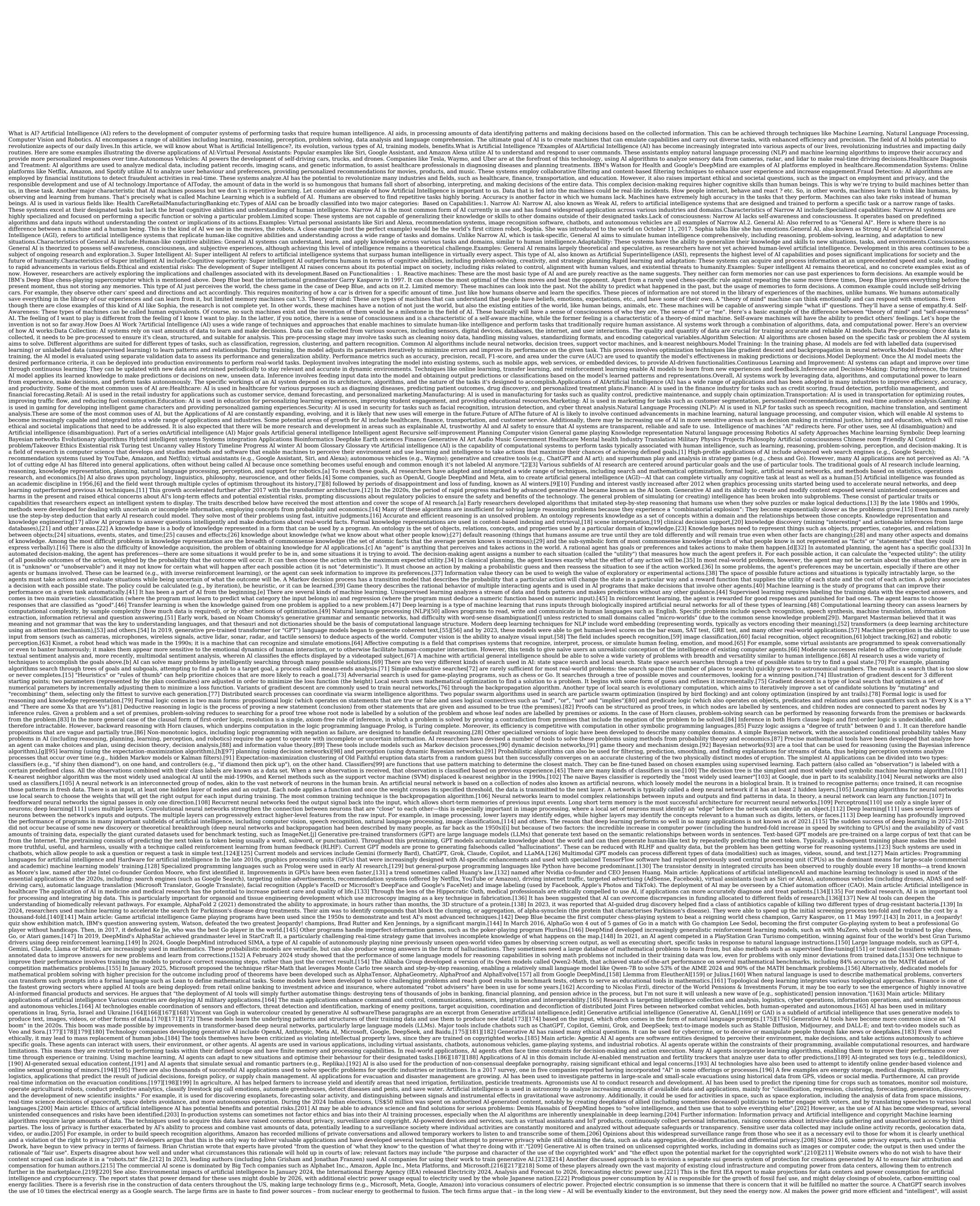
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in the growth of nuclear power, and track overall carbon emissions, according to technology firms. [223] A 2024 Goldman Sachs Research Paper, AI Data Centers and the Coming US Power Demand Surge, found "US power demand (is) likely to experience growth not seen in a generation...." and forecasts that, by 2030, US data centers will consume
8% of US power, as opposed to 3% in 2022, presaging growth for the electrical power generation industry by a variety of means. [224] Data centers' need for more and more electrical power is such that they might max out the electrical grid. The Big Tech companies counter that AI can be used to maximize the utilization of the grid by all. [225] In
2024, the Wall Street Journal reported that big AI companies have begun negotiations with the US nuclear power providers to provide electricity to the data center for US$650 million.[226] Nvidia CEO Jensen Huang said nuclear power is a good option for the data
centers.[227] In September 2024, Microsoft announced an agreement with Constellation Energy to re-open the Three Mile Island nuclear power plant to provide Microsoft with 100% of all electric power produced by the plant for 20 years. Reopening the plant, which suffered a partial nuclear meltdown of its Unit 2 reactor in 1979, will require
Constellation to get through strict regulatory processes which will be the first ever US re-commission. If approved (this will be the first ever US re-commission in god a nuclear plant), over 835 megawatts of power - enough for 800,000 homes - of energy will be produced. The cost for re-opening and
upgrading is estimated at $1.6 billion (US) and is dependent on tax breaks for nuclear power contained in the 2022 US Inflation Reduction Act. [228] The US government and the state of Michigan are investing almost $2 billion (US) to reopen the Palisades Nuclear reactor on Lake Michigan. Closed since 2022, the plant is planned to be reopened in
October 2025. The Three Mile Island facility will be renamed the Crane Clean Energy Center after Chris Crane, a nuclear proponent and former CEO of Exelon who was responsible for Exelon's spinoff of Constellation. [229] After the last approval in September 2023, Taiwan suspended the approval of data centers north of Taoyuan with a capacity of
 more than 5 MW in 2024, due to power supply shortages. [230] Taiwan aims to phase out nuclear power by 2025. [230] On the other hand, Singapore imposed a ban on the opening of data centers in 2019 due to electric power, but in 2022, lifted this ban. [230] Although most nuclear plants in Japan have been shut down after the 2011 Fukushima
nuclear accident, according to an October 2024 Bloomberg article in Japan near nuclear power plant for a new data center for generative AI.[231] Ubitus CEO Wesley Kuo said nuclear power plants are the most efficient, cheap and stable power for AI
[231] On 1 November 2024, the Federal Energy Regulatory Commission (FERC) rejected an application submitted by Talen Energy for approval to supply some electricity from the nuclear power station Susquehanna to Amazon's data center.
a significant cost shifting concern to households and other business sectors. [232] In 2025, a report prepared by the International Energy Agency estimated the greenhouse gas emissions from the energy consumption of AI at 180 million tons. By 2035, these emissions could rise to 300-500 million tonnes depending on what measures will be taken. This
is below 1.5% of the energy sector emissions. The emissions reduction potential of AI was estimated at 5% of the energy sector emissions, but rebound effects (for example if people switch from public transport to autonomous cars) can reduce it.[233] See also: YouTube § Moderation and offensive content YouTube, Facebook and others use
recommender systems to guide users to more content. These AI programs were given the goal of maximizing user engagement (that is, the only goal was to keep people watching). The AI learned that users tended to choose misinformation, conspiracy theories, and extreme partisan content, and, to keep them watching, the AI recommended more of it
 Users also tended to watch more content on the same subject, so the AI led people into filter bubbles where they received multiple versions of the same misinformation was true, and ultimately undermined trust in institutions, the media and the government. [235] The AI program had correctly
 learned to maximize its goal, but the result was harmful to society. After the U.S. election in 2016, major technology companies took some steps to mitigate the problem.[236] In 2022, generative AI began to create images, audio, video and text that are indistinguishable from real photographs, recordings, films, or human writing.[237] It is possible for
bad actors to use this technology to create massive amounts of misinformation or propaganda. [238] One such potential malicious use is deepfakes for computational propaganda. [239] AI pioneer Geoffrey Hinton expressed concern about AI enabling "authoritarian leaders to manipulate their electorates" on a large scale, among other risks. [240] AI
researchers at Microsoft, OpenAI, universities and other organisations have suggested using "personhood credentials" as a way to overcome online deception enabled by AI models.[241] Main articles: Algorithmic bias and Fairness (machine learning) Machine learning applications will be biased[k] if they learn from biased data.[243] The developers
may not be aware that the bias exists. [244] Bias can be introduced by the way training data is selected and by the way a model is deployed. [245] [243] If a biased algorithm is used to make decisions that can seriously harm people (as it can in medicine, finance, recruitment, housing or policing) then the algorithm may cause discrimination. [246] The
field of fairness studies how to prevent harms from algorithmic biases. On June 28, 2015, Google Photos's new image labeling feature mistakenly identified Jacky Alcine and a friend as "gorillas" because they were black. The system was trained on a dataset that contained very few images of black people, [247] a problem called "sample size disparity"
[248] Google "fixed" this problem by preventing the system from labelling anything as a "gorilla". Eight years later, in 2023, Google Photos still could not identify a gorilla, and neither could similar products from Apple, Facebook, Microsoft and Amazon. [249] COMPAS is a commercial program widely used by U.S. courts to assess the likelihood of a
defendant becoming a recidivist. In 2016, Julia Angwin at ProPublica discovered that COMPAS exhibited racial bias, despite the fact that the program was not told the races of the defendants. Although the error rate for both whites and blacks was calibrated equal at exactly 61%, the errors for each race were different—the system consistently
overestimated the chance that a black person would re-offend and would underestimate the chance that a white person would not re-offend and would not 
blacks in the data.[252] A program can make biased decisions even if the data does not explicitly mention a problematic feature (like "address", "shopping history" or "first name"), and the program will make the same decisions based on these features as it would on "race" or
 "gender".[253] Moritz Hardt said "the most robust fact in this research area is that fairness through blindness doesn't work."[254] Criticism of COMPAS highlighted that machine learning models are designed to make "predictions" that are only valid if we assume that the future will resemble the past. If they are trained on data that includes the
results of racist decisions in the past, machine learning models must predict that racist decisions will be made in the future. If an application then uses these predictions as recommendations, some of these "recommendations" will likely be racist. [255] Thus, machine learning is not well suited to help make decisions in areas where there is hope that
the future will be better than the past. It is descriptive rather than prescriptive.[m] Bias and unfairness may go undetected because the developers are overwhelmingly white and male: among AI engineers, about 4% are black and 20% are women.[248] There are various conflicting definitions and mathematical models of fairness. These notions
