The Transformative Opportunities and Threats of AI in Banking and Payments

INNOVATIVE PAYMENTS ASSOCIATION

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Introduction

Artificial intelligence (AI) as a field of study has existed since the 1950's[1] and has been used in banking applications for decades. The recent launch of consumer accessible AI solutions powered by ChatGPT, Bard and lesser-known options including Perplexity AI, Jasper Chat, Colossal Chat, or image generators DALL-E and Midjourney (plus many others), brought the technology to the forefront. With the popularization of these services accompanied by substantial hype, the collective conversation has turned to the enormity of AI's potential that if realized is nothing short of revolutionary. Discussions include AI's ability to solve complex issues that can speed up the development of lifesaving medical findings to the other end of the spectrum, fueling a robot uprising that will destroy mankind, and everything else in between. Bill Gates recently declared, *"The development of AI is as fundamental as the creation of the microprocessor, the personal computer, the Internet, and the mobile phone. It will change the way people work, learn, travel, get health care, and communicate with each other. Entire industries will reorient around it. Businesses will distinguish themselves by how well they use it."*[2]

The potential societal impacts are being discussed more vocally now that AI is in the consumer domain. Much has been written regarding the implications of AI convincingly spreading false information, plus improving but also replacing jobs currently completed by humans, including that of researchers and writers of whitepapers. Regulators across the globe are taking note and considering how to balance a need to equitably protect civilization without restricting the growth and positive outcomes offered by the integration of AI.

The topic of AI is so broad and its impact so fundamental that it will take decades to unfold and be fully understood. This paper will consider a very small segment of the ecosystem, namely how AI is being used in banking and financial services today and its near-term prospects. Specifically, this paper seeks to answer the questions:

- What is AI?
- How is it currently and projected to be used in financial services?
- How can users know if AI is working and not negatively impacting consumers?
- What support is needed to manage AI and how are AI teams staffed?
- How are regulators responding to the expanded use of AI?

In an interview with IPA member APS, a leader in regulatory technology for banking, payments, and fintech brands, CIO/CTO Brian Ludemann made this prescient comment regarding the potential opportunity for AI in financial services; "*Appreciate the uniqueness of this time. It's not just ChatGPT that has caught the attention of seemingly everyone. People, including those without a technical background, are proactively educating themselves on the topic. We need to use this momentum to propel AI for good".*

[1] https://www.livescience.com/49007-history-of-artificial-intelligence.html

[2] https://www.gatesnotes.com/The-Age-of-AI-Has-Begun

Just What is AI?

A simple and broad definition of AI is the collection of data and information (like images), identified, sorted, and organized in a usable format that allows computer models to learn and to reason like humans to solve issues and deliver decisions. As an experiment, AI chatbots Bard and Chat GPT were asked to describe AI. When prompted with the query, "*Provide an easy-to-understand, one-paragraph definition of artificial intelligence,*" these two responses were received in a matter of seconds:

From Bard:

> *Artificial intelligence (AI) is the ability of a computer or machine to mimic intelligent human behavior. This can include tasks such as learning, reasoning, problem-solving, and decision-making. AI is used in a wide variety of applications, including natural language processing, speech recognition, image recognition, and robotics.*
>
> *AI is a rapidly growing field with the potential to revolutionize many aspects of our lives. As AI continues to develop, it is important to consider the ethical implications of this technology. For example, how should we ensure that AI is used for good and not for harm? How can we protect the privacy of individuals whose data is used to train AI systems? These are just some of the questions that we need to address as AI becomes more powerful.*

From Chat GPT:

> *Artificial intelligence (AI) refers to the development of computer systems that can perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation. AI is achieved using machine learning algorithms, which enable computer systems to learn from and adapt to data inputs and perform specific tasks without being explicitly programmed to do so. AI systems can be classified into categories such as supervised learning, unsupervised learning, and reinforcement learning, and are increasingly used in a wide range of applications, from voice assistants and self-driving cars to medical diagnosis and financial forecasting.*

AI Terminology

With the intense attention to AI and its applications, AI jargon has also entered everyday conversations. The following provides summary definitions of a few common terms and phases that are useful to understand:

Generative AI is a type of AI technology that learns how to create new content like text, computer code, or a visual output based on vast quantities of information that the system has ingested. Generative AI continues to evolve or get smarter as new data is provided and as humans intercede to direct and shape the output. AI chatbots are based on generative AI. Generative AI is different than non-generative AI in its capability to deliver brand new *content*, where older AI models will organize existing content to describe, predict, or recommend something.

