European Agency for Safety and Health at Work

GLOSSARY

TERM/CONCEPT	DEFINITION
Additive manufacturing	Additive manufacturing uses data, computer-aided-design (CAD) software or 3D object scanners to direct hardware to deposit material, layer upon layer, in precise geometric shapes. As its name implies, additive manufacturing adds material to create an object. Although the terms '3D printing' and 'rapid prototyping' are occasionally used to refer to additive manufacturing, each process is actually a subtype of additive manufacturing.
Advanced robotics	The term advanced robotics refers to the design, production and use of machines able to carry out difficult and complex tasks using AI to interact with the real world around them.
Artificial intelligence (AI)	AI refers to systems that display intelligent behaviour by analysing their environment and taking actions – with some degree of autonomy – to achieve specific goals. AI-based systems can be purely software-based, acting in the virtual world (e.g. voice assistants, image analysis software, search engines, speech and face recognition systems) or AI can be embedded in hardware devices (e.g. advanced robots, autonomous cars, drones or Internet of things applications).[1]
AI-based worker management (AIWM)	Refers to a worker management system that gathers data, often in real time, on the workspace, workers and the work they do, which is then fed into an AI-based model that makes automated or semi-automated decisions or provides information for decision-makers on worker management-related questions.
AI-powered prediction models	Forecasting models that use AI for data analysis to predict different factors related to workers, such as those used for people analytics. These may be used for example to predict who in the staff is most likely to leave the company soon as a result of stress or burnout or for lack of motivation, and hence should receive more attention from managers.
Algorithm	An explicitly defined set of instructions describing how a computer or a human could perform an action, task or procedure or solve a problem.

[1] High-Level Expert Group on Artificial Intelligence. (2018). *A definition of AI: Main capabilities and scientific disciplines.* European Commission. https://ec.europa.eu/newsroom/dae/document.cfm?doc_id=56341

Algorithmic management	A worker management system where simple (i.e. without 'intelligence') algorithms and digital technologies (e.g. worker-monitoring devices, computers or face recognition software) are used to manage workers in an automated or semi-automated manner.[2] It provides the means to automate a large number of worker management tasks (e.g. schedule-making, shift-making and worker monitoring through wearable devices). AI-based worker management involves the *intelligence simulation* necessary to deal with uncertainty (e.g. providing different outputs based on changes in the environment), whereas algorithmic management is *deterministic* in nature (i.e. it always provides the same output, given the same input).
Algorithmic transparency	Algorithmic transparency is the principle that the factors that influence the functioning of algorithms and the results they produce should be visible, or transparent, to employers, policy-makers and workers, who use, regulate, and are affected by the systems that employ those algorithms. The involvement of staff representatives is essential to build workers' trust in the systems.
Anthropomorphism	The attribution of human traits, emotions or intentions to non-human entities (e.g. robots).
Automation	Use of systems or technical procedures to allow a device or system to execute (partially or fully) a function that was previously, or conceivably could be, carried out (partially or fully) by a human.[3]
Big data	Datasets characterised by volume (large size), velocity (constantly growing), and variety (structured and unstructured form such as texts), which are often used by artificial intelligence machines.[4]
Cameras to monitor activities	There are two types of cameras: basic systems that only record signals, which can be stored and/or actively monitored; and intelligent systems that use algorithms to interpret data, related to the environment and/or to behaviours, for instance.[5]

[2] Mateescu, A., & Nguyen, A. (2019, February 6). *Explainer: Algorithmic management in the workplace.* Data & Society. https://datasociety.net/library/explainer-algorithmic-management-in-the-workplace/.

[3] Based on Parasuraman et al., 2000, p. 287.

[4] OECD. (2016). Big data: Bringing competition policy to the digital era. *Background note by the Secretariat.* https://one.oecd.org/document/DAF/COMP(2016)14/en/pdf

[5] Cocca, P., Marciano, F., & Alberti, M. (2016). Video surveillance systems to enhance occupational safety: A case study. *Safety Science, 84*, 140-148. https://doi.org/10.1016/j.ssci.2015.12.005
Gavrila, D. M. (1999). The visual analysis of human movement: A survey. *Computer Vision and Image Understanding, 73*(1), 82-98. https://doi.org/10.1006/cviu.1998.0716
Boult, T. E., Micheals, R. J., Gao, X., & Eckmann, M. (2001). Into the woods: Visual surveillance of noncooperative and camouflaged targets in complex outdoor settings. *Proceedings of the IEEE, 89*(10), 1382-1402. https://doi.org/10.1109/5.959337
Diehl, C. P. (2000). *Toward efficient collaborative classification for distributed video surveillance* (Doctoral dissertation, Carnegie Mellon University). https://www.proquest.com/openview/b89c92184f2b8596c163ae0687cd895f/1?pq-origsite=gscholar&cbl=18750&diss=y