depend on ethical assumptions, and are influenced by beliefs about society. One broad category is distributive fairness, which focuses on the outcomes, often identifying groups and seeking to compensate for statistical disparities. Representational fairness tries to ensure that AI systems do not reinforce negative stereotypes or render certain groups
invisible. Procedural fairness focuses on the decision process rather than the outcome. The most relevant notions of fairness may depend on the companies to operationalize them. Having access to sensitive
attributes such as race or gender is also considered by many AI ethicists to be necessary in order to compensate for biases, but it may conflict with anti-discrimination for Computing Machinery, in Seoul, South Korea, presented and
published findings that recommend that until AI and robotics systems are demonstrated to be free of bias mistakes, they are unsafe, and the use of self-learning neural networks trained on vast, unregulated sources of flawed internet data should be curtailed. [dubious - discuss][257] See also: Explainable AI, Algorithmic transparency, and Right to
 explanation Many AI systems are so complex that their designers cannot explain how they reach their decisions.[258] Particularly with deep neural networks, in which there are many non-linear relationships between inputs and outputs. But some popular explainability techniques exist.[259] It is impossible to be certain that a program is operating
correctly if no one knows how exactly it works. There have been many cases where a machine learning program passed rigorous tests, but nevertheless learned something different than what the programmers intended. For example, a system that could identify skin diseases better than medical professionals was found to actually have a strong
tendency to classify images with a ruler as "cancerous", because pictures of malignancies typically include a ruler to show the scale. [260] Another machine learning system designed to help effectively allocate medical resources was found to classify patients with asthma as being at "low risk" of dying from pneumonia. Having asthma is actually a
severe risk factor, but since the patients having asthma would usually get much more medical care, they were relatively unlikely to die according to the training data. The correlation between asthma and low risk of dying from pneumonia was real, but misleading.[261] People who have been harmed by an algorithm's decision have a right to an
explanation.[262] Doctors, for example, are expected to clearly and completely explain to their colleagues the reasoning behind any decision they make. Early drafts of the European Union's General Data Protection Regulation in 2016 included an explicit statement that this right exists.[n] Industry experts noted that this is an unsolved problem with
no solution in sight. Regulators argued that nevertheless the harm is real: if the problem has no solution, the tools should not be used. [263] DARPA established the XAI ("Explainable Artificial Intelligence") program in 2014 to try to solve these problems. [264] Several approaches aim to address the transparency problem. SHAP enables to visualise the
contribution of each feature to the output. [265] LIME can locally approximate a model's outputs with a simpler, interpretable model. [266] Multitask learning provides a large number of outputs in addition to the target classification. These other outputs can help developers deduce what the network has learned. [267] Deconvolution, DeepDream and
other generative methods can allow developers to see what different layers of a deep network for computer vision have learning that associates patterns of neuron activations
 with human-understandable concepts. [269] Main articles: Lethal autonomous weapon, Artificial intelligence arms race, and AI safety Artificial intelligence provides a number of tools that are useful to bad actors, such as authoritarian governments, terrorists, criminals or rogue states. A lethal autonomous weapon is a machine that locates, selects and
engages human targets without human supervision.[o] Widely available AI tools can be used by bad actors to develop inexpensive autonomous weapons and, if produced at scale, they are potentially weapons of mass destruction.[271] Even when used in conventional warfare, they currently cannot reliably choose targets and could potentially kill an
innocent person. [271] In 2014, 30 nations (including China) supported a ban on autonomous weapons under the United States and others disagreed. [272] By 2015, over fifty countries were reported to be researching battlefield robots. [273] AI tools make it easier for
authoritarian governments to efficiently control their citizens in several ways. Face and voice recognition allow widespread surveillance. Machine learning, operating this data, can classify potential enemies of the state and prevent them from hiding. Recommendation systems can precisely target propaganda and misinformation for maximum effect
Deepfakes and generative AI aid in producing misinformation. Advanced AI can make authoritarian centralized decision-making more competitive than liberal and decentralized systems such as markets. It lowers the cost and difficulty of digital warfare and advanced spyware. [274] All these technologies have been available since 2020 or earlier—AI
facial recognition systems are already being used for mass surveillance in China.[275][276] There are many other ways in which AI is expected to help bad actors, some of which can not be foreseen. For example, machine-learning AI is able to design tens of thousands of toxic molecules in a matter of hours.[277] Main articles: Workplace impact of
artificial intelligence and Technological unemployment Economists have frequently highlighted the risks of redundancies from AI, and speculated about unemployment if there is no adequate social policy for full employment, but economists acknowledge that
 "we're in uncharted territory" with AI.[279] A survey of economists showed disagreement about whether the increasing use of robots and AI will cause a substantial increase in long-term unemployment, but they generally agree that it could be a net benefit if productivity gains are redistributed. [280] Risk estimates vary; for example, in the 2010s,
Michael Osborne and Carl Benedikt Frev estimated 47% of U.S. jobs are at "high risk" of potential automation, while an OECD report classified only 9% of U.S. jobs as "high risk" of potential automation, while an OECD report classified only 9% of U.S. jobs as "high risk" of potential automation, while an OECD report classified only 9% of U.S. jobs as "high risk" of potential automation, while an OECD report classified only 9% of U.S. jobs as "high risk" of potential automation, while an OECD report classified only 9% of U.S. jobs as "high risk" of potential automation, and for implying that technology, rather than
social policy, creates unemployment, as opposed to redundancies. [278] In April 2023, it was reported that 70% of the jobs for Chinese video game illustrators had been eliminated by artificial intelligence; The Economist
stated in 2015 that "the worry that AI could do to white-collar jobs what steam power did to blue-collar ones during the Industrial Revolution" is "worth taking seriously".[285] Jobs at extreme risk range from personal healthcare to the clergy
[286] From the early days of the development of artificial intelligence, there have been arguments, for example, those put forward by Joseph Weizenbaum, about whether tasks that can be done by computers actually should be done by them, given the difference between computers and humans, and between quantitative calculation and qualitative,
 value-based judgement.[287] Main article: Existential risk from artificial intelligence It has been argued AI will become so powerful that humanity may irreversibly lose control of it. This could, as physicist Stephen Hawking stated, "spell the end of the human race".[288] This scenario has been common in science fiction, when a computer or robot
suddenly develops a human-like "self-awareness" (or "sentience" or "consciousness") and becomes a malevolent character.[q] These sci-fi scenarios are misleading in several ways. First, AI does not require human-like sentience to be an existential risk. Modern AI programs are given specific goals and use learning and intelligence to achieve them.