Output from AI delivered in easily understood and often very convincing human-like language, imagery or even computer code. The output is based on the specific data made available and the probability that the words, images or computer code is accurately composed or executed. Because AI systems don't understand the validity of the data it has been fed, or the model it relies on is flawed, the output is sometimes nonsensical, fabricated, or simply false. These are called **Hallucinations**. Some examples are easy to identify and therefore fix – like a really bad autocorrect suggestion – but others are much more difficult to notice. Stories abound about AI-generated research papers that reference information sources, that are completely fabricated. It's easy to understand the destructive nature of AI if left unchecked.

An article published by McKinsey, *Exploring Opportunities in the Generative AI Value Chain,* has a good summary of the applications for generative AI[3]. As they point out, this is not an exhaustive list (next page).

Large Language Models (**LLM**) are made of multiple neural networks and use algorithms to analyze and process language and patterns within languages to perform a task. It assesses the probability that words are composed in context. It is the basis for Chat GPT and other similar solutions.

Machine Learning (ML) is a form of AI that uses algorithms and statistical models to detect patterns in data. Machine learning programs can execute a task without being explicitly told by a human to do so. As new data points are added to a machine learning model, responses are reinforced or refined. In the financial payments industry, machine learning is used to define what is fraudulent and what is a legitimate transaction and make the appropriate approve or deny authorization decision. **Deep Learning Models** are a subset of ML that uses a neural network with three or more layers. Additional layers can help to improve accuracy.

Neural networks as explained by freecodecamp.org[4] are modeled around how human brains work. Individual nodes form the layers in the network, just like the neurons in our brains connect different areas. The inputs to nodes are organized in a single layer and will have a weight assigned to them that changes the effect that a parameter has on the overall prediction result. Since the weights are assigned on the links between nodes, each node may be influenced by multiple weights. The neural network takes all the training data in the input layer. Then it passes the data through the layers, transforming the values based on the weights at each node. Finally, it returns a value in the output layer. It can take some time to properly tune a neural network to get consistent, reliable results.

Another term that is often brought up when discussing AI is that of **singularity**. This is the doomsday state where machines, powered by AI, will be able to think at or beyond the capacity of human understanding and allow intelligent machines to evolve at their own rate if left uncontrolled. This potential creates the most concern and is often the focus for legislators and regulators as they look to put boundaries around AI's development while still allowing it to evolve its beneficial uses.

[3] https://www.mckinsey.com/~/media/mckinsey/business%20functions/quantumblack/our%20insights/exploring%20opportunities%20in%20the%20generative%20ai%20value%20chain/exploring-opportunities-in-the-generative-ai-value-chain.pdf

[4] https://www.freecodecamp.org/news/convolutional-neural-network-tutorial-for-beginners/

A taxonomy of other frequently used AI terms and brief definitions of how these concepts are interrelated can be found in the Appendix.

Modality	Application	Example use cases
Text	Content writing	• Marketing: creating personalized emails and posts • Talent: drafting interview questions, job descriptions
	Chatbots or assistants	• Customer service: using chatbots to boost conversion on websites
	Search	• Making more natural web search • Corporate knowledge: enhancing internal search tools
	Analysis and synthesis	• Sales: analyzing customer interactions to extract insights • Risk and legal: summarizing regulatory documents
Code	Code generation	• IT: accelerating application development and quality with automatic code recommendations
	Application prototype and design	• IT: quickly generating user interface designs
	Data set generation	• Generating synthetic data sets to improve AI models quality
Image	Stock image generator	• Marketing and sales: generating unique media
	Image editor	• Marketing and sales: personalizing content quickly
Audio	Text to voice generation	• Trainings: creating educational voiceover
	Sound creation	• Entertainment: making custom sounds without copyright violations
	Audio editing	• Entertainment: editing podcast in post without having to rerecord
3-D or other	3-D object generation	• Video games: writing scenes, characters • Digital representation: creating interior-design mockups and virtual staging for architecture design
	Product design and discovery	• Manufacturing: optimizing material design • Drug discovery: accelerating R&D process
Video	Video creation	• Entertainment: generating short-form videos for TikTok • Training or learning: creating video lessons or corporate presentations using AI avatars
	Video editing	• Entertainment: shortening videos for social media • E-commerce: adding personalization to generic videos • Entertainment: removing background images and background noise in post
	Voice translation and adjustments	• Video dubbing: translating into new languages using AI-generated or original-speaker voices • Live translation: for corporate meetings, video conferencing • Voice cloning: replicating actor voice or changing for studio effect such as aging
	Face swaps and adjustments	• Virtual effects: enabling rapid high-end aging; de-aging; cosmetic, wig, and prosthetic fixes • Lip syncing or "visual" dubbing in post-production: editing footage to achieve release in multiple ratings or languages • Face swapping and deep-fake visual effects • Video conferencing: real-time gaze correction