Client relationship management (CRM) software	Customer Relationship Management, abbreviated as CRM, is an integrated management information system that is used to schedule, plan and control the sales and pre-sales activities in an organization. CRM systems comprise of hardware, software and networking tools to improve customer tracking and communication.
(The) cloud	The cloud is a network of remote servers around the world which are connected together and operate as a single ecosystem. These servers are designed to either store and manage data, run applications, or deliver content or a service (e.g. streaming videos, web mail, office productivity software, or social media). Files and data are accessible online from any Internet-connected device.
Cloud computing	Cloud computing is the on-demand availability of cloud-hosted services (e.g. data storage, computing power) delivered to a user over the Internet.
Cobot (collaborative robot)	A type of robot designed to perform tasks in collaboration with workers in industrial sectors.[6]
Cognitive task	A task that requires a number of mental processes for its completion, such as decision-making, pattern recognition, and speech- or language-based tasks.
Cybersecurity	The protection of computer systems and networks from information disclosure and theft of or damage to their hardware, software or electronic data, as well as from the disruption or misdirection of the services they provide.[7]
Data analytics	A process of extracting insights and knowledge from data using statistical or other techniques and tools.[8]
Data bias	Data bias occurs when data contain systematically certain types of errors for which some elements in a dataset are more or less weighted and/or represented than others. Socio-cultural prejudices and beliefs of programmers or software developers can be the reason why systems collect and produce biased data.
Deep learning	Branch of machine learning that uses (artificial) neural networks to mimic a human brain and to improve artificial intelligence learning capabilities.[9]

[6] International Federation of Robotics. (n.d.). *World Robotics R&D Program*. Retrieved April 29, 2022, from https://ifr.org/r-and-d

[7] Schatz, D., Bashroush, R., & Wall, J. (2017). Towards a more representative definition of cyber security. *Journal of Digital Forensics, Security and Law, 12*(2), Article 8. https://commons.erau.edu/jdfsl/vol12/iss2/8/

[8] Gandomi, A., & Haider, M. (2015). Beyond the hype: Big data concepts, methods, and analytics. International Journal of Information Management, 35(2), 137-144. https://doi.org/10.1016/j.ijinfomgt.2014.10.007.

[9] Goodfellow, I., Bengio, Y., & Courville, A. (2017). Deep learning, 1. The MIT Press.

Deskilling	Loss of skills and knowledge needed to perform a job as a consequence of automation.[10]
Digital labour platform	An online facility or marketplace operating on digital technologies (including the use of mobile apps) that are owned and/or operated by an undertaking, facilitating the matching between the demand for and supply of labour provided by a platform worker. Examples of platforms include Uber, Glovo, Wolt and Task Rabbit.
Digital platform work	Digital platform work is all paid work provided through, on or mediated by an online platform – that is, an online marketplace operating on digital technologies that facilitate the matching of demand for and supply of labour.
Exoskeletons	Exoskeletons are wearable devices that modify internal or external forces acting on the body and therefore enhance or support the strength of the user. For workers wearing occupational exoskeletons (both active and passive), several risk scenarios can be identified relating to their prolonged use.[11]
Gamification	Gamification refers to bringing ideas and concepts from games, such as rewards for milestones, into the work environment and work processes to nudge the worker into behaviours desired by the employer to ultimately improve efficiency and productivity.[12] It can promote collaboration and interaction between teams, reduce stress and improve overall employee satisfaction in the workplace.[13]
Human-in-command approach	In the human-in-command approach to digital transformation, artificial intelligence and digital technologies support but do not replace human control and decisions or information, consultation and participation of workers. Making the design, development and use of digital systems human-centred allows them to be used to support workers, while leaving humans in control.
Human-robot interaction (HRI)	Human-robot interaction (HRI) is the study of interactions between people (users) and robots. HRI is multidisciplinary with contributions from the fields of human-computer interaction, artificial intelligence, robotics, speech recognition, and social sciences (psychology, cognitive science, anthropology, and human factors).

[10] Joh, E. E. (2019). The Consequences of Automating and Deskilling the Police. UCLA Law Review Discourse, 67, 133.

[11] EU-OSHA (2021). Occupational exoskeletons: wearable robotic devices and preventing work-related musculoskeletal disorders in the workplace of the future. https://osha.europa.eu/en/publications/occupational-exoskeletons-wearable-robotic-devices-and-preventing-work-related

[12] Savignac, E., (2019). La gamification du travail: L'ordre du jeu. ISTE Group.

[13] Makanawala, P., Godara J., Goldwasser E., & Le, H. (2013). Applying gamification in customer service application to improve agents' efficiency and satisfaction. In A. Marcus (Ed.), *Design, user experience, and usability. Health, learning, playing, cultural, and cross-cultural user experience*. Lecture Notes in Computer Science (8013). Springer.