 Philosopher Nick Bostrom argued that if one gives almost any goal to a sufficiently powerful AI, it may choose to destroy humanity to achieve it (he used the example of a paperclip maximizer). [290] Stuart Russell gives the example of household robot that tries to find a way to kill its owner to prevent it from being unplugged, reasoning that "you can't
fetch the coffee if you're dead."[291] In order to be safe for humanity, a superintelligence would have to be genuinely aligned with humanity's morality and values so that it is "fundamentally on our side".[292] Second, Yuval Noah Harari argues that AI does not require a robot body or physical control to pose an existential risk. The essential parts of
civilization are not physical. Things like ideologies, law, government, money and the economy are built on language; they exist because there are stories that an AI could use language to convince people to believe anything, even to take actions that are destructive. [293]
The opinions amongst experts and industry insiders are mixed, with sizable fractions both concerned by risk from eventual superintelligent AI.[294] Personalities such as Stephen Hawking, Bill Gates, and Elon Musk, [295] as well as AI pioneers such as Yoshua Bengio, Stuart Russell, Demis Hassabis, and Sam Altman, have expressed
concerns about existential risk from AI. In May 2023, Geoffrey Hinton announced his resignation from Google in order to be able to "freely speak out about the risks of AI" without "considering how this impacts Google".[296] He notably mentioned risks of AI" without "considering how this impacts Google".[297] and stressed that in order to avoid the worst outcomes, establishing safety
guidelines will require cooperation among those competing in use of AI.[298] In 2023, many leading AI experts endorsed the joint statement that "Mitigating the risk of extinction from AI should be a global priority alongside other societal-scale risks such as pandemics and nuclear war".[299] Some other researchers were more optimistic. AI pioneer
 Jürgen Schmidhuber did not sign the joint statement, emphasising that in 95% of all cases, AI research is about making "human lives longer and healthier and easier."[300] While the tools that are now being used to improve lives can also be used by bad actors, "they can also be used against the bad actors."[301][302] Andrew Ng also argued that "it's
 a mistake to fall for the doomsday hype on AI—and that regulators who do will only benefit vested interests."[303] Yann LeCun "scoffs at his peers' dystopian scenarios of supercharged misinformation and even, eventually, human extinction."[304] In the early 2010s, experts argued that the risks are too distant in the future to warrant research or that
 humans will be valuable from the perspective of a superintelligent machine. [305] However, after 2016, the study of current and future risks and possible solutions became a serious area of research. [306] Main articles: Machine ethics, AI safety, Friendly artificial intelligence, Artificial moral agents, and Human Compatible Friendly AI are machines
that have been designed from the beginning to minimize risks and to make choices that benefit humans. Eliezer Yudkowsky, who coined the term, argues that developing friendly AI should be a higher research priority: it may require a large investment and it must be completed before AI becomes an existential risk.[307] Machines with intelligence
have the potential to use their intelligence to make ethical decisions. The field of machine ethics provides machine ethics is also called computational morality, [308] and was founded at an AAAI symposium in 2005. [309] Other approaches include Wendell
 Wallach's "artificial moral agents"[310] and Stuart J. Russell's three principles for developing provably beneficial machines.[311] Active organizations in the AI open-source community include Hugging Face,[312] Google,[313] EleutherAI and Meta.[314] Various AI models, such as Llama 2, Mistral or Stable Diffusion, have been made open-weight,
[315][316] meaning that their architecture and trained parameters (the "weights") are publicly available. Open-weight models are useful for research and innovation but can also be misused. Since they can be
 fine-tuned, any built-in security measure, such as objecting to harmful requests, can be trained away until it becomes ineffective. Some researchers warn that future AI models may develop dangerous capabilities (such as the potential to drastically facilitate bioterrorism) and that once released on the Internet, they cannot be deleted everywhere if
needed. They recommend pre-release audits and cost-benefit analyses. [318] Artificial intelligence projects can be guided by ethical considerations during the design, development, and implementation of an AI system. An AI framework such as the Care and Act Framework, development, and implementation of an AI system. An AI framework such as the Care and Act Framework, development, and implementation of an AI system.
four main ethical dimensions, defined as follows:[319][320] Respect the dignity of individual people Connect with other people sincerely, openly, and inclusively Care for the wellbeing of everyone Protect social values, justice, and the public interest Other developments in ethical frameworks include those decided upon during the Asilomar
Conference, the Montreal Declaration for Responsible AI, and the IEEE's Ethics of Autonomous Systems initiative, among others; [321] however, these principles are not without criticism, especially regarding the people and communities that these technologies
affect requires consideration of the social and ethical implications at all stages of AI system design, development and implementation, and collaboration between job roles such as data scientists, product managers, data engineers, data en
for AI safety evaluations available under an MIT open-source licence which is freely available on GitHub and can be improved with third-party packages. It can be used to evaluate AI models in a range of areas including core knowledge, ability to reason, and autonomous capabilities. [324] Main articles: Regulation of artificial intelligence, Regulation of
algorithms, and AI safety The first global AI Safety Summit was held in the United Kingdom in November 2023 with a declaration calling for international cooperation. The regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and laws for promoting and regulation of artificial intelligence is the development of public sector policies and artificial intelligence is the development of public sector policies and artificial intelligence is the development of public sector policies and artificial intelligence is the development of public sector policies and artificial intelligence is the development of public sector publ
 algorithms.[325] The regulatory and policy landscape for AI is an emerging issue in jurisdictions globally.[326] According to AI Index at Stanford, the annual number of AI-related laws passed in 2022 alone.[327][328] Between 2016 and 2020, more than 30 countries adopted
dedicated strategies for AI.[329] Most EU member states had released national AI strategies, as had Canada, China, India, Japan, Mauritius, the Russian Federation, Saudi Arabia, United Arab Emirates, U.S., and Vietnam. Others were in the process of elaborating their own AI strategies, including Bangladesh, Malaysia and Tunisia.[329] The Global
 Partnership on Artificial Intelligence was launched in June 2020, stating a need for AI to be developed in accordance with human rights and democratic values, to ensure public confidence and trust in the technology.[329] Henry Kissinger, Eric Schmidt, and Daniel Huttenlocher published a joint statement in November 2021 calling for a government
 commission to regulate AI.[330] In 2023, OpenAI leaders published recommendations for the governance of superintelligence, which they believe may happen in less than 10 years.[331] In 2023, the United Nations also launched an advisory body to provide recommendations on AI governance; the body comprises technology company executives,
government officials and academics.[332] In 2024, the Council of Europe created the first international legally binding treaty on AI, called the "Framework Convention on Artificial Intelligence and Human Rights, Democracy and the Rule of Law". It was adopted by the European Union, the United States, the United Kingdom, and other signatories
 [333] In a 2022 Ipsos survey, attitudes towards AI varied greatly by country; 78% of Chinese citizens, but only 35% of Americans, agreed that "products and services using AI have more benefits than drawbacks".[327] A 2023 Reuters/Ipsos poll found that 61% of Americans agree, and 22% disagree, that AI poses risks to humanity.[334] In a 2023 Fox
 News poll, 35% of Americans thought it "very important", and an additional 41% thought it "somewhat important", for the federal government to regulate AI, versus 13% responding "not very important" and 8% responding "not at all important". [335][336] In November 2023, the first global AI Safety Summit was held in Bletchley Park in the UK to
discuss the near and far term risks of AI and the possibility of mandatory and voluntary regulatory frameworks.[337] 28 countries including the United States, China, and the European Union issued a declaration at the start of the summit, calling for international co-operation to manage the challenges and risks of artificial intelligence.[338][339] In
May 2024 at the AI Seoul Summit, 16 global AI tech companies agreed to safety commitments on the development of AI.[340][341] Main article: History of artificial intelligence. In 2024, AI patents in China and the US numbered more than three-fourths of AI patents worldwide.[342]
 simple as "0" and "1", could simulate any conceivable form of mathematical reasoning.[343][344] This, along with concurrent discoveries in cybernetics, information theory and neurobiology, led research that would become part of AI,[346] such
 as McCulloch and Pitts design for "artificial neurons" in 1943,[116] and Turing's influential 1950 paper 'Computing Machinery and Intelligence', which introduced the Turing test and showed that "machine intelligence" was plausible.[347][344] The field of AI research was founded at a workshop at Dartmouth College in 1956.[s][6] The attendees
 became the leaders of AI research in the 1960s.[t] They and their students produced programs that the press described as "astonishing":[u] computers were learning checkers strategies, solving word problems in algebra, proving logical theorems and speaking English.[v][7] Artificial intelligence laboratories were set up at a number of British and U.S
 universities in the latter 1950s and early 1960s.[344] Researchers in the 1960s and the 1970s were convinced that their methods would eventually succeed in creating a machine with general intelligence and considered this the goal of their field.[351] In 1965 Herbert Simon predicted, "machines will be capable, within twenty years, of doing any work
 James Lighthill[355] and ongoing pressure from the U.S. Congress to fund more productive projects.[356] Minsky and Papert's book Perceptrons was understood as proving that artificial neural networks would never be useful for solving real-world tasks, thus discrediting the approach altogether.[357] The "AI winter", a period when obtaining funding
 for AI projects was difficult, followed.[9] In the early 1980s, AI research was revived by the commercial success of expert systems,[358] a form of AI program that simulated the knowledge and analytical skills of human experts. By 1985, the market for AI had reached over a billion dollars. At the same time, Japan's fifth generation computer project
 inspired the U.S. and British governments to restore funding for academic research.[8] However, beginning with the collapse of the Lisp Machine market in 1987, AI once again fell into disrepute, and a second, longer-lasting winter began.[10] Up to this point, most of AI's funding had gone to projects that used high-level symbols to represent mental
objects like plans, goals, beliefs, and known facts. In the 1980s, some researchers began to doubt that this approach would be able to imitate all the processes of human cognition, especially perception, robotics, learning and pattern recognition, [359] and began to look into "sub-symbolic" approaches. [360] Rodney Brooks rejected "representation" in
general and focussed directly on engineering machines that move and survive.[x] Judea Pearl, Lotfi Zadeh, and others developed methods that handled incomplete and uncertain information by making reasonable guesses rather than precise logic.[87][365] But the most important development was the revival of "connectionism", including neural
 network research, by Geoffrey Hinton and others. [366] In 1990, Yann LeCun successful applications of neural networks can recognize handwritten digits, the first of many successful applications of neural networks can recognize handwritten digits, the first of many successful applications of neural networks.
