-noise environments. Applications include computational speech, and audio and audio-visual processing.

Augmented research (marketing, medicine, science, etc.) – AI applications that support researchers in science, medicine and business by analysing, organizing and presenting data, and developing and testing hypotheses.

Autonomous vehicles and drones – Autonomous mobile robots that carry people, fly or perform the work of wheeled farm and mining equipment.

Autonomous robotics – Robots that decide where and how to move without human intervention or prior human instruction. Perception, reasoning, action and learning, as well as interaction capabilities with other systems, are usually integrated into the control architecture of autonomous robotic systems.

B

Bias – Refers to a prejudice for or against something, which could lead to an unfair behaviour that favours one group over another.

Bias in AI can occur when the training data is biased; that is, it is not balanced or inclusive enough. In this case, the AI system trained on such data may not be able to generalize well and will possibly make unfair decisions that can favour some groups over others.

Biometrics, facial and gesture recognition – System that identifies people, gestures or trends in biometric measures (stress, activity etc.) for purposes of natural human-machine interaction or identification and verification.

Black box algorithms – Cases where an algorithm’s decision-making process or output cannot be easily explained by the computer or the researcher who built it.

C

Collaborative robotics (cobots) – Robots that operate at slower speeds and are fitted with sensors to enable safe collaboration with human workers.

Computer vision – Field that focuses on teaching computers to identify, categorize and interpret the content within images and video, mimicking and extending what the human visual system does.

D

Deep learning (DL) – Subfield of machine learning concerned with algorithms using artificial neural networks to solve more difficult problems. Contrary to other machine-learning techniques, deep learning identifies the most important features of the input data without requiring human developers to perform this task, thus making the model-building effort much easier.

E

Embodied AI – Alternative way of saying “robots with AI capabilities”.

Expert systems (inference) – Computer system that mimics the decision-making ability of a human expert by following preprogrammed rules, such as “if this occurs, then do that”. Expert systems use field-specific knowledge (medicine, chemistry, law) combined with a rules engine that dictates how such knowledge is applied. The system improves as more knowledge is added or when the rules are updated and improved.

Explainability – Property of AI systems that can provide a form of explanation for their actions.

Extended reality – Term referring to the combination of the power of AI with virtual, augmented and mixed-reality technology to add intelligence to training, maintenance and other activities.





F

Few-shot learning – Usually, computer vision systems need to see hundreds or thousands (or even millions) of examples to figure out how to do something. One-shot and few-shot learning tries to create a system that can be taught to do something with far less training, similar to how toddlers might learn a new concept or task.

G

Generative adversarial networks (GANs) – Also called GANs, two neural networks that are trained on the same dataset of photos, videos or sounds. Then, one creates similar content while the other tries to determine whether the new example is part of the original dataset, forcing the first to improve its efforts. This approach can create realistic media, including artworks.

Generative product design – Software that produces designs for products by generating drafts that contain all specified features and requirements.

H

Human augmentation – Additions to the human body that use AI to give people cognitive and physical powers beyond their own capability. Can include prosthetics that interpret the wearer's intention and implants that extend the senses.¹

I

Intelligent agents – Agents that interact with humans. They can be used to augment human workers working in customer service, human resources, training and other areas of business to handle FAQ-type enquiries.

K

Knowledge representation – Field of artificial intelligence dedicated to representing information about the world in a form that a computer system can use to perform complex tasks, such as diagnosing disease or conducting a conversation with a person.

L

Local search (optimization) – Mathematical approach to problem-solving that uses an array of possible solutions. The algorithm searches for an optimal solution by starting at one point in the array and iteratively and systematically moving to neighbouring solutions until it finds the optimal solution.

M

Machine learning (ML) – Subset of AI in the field of computer science that often uses statistical techniques to give computers the ability to “learn” (e.g. progressively improve performance on a specific task) using data without being explicitly programmed. When provided with sufficient data, a machine-learning algorithm can learn to make predictions or solve problems, such as identifying objects in pictures or winning at particular games, for example. Thanks to the explosion of available data for training these algorithms, machine learning is now used in fields as diverse as vision-based research, fraud detection, price prediction, natural language processing and more.

Machine vision – Field that focuses on teaching computers to identify, categorize and understand the content within images and video, mimicking and extending what the human visual system does. Also known as computer vision.

Model – Encompasses the learned coefficients of mathematical expressions.





N

Natural language processing (NLP) – Field in which computers process human (natural) languages. Applications include speech recognition, machine translation and sentiment analysis.

Neural network – Also known as an artificial neural network, a conceptual structure, used by machine-learning techniques, that is loosely inspired by the structure of the human brain. A neural network is composed of simple processing nodes, or “artificial neurons”, which are connected to one another in layers. Each node will receive data from several nodes “above” it and give data to several nodes “below” it. Nodes attach a “weight” to the data they receive and attribute a value to that data. If the data does not pass a certain threshold, it is not passed on to another node. The weights and thresholds of the nodes are adjusted when the algorithm is trained until the error over a test dataset is small enough.

P

Personalization – Analyses trends and patterns for customers and employees to optimize tools and products for individual users or customers.

Predictive systems (maintenance, retail, trading, etc.) – System that finds relationships between variables in historical datasets and their outcomes. The relationships are used to develop models, which in turn are used to predict future outcomes.

R

Rational AI systems – Very basic version of AI systems that modify the environment but do not adapt their behaviour over time to better achieve their goal.

Reasoning and decision-making – Group of techniques that includes knowledge representation and reasoning, planning, scheduling, search and optimization. These techniques allow AI systems to perform reasoning on data from sensors or other sources.