Source: McKinsey and Company, Exploring Opportunities in the Generative AI Value Chain

AI in Financial Services Today

Readers working in the financial services industry are likely already aware of functioning use cases that rely on AI. A study conducted by NVIDIA in February 2023 found four in five financial services organizations have up to five AI use cases operational within their organizations already.[5] Chatbots like Alexa and Siri use forms of AI to interpret natural language commands from banking customers to answer questions, inform users of existing account balances or pay bills. AI is used to interpret these inquiries and turn them into actionable activities and transactions. Fraud detection systems for payments have long relied on machine learning and neural networks, both subsets of AI, to recognize patterns in large quantities of unstructured data then identify transactions that predictably result in a non-fraudulent transaction and those that represent anomalies without the intervention of humans to interject with new business rules.

The use of AI in financial services has advanced so quickly that there is even an index available to measure the level of AI application use within financial institutions. Evident AI Index[6] ranks banks on 150 different indicators of AI deployment. JP Morgan Chase is currently at the top of the list. Jamie Dimon dedicated a sizable portion of his 2022 annual letter to shareholders on the bank's investments in the technology, commenting; "*AI and the raw material that feeds it, data, will be critical to our company's future success — the importance of implementing new technologies simply cannot be overstated. We already have more than 300 AI use cases in production today for risk, prospecting, marketing, customer experience and fraud prevention, and AI runs throughout our payments processing and money movement systems across the globe.*" [7]

Other banks, credit unions, networks, processors and fintechs have all voiced similar commitments to AI technologies. When

AI IN ACTION

In a podcast, IPA member **Deep Labs** discusses how they help clients achieve results in various AI-enabled use cases, from fraud detection to revenue generation. It can be accessed at: **Payments Pod.** One key point highlighted is the absolute dependency on complete and validated data. Deep Labs commented in the podcast (lightly edited for clarity):

"…making sense of data is critical to the process of what we would call machine learning. One of the things that we do at Deep Labs, we work with clients to understand what data they have available and how readily accessible it is. Sometimes it's in multiple places, sometimes it's inaccessible, sometimes it's hard to cobble together. And we also bring our own data and then oftentimes append publicly available data or data for purchase so that we can build a really robust picture of the environment that the client is working in. And so, the machine learning that we do consider it a very, very sophisticated black box. But it's all about making sense of data and making sure that we're bringing in high-quality data, data that is both accurate and predictive."

[5] AI Solutions for Finance Industries | NVIDIA

[6] Evident - Evident AI Index (evidentinsights.com)

[7] Jamie Dimon's Letter to Shareholders, Annual Report 2022 | JPMorgan Chase & Co.

taking note of the comments made by those in financial services, the use cases for AI is currently congregating into the following areas:

Improved customer experience:

- Responding to customer questions and resolving straight-forward issues 24/7,
- Automate account management by performing tasks such as arranging payments, updating account information,
- Assist users with financial planning tasks and make personalized recommendations for budgeting, establishing financial objectives and recommending investment decisions.

Cost reductions and operational efficiencies:

- Detect and act when fraudulent transactions are identified in real time,
- Review and reconcile transaction activity,
- Validate new account application data received,
- Update client relationship data from internal and external data sources
- Identify new regulatory requirements and assess a financial institution's compliance with existing requirements to avoid penalties.

Revenue generation and client growth:

- Create and deliver highly personalized communications with new product recommendations to existing and prospective users, based on needs, risk tolerance and demographics,
- Identify customers at risk of leaving.

Validating AI

It Works, Doesn't Harm Consumers

One of the greatest concerns about AI is that it reaches incorrect conclusions and executes harmful actions, from the annoying such as declining a valid transaction to the horrifying such as making account application decisions based on age, geography, or racial parameters. AI systems are only as good as the accuracy and completeness of the data that is supplied. The Consumer Financial Protection Bureau (CFPB) is actively monitoring how AI technologies used by banks could create risks in managing customer care. In a joint statement with the Civil Rights Division of the United States Department of Justice, the Federal Trade Commission, and the U.S. Equal Employment Opportunity Commission, a stern warning was issued to financial institutions that bankers can't blame their AI systems when consumers are harmed, and regulatory violations are committed[8]. A circular issued by the CFPB in May 2022 warned creditors of the following obligations:

[8] https://www.consumerfinance.gov/about-us/newsroom/cfpb-federal-partners-confirm-automated-systems-advanced-technology-not-an-excuse-for-lawbreaking-behavior/

Federal consumer financial protection laws and adverse action requirements should be enforced regardless of the technology creditors use. For example, the Equal Credit Opportunity Act (ECOA) does not permit creditors to use technology that prevents them from providing specific and accurate reasons for adverse actions. Creditors' use of complex algorithms should not limit enforcement of ECOA or other federal consumer financial protection laws.