Industrial robot	An industrial robot is an automatically controlled, reprogrammable multipurpose manipulator, programmable in three or more axes, which can be either fixed or mobile.[14]
Internet of things (IoT)	The IoT is a cyber-physical system in which the information collected is fed, via the internet, to computers to gather data about production and work processes and to analyse these data with unprecedented granularity.[15] This entails humans creating a '"ubiquitous world" in which all devices … will be fully networked.'[16] The IoT reshapes our interaction with the physical world through devices interconnected on a platform (e.g. the cloud) and performing functions adaptively based on inputs and programming.[17]
Kinematics	A branch of physics, developed in classical mechanics, that describes the geometrically possible motion of points, bodies (objects), and systems of bodies (groups of objects) without considering the forces involved (i.e. causes and effects of the motions).
Machine learning	Machine learning is a branch of artificial intelligence dealing with how computers can learn, grow and improve on their own from data without human intervention.[18]
New occupational safety and health (OSH) monitoring systems	New OSH monitoring systems use digital technology to collect and analyse data from workers and/or working environment to identify hazards, assess risks, prevent and/or minimise harm, and promote OSH.
People or workforce analytics	Application of AI-based worker management used to support decision-making about human resource management aspects. It uses digital tools and data to measure, report and understand employee performance.[19]
Physical task	A task that requires one or more physical acts for its completion.

[14] ISO 8373:2012 Robots and robotic devices. Available at: https://www.iso.org/standard/55890.html

[15] European Foundation for the Improvement of Living and Working Conditions. (2018). *Game changing technologies: Exploring the impact on production processes and work*. https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/fomeef18001en.pdf

[16] EU-OSHA – European Agency for Safety and Health at Work, *A review on the future of work: Robotics*, 2015. Available at: https://osha.europa.eu/sites/default/files/Robotics%20dicussion%20paper.pdf

[17] World Bank Group. (2017). *Internet of things. The new government to business platform. A review of opportunities, practices, and challenges.* https://openknowledge.worldbank.org/bitstream/handle/10986/28661/120876.pdf?sequence=5&isAllowed=y

[18] Sharma, N., Sharma, R., & Jindal, N. (2021). Machine learning and deep learning applications-A vision. *Global Transitions Proceedings, 2*(1), 24-28. https://doi.org/10.1016/j.gltp.2021.01.004.

[19] Collins, L., Fineman, D. R., & Tshuchica, A. (2017). *People analytics: Recalculating the route.* Deloitte Insights. https://www2.deloitte.com/us/en/insights/focus/human-capital-trends/2017/people-analytics-in-hr.html, p. 98.

Radio-frequency identification (RFID)	RFID is 'a wireless sensor technology which is based on the detection of electromagnetic signals [that] includes three components: an antenna or coil, a transceiver (with decoder) and a transponder (RF tag). […] There is emission of radio signals by the antenna in order for the tag to be activated and data to be read and written to it.'[20]
Remote work	Remote work is any type of working arrangement to work from home or – more generally – away from the employer's premises or in a fixed location. In this context the focus is on remote work enabled by digital technologies (e.g. personal computers, smartphones, laptops, software packages and the internet).
Reskilling	The process of acquiring/learning new skills.
Semi- and fully automated decisions	Semi-automated decision-making refers to human decisions supported by results of automated computer algorithms (with or without AI integration), while fully automated decision-making refers to giving full autonomy to computer algorithms to make decisions.[21]
Smart digital systems	Umbrella term to indicate digital systems for monitoring and enhancing workers' safety and health including for example smart PPE (that can identify levels of gases, toxins, noise levels and high-risk temperatures), wearables (able to interact with workers, with sensors that may be embedded in hardhats or safety glasses), mobile or static systems that use cameras and sensors (e.g. drones that effectively reach and monitor dangerous areas of work sites avoiding to put humans in danger in the construction and the mining industries).
Smart personal protective equipment (PPE)	Smart PPE is the last level of protection to be used against hazards for workers and is used when hazards cannot be removed or their risks cannot be mitigated further by collective or organisational measures, engineering designs or maintenance practices – it combines traditional garments with smart parts, such as sensors, detectors, data transfer modules, batteries, cables.[22]

[20] Domdouzis, K., Kumar, B., & Anumba, C. (2007). Radio-frequency identification (RFID) applications: A brief introduction. *Advanced Engineering Informatics, 21*(4), 350-355. https://doi.org/10.1016/j.aei.2006.09.001

[21] Deobald, U. L., Busch, T., Schank, C., Weibel, A., Schafheitle, S., Wildhaber, I., & Kasper, G. (2019). The challenges of algorithm-based HR decision-making for personal integrity. *Journal of Business Ethics, 160*(2), 377-392. https://doi.org/10.1007/s10551-019-04204-w.