Recommendation systems – AI systems that make suggestions based on subtle patterns identified in data and detected by AI algorithms over time. These can be targeted towards consumers to suggest new products or used internally in a company to make strategic suggestions.

Reinforcement learning – Process where machines learn to perform a new task over time through a system of rewards and punishments, starting as a novice and improving with practice and feedback. The feedback allows the algorithm to build the most efficient and optimized path towards the goal.

Robotic process automation (RPA) – Form of business process automation that duplicates how humans perform a task in an application. By adding AI to these “software robots”, RPA can automate processes that require a degree of variation.²

S

Search and optimization – Mathematical approach to problem-solving that uses rule-based techniques to efficiently find the best solution out of a potentially large array of solutions.

Semi-supervised learning – Learning technique that uses both labelled and unlabelled data for training. Many machine-learning researchers have found that the combination of these two types of data considerably improves learning accuracy.

Sensors and perception – Cameras, microphones, keyboards, websites or other input devices, as well as sensors of physical quantities (e.g. temperature, pressure, distance, force/torque, tactile sensors etc.). In general, we need to provide the AI system with sensors that perceive the data present in the environment that is relevant to the goal it has been given.

Speech to text – AI systems that convert audio signals to text signals in a variety of languages. Applications include translation, voice command and control, audio transcription and more.

Structured and unstructured data – Structured data is data that is organized in a predefined manner such as spreadsheets and tables. Unstructured data is data that is not organized, such as text, audio and video.³

Supervised learning – Technique that teaches a machine-learning algorithm to solve a specific task using data that has been carefully labelled by a human. Everyday examples include weather prediction and spam detection. The goal for the algorithm is to learn the general rules that connect the inputs to the outputs and use those rules to predict future events with input data alone.

T

Text, speech, image and video recognition – System that parses text, speech, image and video data and creates associations that can be used to scale analytical activities and enable higher-level applications related to interaction and vision. Includes speech recognition, machine translation and sentiment analysis.

Training – Process of refining an algorithm so that it can learn from a dataset.

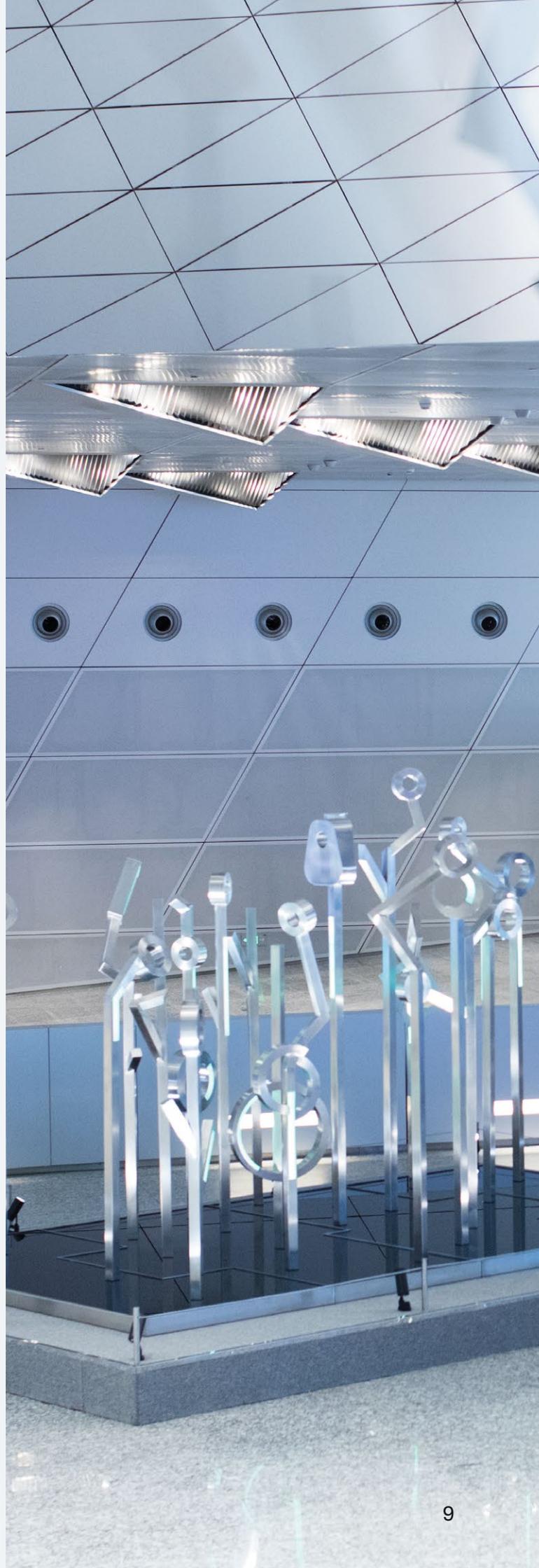
Transfer learning – Method that tries to take training data used for one task and reuse it for a new set of tasks without having to retrain the system from scratch.

U

Unsupervised learning – Approach that gives AI unlabelled data, which it has to make sense of without any instruction. In essence, it is when machines “teach themselves”. No labels are given to the learning algorithm, leaving it to find the structures and patterns of the inputs on its own. Unsupervised learning can be a goal in itself (discovering hidden patterns in data) or a means to an end (extracting features within the data). Unsupervised learning is less focused than supervised learning on the output and more focused on exploring the input data and inferring hidden structures from unlabelled data.

W

Weak AI – Weak (or narrow) AI is the kind of AI that we currently have. It can do just one thing at a time, such as playing chess, recognizing breeds of cats, identifying a cancer or translating between languages. The opposite would be strong (or general) AI, also known as artificial general intelligence (AGI), which would have the capability to do anything that most humans can do.



Resources

(All references as of 24/7/19)

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