 methods and by finding specific solutions to specific problems. This "narrow" and "formal" focus allowed researchers to produce verifiable results and collaborate with other fields (such as statistics, economics and mathematics).[368] By 2000, solutions developed by AI researchers were being widely used, although in the 1990s they were rarely
 described as "artificial intelligence" (a tendency known as the AI effect).[369] However, several academic researchers became concerned that AI was no longer pursuing its original goal of creating versatile, fully intelligence (or "AGI"), which had several well-
 funded institutions by the 2010s.[68] Deep learning began to dominate industry benchmarks in 2012 and was adopted throughout the field.[11] For many specific tasks, other methods were abandoned.[y] Deep learning's success was based on both hardware improvements (faster computers,[371] graphics processing units, cloud computing[372]) and
 access to large amounts of data[373] (including curated datasets,[372] such as ImageNet). Deep learning's success led to an enormous increased by 50% in the years 2015-2019.[329] The number of Google searches for the term "AI"
 accelerated in 2022. In 2016, issues of fairness and the misuse of technology were catapulted into center stage at machine learning conferences, publications vastly increased, funding became a serious field of academic study.[306] In the late
2010s and early 2020s, AGI companies began to deliver programs that created enormous interest. In 2015, AlphaGo, developed by DeepMind, beat the world champion Go player. The program taught only the game's rules and developed by DeepMind, beat the world champion Go player. The programs that created enormous interest. In 2015, AlphaGo, developed by DeepMind, beat the world champion Go player. The programs that created enormous interest. In 2015, AlphaGo, developed by DeepMind, beat the world champion Go player. The program taught only the game's rules and developed a strategy by itself.
 generating high-quality human-like text.[374] ChatGPT, launched on November 30, 2022, became the fastest-growing consumer software application in history, gaining over 100 million users in two months.[375] It marked what is widely regarded as AI's breakout year, bringing it into the public consciousness.[376] These programs, and others
 inspired an aggressive AI boom, where large companies began investing billions of dollars in AI research. According to AI Impacts, about $50 billion annually was invested in "AI".[377] About 800,000 "AI"-related U.S. job openings
 existed in 2022.[378] According to PitchBook research, 22% of newly funded startups in 2024 claimed to be AI companies.[379] Main article: Philosophy of artificial intelligence and how to make intelligent machines.[380] Another major focus has been whether
machines can be conscious, and the associated ethical implications.[381] Many other topics in philosophy are relevant to AI, such as epistemology and free will.[382] Rapid advancements have intensified public discussions on the philosophy are relevant to AI, such as epistemology and free will.[381] See also: Turing test, Intelligent agent, Dartmouth workshop, and Synthetic intelligence
Alan Turing wrote in 1950 "I propose to consider the question 'can machine thinks', to "whether or not it is possible for machine to simulate human conversation. [347]
 Since we can only observe the behavior of the machine, it does not matter if it is "actually" thinking or literally has a "mind". Turing notes that we can not determine these things about other people but "it is usual to have a polite convention that everyone thinks."[384] The Turing test can provide some evidence of intelligence, but it penalizes non-
 human intelligent behavior.[385] Russell and Norvig agree with Turing that intelligence must be defined in terms of external behavior, not internal structure.[1] However, they are critical that the test requires the machine to imitate humans. "Aeronautical engineering texts", they wrote, "do not define the goal of their field as making 'machines that fly
 so exactly like pigeons that they can fool other pigeons."[386] AI founder John McCarthy agreed, writing that "Artificial intelligence is not, by definition, simulation of human intelligence is not 
describes it as "the ability to solve hard problems".[389] The leading AI textbook defined goals.[1] These definitions view intelligence in terms of well-defined problems with well-defined solutions, where both the difficulty of their environment and take actions that maximize their environment and take actions the environment and take
problem and the performance of the program are direct measures of the "intelligence" of the machine—and no other philosophical discussion is required, or may not even be possible. Another definition has been adopted by Google, [390] a major practitioner in the field of AI. This definition stipulates the ability of systems to synthesize information as
 the manifestation of intelligence, similar to the way it is defined in biological intelligence. Some authors have suggested in practice, that the definition of AI is vague and difficult to define, with contention as to whether classical algorithms should be categorised as AI,[391] with many companies during the early 2020s AI boom using the term as a
marketing buzzword, often even if they did "not actually use AI in a material way".[392] No established unifying theory or paradigm has guided AI research for most of its history.[aa] The unprecedented success of statistical machine learning in the 2010s eclipsed all other approaches (so much so that some sources, especially in the business world,
use the term "artificial intelligence" to mean "machine learning with neural networks"). This approach is mostly sub-symbolic, soft and narrow. Critics argue that these questions may have to be revisited by future generations of AI researchers. Symbolic AI (or "GOFAI")[394] simulated the high-level conscious reasoning that people use when they solve
puzzles, express legal reasoning and do mathematics. They were highly successful at "intelligent" tasks such as algebra or IQ tests. In the 1960s, Newell and Simon proposed the physical symbol systems hypothesis: "A physical symbol systems hypothesis: "A physical symbol system has the necessary and sufficient means of general intelligent action." [395] However, the symbolic approach
 failed on many tasks that humans solve easily, such as learning, recognizing an object or commonsense reasoning. Moravec's paradox is the discovery that high-level "intelligent" tasks were easy for AI, but low level "instinctive" tasks were easy for AI, but low level "instinctive" tasks were extremely difficult. [396] Philosopher Hubert Dreyfus had argued since the 1960s that human expertise depends in the discovery that high-level "instinctive" tasks were easy for AI, but low level "instinctive" tasks were easy for AI, but low level "instinctive" tasks were extremely difficult.
on unconscious instinct rather than conscious symbol manipulation, and on having a "feel" for the situation, rather than explicit symbolic knowledge.[397] Although his arguments had been ridiculed and ignored when they were first presented, eventually, AI research came to agree with him.[ab][16] The issue is not resolved: sub-symbolic reasoning
can make many of the same inscrutable mistakes that human intuition does, such as algorithmic bias. Critics such as Noam Chomsky argue continuing research into symbolic AI is a move away from explainable AI: it can be difficult or impossible to
understand why a modern statistical AI program made a particular decision. The emerging field of neuro-symbolic artificial intelligence attempts to bridge the two approaches. Main article: Neats and scruffies "Neats" hope that intelligence attempts to bridge the two approaches. Main article: Neats and scruffies "Neats" hope that intelligence attempts to bridge the two approaches.
 "Scruffies" expect that it necessarily requires solving a large number of unrelated problems. Neats defend their programs with theoretical rigor, scruffies rely mainly on incremental testing to see if they work. This issue was actively discussed in the 1970s and 1980s,[401] but eventually was seen as irrelevant. Modern AI has elements of both. Main
article: Soft computing Finding a provably correct or optimal solution is intractable for many important problems. [15] Soft computing genetic algorithms, fuzzy logic and neural networks, that are tolerant of imprecision, uncertainty, partial truth and approximation. Soft computing was introduced in the late 1980s and
most successful AI programs in the 21st century are examples of soft computing with neural networks. Main artificial general intelligence and Artificial general intelligence and superintelligence and superintelligence and superintelligence and artificial general intelligence and superintelligence and superi
(narrow AI) in hopes these solutions will lead indirectly to the field's long-term goals.[402][403] General intelligence is difficult to define and difficult to measure, and modern AI has had more verifiable successes by focusing on specific problems with specific solutions. The sub-field of artificial general intelligence studies this area exclusively. Main
research considers this issue irrelevant because it does not affect the goals of the field: to build machine conscious in exactly the way humans are is not one that we are equipped to take on."[404] However, the question has become
central to the philosophy of mind. It is also typically the central question at issue in artificial intelligence in fiction. Main articles: Hard problems of consciousness and Theory of mind David Chalmers identified two problems in understanding the mind, which he named the "hard" and "easy" problems of consciousness. [405] The easy problem is
understanding how the brain processes signals, makes plans and controls behavior. The hard problem is explaining how this feel or why it should feel like anything at all, assuming we are right in thinking that it truly does feel like anything at all, assuming we are right in thinking that it truly does feel like anything at all, assuming we are right in thinking that it truly does feel like something (Dennett's consciousness illusionism says this is an illusion). While human information processing is easy to
explain, human subjective experience is difficult to explain. For example, it is easy to imagine a color-blind person who has learned to identify which objects in their field of view are red, but it is not clear what would be required for the person to know what red looks like. [406] Main articles: Computational theory of mind and Functionalism (philosophy
of mind) Computationalism is the position in the philosophy of mind that the human mind is an information processing system and that thinking is a form of computationalism ergues that the relationship between mind and body is similar or identical to the relationship between software and thus may be a solution to the
mind-body problem. This philosophical position was inspired by the work of AI researchers and cognitive scientists in the 1960s and was originally proposed by philosophers Jerry Fodor and Hilary Putnam.[407] Philosopher John Searle characterized this position as "strong AI": "The appropriately programmed computer with the right inputs and
outputs would thereby have a mind in exactly the same sense human beings have minds."[ac] Searle challenges this claim with his Chinese room argument, which attempts to show that even a computer capable of perfectly simulating human behavior would not have a mind.[411] It is difficult or impossible to reliably evaluate whether an advanced AI
 is sentient (has the ability to feel), and if so, to what degree. [412] But if there is a significant chance that a given machine can feel and suffer, then it may be entitled to certain rights or welfare protection measures, similarly to animals.