[22] EU-OSHA – European Agency for Safety and Health at Work, *Smart personal protective equipment: Intelligent protection for the future*, 2020. Available at: https://osha.europa.eu/sites/default/files/Smart_personal_protective_equipment_intelligent_protection_of_the_future.pdf

Trust	Trust can be defined as the attitude that an agent [automation technology, i.e. advanced robotics] will help achieve an individual's goal in a situation characterised by uncertainty and vulnerability.[23]
Unmanned aerial system (UAS)	UASs are 'composed of the vehicle airframe and power supply, vehicle sensors, remote operator, an onboard computer, and vehicle actuators. Sensors gather information about the vehicle's environment and actuators cause movement of the vehicle. The operator can receive information by looking directly at the vehicle (flying by 'line of sight') or by looking at a video transmitted from the vehicle (flying by 'first-person view')'.[24]
Upskilling	The process of acquiring/teaching additional skills.
Virtual reality (VR) and augmented reality (AR)	VR is a computer-generated scenario that simulates a real-world experience, while AR combines real-world experiences with computer-generated content.[25] AR can be defined as an 'immersive' technology, blurring the lines between reality and the virtual world, enhancing the interaction of the user with the environment.[26] Practically, AR users point their devices (smartphones, wearables, etc.) towards a specific image, which is acquired and processed to create projections (2D or 3D), which the user can interact with.[27]
Wearables	Wearables are electronic devices with sensors and computational capacity (e.g. smart watches, data glasses, or other devices with embedded sensors or tags), which can be placed on different body parts to gather data to be fed into other digital systems for processing purposes. They can be used to analyse physiological and psychological data such as feelings, sleep, movements, heart rate, body temperature and blood pressure, via applications either installed on the device itself or on external devices, such as smartphones connected to the cloud.

[23] Lee, J. D., & See, K. A. (2004). Trust in automation: Designing for appropriate reliance. *Human Factors, 46*(1), 50-80. https://doi.org/10.1518/hfes.46.1.50_30392

[24] Howard, J., Murashov, V., & Branche, C.M. (2017). Unmanned aerial vehicles in construction and worker safety. *American Journal of Industrial Medicine, 61*(1), 3-10. https://doi.org/10.1002/ajim.22782

[25] Eurofound. (2021). *Digitisation in the workplace*. Publications Office of the European Union. https://www.eurofound.europa.eu/publications/report/2021/digitisation-in-the-workplace

[26] Pierdicca, R., Prist, M., Monteriù, A., Frontoni, E., Ciarapica, F., Bevilacqua, M., & Mazzuto, G. (2020). Augmented reality smart glasses in the workplace: Safety and security in the Fourth Industrial Revolution era. In L. De Paolis & P. Bourdot (Eds), *Augmented reality, virtual reality, and computer graphics*. AVR 2020. Lecture Notes in Computer Science (LNCS), Vol. 12243. Available at: https://doi.org/10.1007/978-3-030-58468-9_18

[27] Kim, S., Nussbaum, M. A., & Gabbard, J. L. (2016). Augmented reality "smart glasses" in the workplace: Industry perspectives and challenges for worker safety and health. *IIE Transactions on Occupational Ergonomics and Human Factors, 4*(4), 253-258. https://doi.org/10.1080/21577323.2016.1214635

Worker monitoring	The practice of capturing information on employees, such as their location, wellbeing and current task, with a goal to track performance and compliance with company policies, but also to identify health issues or safety risks. Worker monitoring is reported to entail violation of data protection legislation and worker's personal rights and can result in stress and mental health issues.[28]
Worker surveillance	A more intrusive worker monitoring, extending also beyond work and including activities as tracking social media posts and website visits[29] to gather as much information on workers as possible. .[30] Worker surveillance practices can violate data protection legislation and worker's personal rights and can result in stress and ill mental health.

[28] Eurofound. (2020). *Working conditions. Employee monitoring and surveillance: The challenges of digitalisation.* Publications Office of the European Union. https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef20008en.pdf; European Agency for Safety and Health at Work (EU-OSHA), (2017). Monitoring Technology: The 21st century's pursuit of well-being? https://oshwiki.osha.europa.eu/en/themes/monitoring-technology-21st-centurys-pursuit-wellbeing

[29] Eurofound. (2020). *Working conditions. Employee monitoring and surveillance: The challenges of digitalisation.* Publications Office of the European Union. https://www.eurofound.europa.eu/sites/default/files/ef_publication/field_ef_document/ef20008en.pdf.

[30] Edwards, L., Martin, L., & Henderson, T. (2018). Employee surveillance: The road to surveillance is paved with good intentions. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3234382