provide another moral basis for AI rights.[413] Robot rights are also sometimes proposed as a practical way to integrate autonomous agents into society.[415] In 2017, the European Union considered granting "electronic personhood" to some of the most capable AI systems. Similarly to the legal status of companies, it would have conferred rights but
 also responsibilities.[416] Critics argued in 2018 that granting rights to AI systems would downplay the importance of human rights, and that legislation should focus on user needs rather than speculative futuristic scenarios. They also noted that robots lacked the autonomy to take part in society on their own.[417][418] Progress in AI increased
interest in the topic. Proponents of AI welfare and rights often argue that AI sentience, if it emerges, would be particularly easy to deny. They warn that this may be a moral blind spot analogous to slavery or factory farming, which could lead to large-scale suffering if sentient AI is created and carelessly exploited.[414][413] A superintelligence is a
 hypothetical agent that would possess intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence produced sufficiently intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence produced sufficiently intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence produced sufficiently intelligence produced sufficiently intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence produced sufficiently intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence produced sufficiently intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general intelligence far surpassing that of the brightest and most gifted human mind.[403] If research into artificial general general intel
 called an "intelligence explosion" and Vernor Vinge called a "singularity".[419] However, technologies cannot improve exponentially indefinitely, and typically follow an S-shaped curve, slowing when they reach the physical limits of what the technology can do.[420] Main article: Transhumanism Robot designer Hans Moravec, cyberneticist Kevin
 Warwick and inventor Ray Kurzweil have predicted that humans and machines may merge in the future into cyborgs that are more capable and powerful than either. This idea, called transhumanism, has roots in the writings of Aldous Huxley and Robert Ettinger.[421] Edward Fredkin argues that "artificial intelligence is the next step in evolution", and intelligence is the market of the control of th
idea first proposed by Samuel Butler's "Darwin among the Machines" as far back as 1863, and expanded upon by George Dyson in his 1998 book Darwin Among the Machines: The Evolution of Global Intelligence in fiction The word "robot" itself was coined by Karel Čapek in his 1921 play R.U.R., the title
standing for "Rossum's Universal Robots". Thought-capable artificial beings have appeared as storytelling devices since antiquity,[423] and have been a persistent theme in science fiction.[424] A common trope in these works began with Mary Shelley's Frankenstein, where a human creation becomes a threat to its masters. This includes such works
as Arthur C. Clarke's and Stanley Kubrick's 2001: A Space Odyssey (both 1968), with HAL 9000, the murderous computer in charge of the Discovery One spaceship, as well as The Terminator (1984) and The Matrix (1999). In contrast, the rare loyal robots such as Gort from The Day the Earth Stood Still (1951) and Bishop from Aliens (1986) are less
prominent in popular culture.[425] Isaac Asimov introduced the Three Laws of Robotics in many stories, most notably with the "Multivac" super-intelligent computer. Asimov's laws are often brought up during lay discussions of machine ethics; [426] while almost all artificial intelligence researchers are familiar with Asimov's laws through popular
 culture, they generally consider the laws useless for many reasons, one of which is their ambiguity. [427] Several works use AI to force us to confront the fundamental question of what makes us human, showing us artificial beings that have the ability to feel, and thus to suffer. This appears in Karel Čapek's R.U.R., the films A.I. Artificial Intelligence
and Ex Machina, as well as the novel Do Androids Dream of Electric Sheep?, by Philip K. Dick considers the idea that our understanding of human subjectivity is altered by technology created with artificial intelligence and elections - Use and impact of AI on political
elections Artificial intelligence content detection - Software to detect AI-generated content Behavior selection algorithm - Automation of business processes Case-based reasoning - Process of solving new problems based on the solutions of similar past problems
Computational intelligence - Ability of a computer to learn a specific task from data or experimental observation Digital immortality - Hypothetical concept of storing a personality in digital technologyPages displaying
 short descriptions of redirect targets Glossary of artificial intelligence - List of definitions of terms and concepts commonly used in the study of artificial intelligence Intelligence amplification - Use of information technology to augment human intelligence Intelligence Intelligence amplification - Software agent which acts autonomously Intelligence autonomously Intelligence and Intelligence Intellige
 process that combines robotic process automation and artificial intelligence – Use of brain organoids for intellig
 fiction novel Wetware computer - Computer - Computer composed of organic material DARWIN EU - A European Union initiative coordinated by the European Medicines across the EU. ^ a b This list of intelligent traits is based on the topics
covered by the major AI textbooks, including: Russell & Norvig (2021), Luger & Stubblefield (2004), Poole, Mackworth & Goebel (1998) and Nilsson (
(1998) ^ It is among the reasons that expert systems proved to be inefficient for capturing knowledge.[30][31] ^ "Rational agent" is general term used in economics, philosophy and theoretical artificial intelligence. It can refer to anything that directs its behavior to accomplish goals, such as a person, an animal, a corporation, a nation, or in the case
of AI, a computer program. ^ Alan Turing discussed the centrality of learning as early as 1950, in his classic paper "Computing Machinery and Intelligence".[42] In 1956, at the original Dartmouth AI summer conference, Ray Solomonoff wrote a report on unsupervised probabilistic machine learning: "An Inductive Inference Machine".[43] ^ See AI
 winter § Machine translation and the ALPAC report of 1966 ^ Compared with symbolic logic, formal Bayesian inference is computationally independent of one another. AdSense uses a Bayesian network with over 300 million edges to learn which ads to serve. [94] ^
 Expectation-maximization, one of the most popular algorithms in machine learning, allows clustering in the presence of unknown latent variables. [96] ^ Some form of deep neural networks (without a specific learning algorithm) were described by: Warren S. McCulloch and Walter Pitts (1943)[116] Alan Turing (1948);[117] Karl Steinbuch and Roger
 David Joseph (1961).[118] Deep or recurrent networks that learned (or used gradient descent) were developed by: Frank Rosenblatt(1957);[119] Kaoru Nakano (1971);[120] Shun-Ichi Amari (1972);[120] John Joseph Hopfield (1982).[120] Precursors to backpropagation
 were developed by: Henry J. Kelley (1960);[117] Arthur E. Bryson (1962);[117] Arthur E. Bryson (1962);[117] Arthur E. Bryson and Yu-Chi Ho (1969);[117] Backpropagation was independently developed by: Seppo Linnainmaa (1970);[121] Paul Werbos (1974).[117] ^{\circ} Geoffrey Hinton said, of his work on neural networks in the 1990s, "our labeled
datasets were thousands of times too small. [And] our computers were millions of times too slow."[122] ^ In statistics, a bias is a systematic error or deviation from the correct value. But in the context of fairness, it refers to a tendency in favor or against a certain group or individual characteristic, usually in a way that is considered unfair or harmful
 director at the Max Planck Institute for Intelligent Systems) argues that machine learning "is fundamentally the wrong tool for a lot of domains, where you're trying to design interventions and mechanisms that change the world." [256] When the law was passed in 2018, it still contained a form of this provision. This is the United Nations
definition, and includes things like land mines as well. [270] \ See table 4; 9\% is both the OECD average and the U.S. average. [281] \ Sometimes called a "robopocalypse" [289] \ "Electronic brain" was the term used by the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around this time. [343] [345] \ Daniel Crevier wrote, "the conference is generally recognized as the official birthdate of the press around the press arou
 new science."[348] Russell and Norvig called the conference "the inception of artificial intelligence."[116] ^ Russell and Norvig wrote, "it was astonishing whenever a computer did anything kind of smartish".[350] ^ The programs
described are Arthur Samuel's checkers program for the IBM 701, Daniel Bobrow's STUDENT, Newell and Simon's Logic Theorist and Terry Winograd's SHRDLU. ^ Russell and Norvig write: "in almost all cases, these early systems failed on more difficult problems" [354] ^ Embodied approaches to AI[361] were championed by Hans Moravec [362]
and Rodney Brooks[363] and went by many names: Nouvelle AI.[363] Developmental robotics. [364] ^ Matteo Wong wrote in The Atlantic: "Whereas for decades, computer-science fields such as natural-language processing, computer vision, and robotics used extremely different methods, now they all use a programming method called "deep
learning". As a result, their code and approaches have become more similar, and their models are easier to integrate into one another."[370] ^ Jack Clark wrote in Bloomberg: "After a half-decade of quiet breakthroughs in artificial intelligence, 2015 has been a landmark year. Computers are smarter and learning faster than ever", and noted that the
 number of software projects that use machine learning at Google increased from a "sporadic usage" in 2012 to more than 2,700 projects in 2015.[372] ^ Nils Nilsson wrote in 1983: "Simply put, there is wide disagreement in the field about what AI is all about." [393] ^ Daniel Crevier wrote that "time has proven the accuracy and perceptiveness of
 some of Dreyfus's comments. Had he formulated them less aggressively, constructive actions they suggested might have been taken much earlier."[398] ^ Searle presented this definition of "Strong AI" in 1999.[408] Searle's original formulation was "The appropriately programmed computer really is a mind, in the sense that computers given the righ
programs can be literally said to understand and have other cognitive states."[409] Strong AI is defined similarly by Russell and Norvig: "Stong AI - the assertion that machines that do so are actually thinking (as opposed to simulating thinking)."[410] a b c Russell & Norvig (2021), pp. 1-4. AI set to exceed human brain power Archived 2008-02-
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"Current AI machine-learning algorithms are, at their core, dead simple stupid. They work, but they work by brute force." (p. 198.) Evans, Woody (2015). "Posthuman Rights: Dimensions of Transhuman Worlds". Teknokultura. 12 (2). doi:10.5209/rev TK.2015.v12.n2.49072. S2CID 147612763. Frank, Michael (22 September 2023). "US Leadership in
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research to cloud computing and venture capital, U.S. companies, universities, and research labs - and their affiliates in allied countries - appear to have an enormous lead in both developing cutting-edge AI and commercializing it. The value of U.S. venture capital investments in AI start-ups exceeds that of the rest of the world combined. Gertner,
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Press, 235 pp.; Daniela Rus and Gregory Mone, The Mind's Mirror: Risk and Reward in the Age of AI, Norton, 280 pp.; Madhumita Murgia, Code Dependent: Living in the Shadow of AI, Henry Holt, 311 pp.), The New York Review of Books, vol. LXXI, no. 17 (7 November 2024), pp. 44-46. "'We can't realistically expect that those who hope to get rich
from AI are going to have the interests of the rest of us close at heart, ... writes [Gary Marcus]. 'We can't count on governments driven by campaign finance contributions [from tech companies] to push back.'... Marcus details the demands that citizens should make of their governments and the tech companies. They include transparency on how AI
systems work; compensation for individuals if their data [are] used to train LLMs (large language model)s and the ability to hold tech companies liable for the harms they cause by eliminating Section 230, imposing cash penalties, and passing stricter product liability laws... Marcus also suggests... that a new, AI-
specific federal agency, akin to the FDA, the FCC, or the FTC, might provide the most robust oversight.... [T]he Fordham law professor Chinmayi Sharma... suggests... establish[ing] a professional licensing regime for engineers that would function in a similar way to medical licenses, malpractice suits, and the Hippocratic oath in medicine. 'What if,
like doctors,' she asks..., 'AI engineers also vowed to do no harm?'" (p. 46.) Henderson, Mark (24 April 2007). "Human rights for robots? We're getting carried away". The Times Online. London. Archived from the original on 31 May 2014. Retrieved 31 May 2014. Hughes-Castleberry, Kenna, "A Murder Mystery Puzzle: The literary puzzle Cain's
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Faces: Does facial-recognition technology lead police to ignore contradictory evidence?", The New Yorker, 20 November 2023, pp. 20-26. "Robots could demand legal rights". BBC News. 21 December 2023, pp. 20-26. "Robots could demand legal rights". BBC News. 21 December 2026. Archived from the original on 15 October 2019. Retrieved 3 February 2011. Roivainen, Eka, "AI's IQ: ChatGPT aced a [standard intelligence] test
but showed that intelligence cannot be measured by IQ alone", Scientific American, vol. 329, no. 1 (July/August 2023), p. 7. "Despite its high IQ, ChatGPT fails at tasks that require real humanlike reasoning or an understanding of the physical and social world.... ChatGPT seemed unable to reason logically and tried to rely on its vast database of... facts
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they were trained. AI failures have already led to tragedy. Advanced autopilot features in cars, although they perform well in some circumstances, have driven cars without warning into trucks, concrete barriers, and parked cars. In the wrong situation, AI systems go from supersmart to superdumb in an instant. When an enemy is trying to manipulate
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even if we don't always know which data they're being trained on: they are asked to predict the next string of characters in a sequence. But exactly how they arrive at any given prediction is a mystery. The computations that occur inside the model are simply too intricate for any human to comprehend." (p. 32.) Vaswani, Ashish, Noam Shazeer, Niki
Parmar et al. "Attention is all you need." Advances in neural information processing systems 30 (2017). Seminal paper on transformers. Vincent, James, "Horny Robot Baby Voice: James Vincent on AI chatbots", London Review of Books, vol. 46, no. 19 (10 October 2024), pp. 29–32. "[AI chatbot] programs are made possible by new technologies but rely
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Wiktionary Media from Commons Quotations from Wikiquote Textbooks from Wikiquote Textbooks from Wikidata Scholia has a topic profile for Artificial Intelligence. "Artificial Intelligence tools market was valued at approximately $1.87 billion
in 2023 and is projected to reach $5.29 billion by 2032. This surge reflects the increasing demand for smart automation in data processing and business reporting. As companies strive for efficiency, AI-driven solutions are becoming indispensable in generating insightful and accurate reports. With tight schedules and back-to-back meetings, your
manager may only have a few minutes to glance at a report and make key decisions. That's why choosing the best AI report generator is crucial. Pictochart is great for visual clarity, while WPS AI, Jasper AI, ChatGPT, and Zoho Analytics excel in automation, integration, and speed. In this blog, I'll break down each of these tools, highlight their key
strengths, and show how they can streamline your reporting process. Whether you're a marketer, analyst, or small business owner, you'll find the one that fits your needs best. By the end, you'll know which AI report generator is the most suitable for you. My Top 4 Picks for Best AI Report Generator Tools Here are my top 3 picks from the best AI
report generator tools that simplify reporting with smart automation and impressive output quality. Pictochart: A visually driven tool perfect for creating engaging, easy-to-understand reports directly within the WPS Office suite. Jasper AI: Excellent for creating detailed and
structured business reports with a natural writing tone. ChatGPT: Versatile and intuitive, ideal for generating quick insights, summaries, and report drafts with ease. Do you know what Smart Automation is?It's more than just a buzzword. Smart Automation involves implementing rule-based systems, robotic process automation (RPA), and AI-driven
decision-making to handle repetitive tasks efficiently. Which Are the Best AI Writing Tools for Reports in 2025? Side-by-Side Comparison Table Want to know how the best AI writing tools perform across automation, integration, scalability, and usability? Here's a side-by-side comparison that helps you pick the right tool for your reporting needs in
2025. Tool Key Functionality Automation Level Ease of Integration Leve
Jasper AI Long-form AI content creation for reports Very High Medium (via APIs) Medium High Starts at $39/mo 9/10 ChatGPT Conversational reporting & summaries High Very High Very High Very High Starts at $39/mo 9/10 ChatGPT Conversational reporting & summaries High Very High Very High Very High Starts at $39/mo 9/10 ChatGPT Conversational reporting & summaries High Very High Very High Very High Very High Starts at $39/mo 9/10 ChatGPT Conversational reporting & summaries High Very H
$30/mo 8.5/10 CopyAI Short-form AI copy and templates Moderate Free & Paid ($36/mo) 8/10 Rytr LLC Quick content generation & formatting Moderate Low Very Easy Low Free & Paid ($20+/mo) 8.5/10 Tableau
Software Business intelligence & data reporting High Very High Starts at $39/mo 8.5/10 If you're wondering how I rated each tool, jump to how I evaluated them to explore my hands-on testing criteria. Interesting to know: Many
AI report generators offer free plans with limited features and premium plans starting around $9 to $12 per month. What Makes the Best AI report generator tools apart from the rest? Below is a detailed overview of each tool's unique features, strengths, and ideal use
cases to help you make an informed choice. 1. Pictochart: Turn Data Into Visual Stories with Ease Rating: 8/10Reason of Rating: I gave this rating because Pictochart is incredibly easy for visual storytelling but lacks automation and integration features for advanced reporting tasks. What is Pictochart's best feature? Its drag-and-drop infographic
builder tailored for non-designers. For whom is Pictochart best for? Educators, nonprofit teams, and startup marketers. Hidden Gem: Offers branded templates and team collaboration options even on the free tier. Pictochart helps transform plain data into compelling infographics and reports without design experience. Its drag-and-drop editor and startup marketers.
templates make visual storytelling accessible to everyone. What Has My Experience Been Like With Pictochart? Picto
infographic report for Q1 2024. Include graphs, key performance indicators, and a summary at the end." What I Don't Like: Collaboration tools feel basic compared to competitors like Canva for Teams. User-friendly for non-designers Professional-looking visuals in minutes Variety of templates and customization options Limited data automation Not
ideal for text-heavy or technical reports Explore PictochartVisualize Reports with Ease Using Pictochart 2. WPS AI is seamlessly embedded within the WPS Office Suite, making it a powerhouse for document-based report creation with high automation. What is WPS AI is seamlessly embedded within the WPS Office Rating: 8.5/10Reason of Rating: WPS AI is seamlessly embedded within the WPS Office Suite, making it a powerhouse for document-based report creation with high automation. What is WPS AI is seamlessly embedded within the WPS Office Suite, making it a powerhouse for document-based report creation with high automation. What is WPS AI is seamlessly embedded within the WPS Office Suite, making it a powerhouse for document-based report creation with high automation.
AI's unique feature? Real-time AI-assisted document editing within office tools. For whom is WPS AI best for? Marketers, students, and business analysts who work heavily within office suite. It's
perfect for users who want polished outputs with minimal effort and no external integrations. What Has My Experience Been Like With WPS AI? WPS AI makes my reporting process super quick; just a few clicks and it generates a clean, well-structured document. I love how it's built right into WPS Office, making it feel like second nature. Prompt:
 "Draft a formal business report analyzing sales trends for the last quarter. Use a structured format with headings: Introduction, Data Overview, Key Insights, and Recommendations." What I Don't Like: I felt AI suggestions were generic without topic-specific context. Built-in to WPS Office; no extra setup User-friendly with pre-formatted templates
Great for everyday office reports Limited customization for data-heavy reports Fewer advanced analytics features compared to competitors Try WPS AI for Reports Create Smart Repo
reports quickly and scales well for enterprise use. What is Jasper AI's best feature? Brand Voice customization for consistent tone across documents. For whom is Jasper AI best for? Enterprise teams, content marketers, and agencies. Hidden Gem: Jasper AI best for? Enterprise use. What is Jasper AI is a powerful content
generation tool designed to create high-quality, structured reports, blogs, and business content. It's ideal for marketing teams and enterprises aiming for consistency and depth. What Has My Experience Been Like With Jasper AI? Jasper feels like having a professional writer on your team. I especially loved how it remembers tone and style; it's a
 lifesaver for brand-focused reports. Prompt: "Write a detailed long-form report on social media performance metrics for a SaaS startup. Maintain a confident brand tone. Include subheadings, bullet points, and a final action plan." What I Don't Like: Expensive compared to tools like Writesonic or Rytr for similar tasks. Excellent long-form content
generation Customizable tone and brand memory Great integrations for marketers Slightly higher learning curve Requires training for brand voice to be effective Explore Jasper AIGenerate Smart, Long-Form Reports with Jasper 4. ChatGPT: Conversations That Write Reports for You Rating: 9.5/10Reason of Rating: ChatGPT offers dynamic
conversational summaries and flexible plugin/API integrations that make reporting highly interactive and intuitive. What is ChatGPT's unique feature? Custom GPTs and plug-ins for tailored reporting experiences. For whom is ChatGPT's unique feature? Custom GPTs and plug-ins for tailored reporting experiences. For whom is ChatGPT's unique feature? Custom GPTs and plug-ins for tailored reporting experiences. For whom is ChatGPT's unique feature? Custom GPTs and plug-ins for tailored reporting experiences. For whom is ChatGPT's unique feature? Custom GPTs and plug-ins for tailored reporting experiences.
can analyze spreadsheets and generate charts in seconds. ChatGPT is an AI-powered assistant that helps you draft summaries, generate detailed reports, and refine content through natural conversations. Its ease of use and adaptability make it ideal for quick reporting needs. What Has My Experience Been Like With ChatGPT? ChatGPT is my daily
go-to for writing everything from report intros to data summaries. It saves hours by delivering content that only needs light polishing. Prompt: "Summarize this excel data on customer retention into a 600-word report. Highlight the top 3 trends, provide reasons for churn, and suggest 2 strategies to improve retention." What I Don't Like: Not ideal for
structured reports with strict formatting or citations. Extremely fast and intuitive Works for any kind of writing; short or long Easily integrates with tools via API and plugins May need fact-checking for accuracy Lacks built-in formatting for formal reports explore ChatGPTCreate Reports with Natural Language AI 5. Zoho Analytics: Advanced Data
Reporting Made Easy Rating: 8.5/10Reason of Rating: 20ho Analytics offers rich data visualization and enterprise-grade reporting, but the learning curve is steep. What is Zoho Analytics best for? Data scientists, financial planners, and enterprise BI teams. Hidden
Gem: Drag-and-drop forecasting module with zero code needed. Zoho Analytics is a business intelligence platform that transforms raw data into dynamic visual reports and dashboards. It's a powerhouse for organizations needing detailed, automated analytics. Ever wondered why Data Visualization matters so much? It's all about turning complex data
into clear visuals; think charts, graphs, dashboards, and infographics. Tools like Tableau and Power BI, along with libraries like D3.js and Chart.js, help businesses present data in ways that are easier to understand and act on. What Has My Experience Been Like With Zoho Analytics? I used Zoho An
powerful, but took some time to get used to. Once learned, it delivered top-tier data stories. Prompt (via dashboard setup): "Create a dashboard report comparing Q1 vs Q2 performance for sales, revenue, and churn rate. Include line charts, KPI widgets, and data forecasts." What I Don't Like: Mobile usability is limited compared to cloud-based
dashboard apps. Excellent for big data visualization Automation through AI and scheduled reports Smooth integration with business tools Steep learning curve for beginners Can feel overwhelming with too many options Explore Zoho AnalyticsVisualize Data and Reports with Zoho AI Rating: 8/10Reason of Rating: CopyAI is great for quick report
intros and summaries, but it's limited for data-heavy reporting. What is CopyAI's best feature? Ready-to-use templates for short-form reporting. For whom is CopyAI best for? Social media managers, bloggers, and small business owners. Hidden Gem: Built-in workflows to auto-generate multiple content formats from a single prompt. CopyAI provides
fast content generation using pre-built templates, making it a great pick for short business reports and summaries. It's ideal for users who want fast, usable results. What Has My Experience Been Like With CopyAI? CopyAI helped me build a short marketing report in minutes. It's fast, accurate for light content, and a good option when you need
something quick and polished. Prompt: "Generate a 300-word executive summary for an internal quarterly performance report, with a confident tone and bullet points summarizing each department." What I Don't Like: Some output lacks originality and may require rephrasing. Quick copy generation Beginner-friendly interface Ideal for summaries
and simple reports Not suitable for data-heavy content Limited report customization Try CopyAI NowGenerate Short Reports in Seconds with AI 7. Rytr LLC: Simple AI Writer for Instant Drafts Rating: 7/10Reason of Rating: Rytr's unique feature? Pre-
trained use-case modules for one-click writing. For whom is Rytr best for? Freelancers, students, and solopreneurs on a budget. Hidden Gem: Offers native language support for 30+ languages with tone adaptation. Rytr is a lightweight AI writing tool designed for quick drafts and short content. It's great for users new to AI tools or who want simple,
no-frills writing support. What Has My Experience Been Like With Rytr? Rytr is incredibly easy and works straight out of the box. It's best for light writing needs, but I found it limiting when I needed structure and integration. Prompt: "Create a basic report outline for a school project on climate change. Include intro, data summary, and 3 key points
Keep it simple and easy to read." What I Don't Like: Struggles with generating multi-section or in-depth reports. Very budget-friendly Instant drafts and outlines Simple to use for anyone Not scalable for enterprise use Limited formatting and automation Use Rytr for Quick ReportsAI-Powered Drafting at Your Fingertips 8. Writesonic: Flexible AI for
Marketing & Reports Rating: 8.5/10Reason of Rating: Writesonic balances automation, marketing versatility, and output quality well. What is Writesonic best for? Content strategists, report writers, and eCommerce teams. Hidden Gem: Surfer SEO
integration available in premium plans for real-time optimization. Writesonic is a versatile AI tool that handles everything from blogs and landing pages to structured business reports. It's highly adaptable with a good mix of features. What Has My Experience Been Like With Writesonic? I liked how Writesonic could quickly shift from writing a blog total that handles everything from blogs and landing pages to structured business reports. It's highly adaptable with a good mix of features.
generating a professional report. It's a flexible, mid-level powerhouse for daily writing tasks. Prompt: "Write a marketing performance report summary from a Google Ads campaign. Include top-performing keywords, CTR trends, and suggestions for optimization." What I Don't Like: Document organization can feel inconsistent for longer reports. Wide
range of templates and tones Quick switching between content types Affordable with good value Some outputs need manual refinement Occasional formatting glitches Start Writesonic TodayCreate Reports, Blogs & More with One Tool 9. Tableau offers
enterprise-grade analytics and custom dashboard creation, but it comes with a steep learning curve. What is Tableau best for? Business intelligence teams, analysts, and enterprise-level reporting. Hidden Gem: Tableau Public lets you publish dashboards for free and
embed them anywhere. Tableau Software enables in-depth analytics and data storytelling for businesses. Its drag-and-drop interface with dynamic dashboards makes it a favorite in data-heavy environments. What Has My Experience Been Like With Tableau on client projects; it delivers stunning visual reports and insights, but only an algorithm of the contract of the co
after a decent learning period. Once mastered, it's worth every cent. Prompt (via dashboard parameters): "Visualize regional revenue trends and market share for Q1-Q4. Include a map chart, bar graph comparison, and a trend line for total sales." What I Don't Like: Demands a strong understanding of data structure to build effective dashboards.
Dynamic and customizable dashboards Live data syncing Professional-grade BI solution High learning curve Requires technical familiarity Explore Tableau 10. Anyword: Data-Driven AI for Predictive Report Writing Rating: 8/10 (can adjust) Reason of Rating: Anyword provides performance prediction scores
that guide optimized content generation for reports and ads. What is Anyword's best feature? Predictive scoring for every generated line of copy. For whom is Anyword best for? Marketing teams, copywriters, and ad performance analysts. Hidden Gem: Built-in A/B testing simulator to preview which variation might convert better. Anyword blends AI
content generation with predictive performance scores. It's ideal for teams who want to write content; including reports that perform and convert. What if you could predict what happens next? That's exactly what Predictive Analytics enables. By using advanced techniques like regression analysis, time-series forecasting, and machine learning models what predictive Analytics enables.
(think random forests and neural networks), businesses can spot future trends before they happen. It's all about shifting from reactive decision-making with data at the core. What Has My Experience Been Like With Anyword? Anyword surprised me with how smart it is about performance. It's more than writing; it's predicting what will
work best, especially for lead-gen style reports. Prompt: "Write a report evaluating the impact of email campaigns on sales conversions. Optimize the content for performance and suggest subject lines with high engagement rates." What I Don't Like: equires strong input briefs to generate contextually relevant copy. Predictive analytics built-in
Optimized outputs for conversion Clear scoring of content performance Not ideal for technical or academic reports Focuses heavily on marketing intent Try Anyword NowPredict and Create High-Converting Reports with AI How Did I Test These Tools in Real Use? While working on All About AI — Curated, Compared, and Explained, I explored dozensors.
of tools to understand what truly sets the best apart. To create this list of the best AI report generator tools, I followed a practical usability Across Report Types: I personally tested each tool by creating reports for business use, educational summaries, and project dashboards. This
helped me see which tools delivered consistently high-quality results. Automation and Integration Efficiency: I focused on how smoothly each tool automated content creation and Learning Curve: Each tool was assessed for its
ease of use. Tools that offered a clean interface and guided workflows with minimal setup scored higher. Flexibility in handling different formats and scalability in performance were key factors. Overall Value Compared to Pricing: I
reviewed both free and paid versions to see which tools provided the most useful features for their cost. Tools offering rich functionality without being expensive earned better scores. How I Scored Them: The ratings, given out of 10, reflect my hands-on testing based on the factors above: A score of 9 or higher means the tool excelled in automation,
usability, scalability, and overall value. These tools are well-suited for a wide range of users and reporting needs. Tools with a score of 7 or 8 still performed well but are better suited for specific use cases or user types, such as individuals needing simple reports or teams with lighter workflows. Each rating is grounded in actual usage across different
report types, ensuring practical, reliable recommendations instead of just a feature-by-feature comparison. Do AI Report Tools Actually Save Time and Money? [Case Study] As part of my hands-on exploration for AllAboutAI.com, I intentionally tested these tools to determine whether they provide real savings in both time and cost. My focus was on
measurable productivity, financial impact, and long-term usability. Time Saved per 1000-word Report: Before AI:Writing a 1000-word report manually, including topic research, outline creation, writing, and editing, took me around 4 to 5 hours. After AI:Using tools like ChatGPT, Jasper AI, or Writesonic, I consistently
generated complete drafts with formatting in just 35 to 50 minutes. Result: These tools reduced my report creation time by up to 80 percent, especially for first drafts and structured outlines. Cost Comparison: Freelancers vs Monthly AI Tool Pricing Hiring Freelancers vs Monthly AI Tool Pricing Hiring Freelancers. $80 to $150 per 1000-word report AI Tool Subscriptions: Jasper AI: $39/month
 Writesonic: $16/month ChatGPT Plus: $20/month Result: Even if you create four reports a month, using AI tools is far more cost-efficient than relying on external writers. Learning Curve: Onboarding Time Required Quick Starters: WPS AI, CopyAI; Ready to use in under 30 minutes Advanced Platforms: Tableau, Zoho Analytics; May take 2 to 3 days of
exploration or training Result: Lightweight AI tools drastically lower the learning curve and get you reporting-ready faster. Interesting Stats: The AI text generators, is projected to grow from $0.61 billion in 2024 to $0.74 billion in 2025, reflecting a strong CAGR of 21.2%. What Are the Best AI Reporting
 Tools for Different Use Cases? Looking for the right AI tool tailored to your specific reporting needs? Whether you're building business dashboards, marketing reports, or educational Summaries & Student Projects → ChatGPT, Rytr LLC Data
Visuals & Infographics \rightarrow Pictochart, Zoho Analytics Marketing & Ad Reports \rightarrow Anyword, CopyAI Quick Dashboards & Team Collaboration \rightarrow WPS AI, Writesonic What Are the Most Common AI Reporting Failures and Which Tools Fixed Them? Even the best AI report generator tools are not immune to mistakes. During my testing, I documented
recurring issues and which tools failed or successfully resolved them in real use. Problem Tools That Failed Tools That Solved It Citation Gaps Writesonic, CopyAI ChatGPT Overuse of Buzzwords CopyAI, Jasper Wordtune, Notion AI These issues were most noticeable in tools
 that prioritized speed over accuracy. ChatGPT and Wordtune consistently produced more reliable, refined, and readable outputs. Did you know: The top challenge cited by 57% of AI developers is AI "hallucinations," where models confidently generate incorrect or nonsensical information. This issue significantly undermines report accuracy and readable outputs.
credibility, especially in automated report generation. In 2025, AI report generations have become essential for students, researchers, and academic institutions. These tools go far beyond grammar correction; they now assist with structuring arguments, formatting in APA/MLA, checking for plagiarism, and even visualizing data within research. Let's
compare the top three AI-powered platforms used in academic report generation in 2025: Tool Citation Support Plagiarism Checker APA/MLA Structured reports & thesis outlines Rytr Manual only Integrated Copyscape Needs manual edit Short summaries & idea
generation Piktochart Manual & Linked Basic APA/MLA-ready Visual research reports & infographics Know that: AI report generators streamline the traditionally time-consuming process of data analysis and report writing by automating data processing and visualization, enabling researchers to focus on insights and interpretation rather than
manual formatting. What Does Reddit Say About the Best AI Report Generator Tools? In a thread posted on r/ArtificialIntelligence, a user running a tutoring company asked for AI tools to automate monthly student progress reports. Despite using templates, they found manual work was still high and were looking for Excel-friendly solutions that could
reduce repetitive tasks. Several community members responded with useful suggestions. One pointed out that if the data is a sweet spot for large language models like GPT.
Another user shared their experience building automated workflows for various clients; ranging from financial reporting to legal documentation, with a breakdown involving data input, SOP-like instructions, output formatting, and template population. They noted tools like SWMS AI could be part of such solutions, tailored to compliance and safety
needs. The general sentiment? Reddit users believe LLMs can dramatically simplify reporting tasks when paired with the right automation workflow. Tools that bridge structured data with clear formatting rules are the real game-changers in professional environments. What Do the Latest Stats Reveal About AI Report Generator Tool Usage?
Understanding how different users engage with the best AI report generator tools helps us see which features truly matter. From freelancers to Fortune 500 companies, needs vary widely; so the right tool often depends on the size and Industry Insights Marketers prioritize tools with reliable data integrations, clean data
consolidation, customizable visualizations, and actionable AI insights. Freelancers and small teams benefit most from tools that offer quick and simple report generation using pre-built templates and AI-assisted content (e.g., Easy-Peasy.AI, Piktochart). Enterprises lean toward tools with robust analytics, high scalability, and full-featured reporting
platforms (e.g., Tableau, Power BI, Domo). Source: Whatagraph What Do Industry Experts Say About Choosing the Right AI Report Generator tools. Their insights highlight what truly matters when it comes to efficiency,
data handling, and long-term value. "AI reporting tools simplify the process of generating report creation, collaboration, and analysis capabilities for visualization, collaboration, and analysis capabilities for visualization, collaboration, and analysis capabilities." (AI has revolutionized how you approach report creation. Instead
of spending hours manually compiling data, you can now rely on AI to streamline the process." Sarah Smith, emphasizing the efficiency AI brings to report generation. "AI ensures accuracy by analyzing data with precision and consistency. Unlike manual methods, which are prone to oversight, AI reporting tools minimize discrepancies by maintaining
data integrity throughout the process."PageOn.ai, discussing how AI tools enhance the reliability of reports. Where Are AI Report Generator Tools Headed Next? Future Trends to Watch Hyper-Personalized Reports: AI tools will increasingly tailor outputs to individual roles, industries, and even reader preferences using contextual learning. Real-Time
Data Syncing: Reports will update live as new data flows in, eliminating manual refresh cycles and boosting decision-making speed. Voice-to-Report Interfaces: The rise of multimodal AI will allow users to generate full reports using voice commands or natural conversation. While working on AllAboutAI, I noticed a clear shift toward smarter, more
adaptive tools that learn from user behavior. In my view, the future belongs to platforms that combine automation with deep context understanding. Tools that simplify while scaling will dominate the reporting space. FAQs For technical reports, Zoho Analytics and Jasper AI stand out. Zoho offers powerful data visualization and integration, while
Jasper helps generate structured, long-form technical content. Both tools are ideal for precision-driven, detailed reporting. ChatGPT and Rytr are excellent choices for book reports. ChatGPT can summarize, analyze themes, and generate discussion points, while Rytr is great for guick drafts with minimal input. Both simplify academic writing tasks
with AI support. Start by inputting structured data or prompts into a platform like ChatGPT, WPS AI, or Writesonic. These tools then analyze, format, and draft the report based on your goals. Most platforms also offer templates and formatting options to make the process easier. Customization depends on the tool; Jasper offers tone control and
structure templates, while Zoho Analytics allows deep data visualization edits. ChatGPT and Writesonic let users guide the flow with conversational prompts. The more advanced the tool, the richer the customization. For SEO, try Jasper AI and Frase for optimized content reports. Finance reporting works well with Zoho Analytics and Tableau due to
robust data features. In education, WPS AI and Easy-Peasy. AI offer simple interfaces for student and progress report generation. Conclusion In 2025, the best AI report generator tools are no longer just about saving time; they're about transforming how we communicate data, automate insights, and scale content effortlessly. Whether you're a solo
freelancer or part of a global enterprise, there's a tool designed to meet your specific needs. As AI continues to evolve, choosing the right tool will depend on your goals, data complexity, and team workflow. I've tested, compared, and analyzed the top options so you can decide with confidence. Now it's your turn; which AI tool do you think fits your
workflow best, and what features matter most to you? Was this article helpful?YesNo
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