Creditors cannot justify noncompliance with ECOA based on the mere fact that the technology they use to evaluate credit applications is too complicated, too opaque in its decision-making, or too new. Creditors who use complex algorithms—including artificial intelligence or machine learning technologies—to engage in credit decisions must still provide a notice that discloses the specific, principal reasons for taking adverse actions. There is no exception for violating the law because a creditor is using technology that has not been adequately designed, tested, or understood.

Bearing in mind some of the pitfalls that can occur with AI, particularly new and under-tested AI systems and use cases, some walk-before-we-run approaches should be considered:

Mind the Data

When implementing a new solution employing AI models, consider initially focusing on use cases exposed only to internal, controlled data, before adding tested and validated external data sources. Exposure to false outcomes grows exponentially when new data sources outside the FI's control are brought in. Data may also want to be narrowed to exclude personally identifiable information or other sensitive FI data.

Low Complexity Tasks

New use cases should be narrow in scope to distinct tasks. These are more easily monitored, and results are clearer to understand before building the complexity.

While nearly all tasks have regulatory implications, consider an initial focus on those activities with fewer regulatory minefields, such as content creation for a marketing email or internal data monitoring before turning the technology to activities that could have serious implications if biases are found in the results.

Test and Monitor

Before launching a new AI-aided process, financial institutions must have planned governance and monitoring – including human oversight – in place. If an AI-powered activity is replacing a less automated solution, consider running both solutions in parallel to compare results and identify any positive and negative impacts. Periodic audits of performance are also recommended.

Continuous Training

Just as humans performing tasks need occasional retraining, AI systems require the same. New data may need to be introduced to provide more accurate outcomes. AI models can be helped by humans, called supervised training, by labeling and organizing data before it being fed into the system. Alternatively, unsupervised learning allows the model to identify, organize and label data and create the necessary associations to formulate results. Regardless of the approach, results need to be validated to see how the model reacts to the inclusion of new data elements before moving to a production test.

In our interview with APS' Brian Ludemann, he highlighted some real-world examples of how AI is being successfully deployed today:

Dispute Management

We have seen very positive impacts of AI in dispute case management. This is particularly with fintech solutions, where the occurrence of disputes and fraudulent disputes is orders of magnitude greater than the experience of a traditional financial institution. AI helps determine which disputes are fraudulent. Understand, AI is NOT making a decision, but acting as a co-pilot. You will hear this term used a lot, particularly from Microsoft who is developing a suite of co-pilot tools that will help humans to make faster, more informed decisions across their productivity suite of applications. Using the fraudulent disputes scenario as an example, you might pair a large language model such as ChatGPT with more traditional AI toolsets so that a disputes case processor can make a query about a specific aspect of the dispute and the model will return key information such as, "this individual has filed the following seven disputes in the last year" or "this merchant has experienced a high-level of disputes in the last 90 days". This provides valuable insight that helps humans make more accurate decisions more quickly.

Fraud Detection

Fraud detection is an obvious place to use AI, and it has been used for years. This is where we will see a lot of banking institutions in particular, begin to leverage AI. They are becoming more comfortable evolving their existing solutions with new technology. Combining AI's ability to interpret vast quantities of data with advances in computing power and the availability of cloud options, organizations of all sizes can use these models successfully.

Regulatory Compliance

Keeping up to date with existing and new regulations and rules has always been a struggle and creates a bottleneck for developing new products, features, and solutions. Companies have developed a model using Chat GPT and trained it on tens of thousands of pages of relevant regulations. Now when a provider develops a new model, it can easily investigate whether what it intends to build is compliant with current regulations. It makes a compliance review much more efficient.

Staffing an AI Team

Jamie Dimon's 2022 letter to shareholders provided a glimpse into how J.P. Morgan Chase has staffed for its AI development. Chase employs (globally) over 1,000 people for data management, more than 900 data scientists who are AI and ML experts creating new models, 600 ML engineers who write code to put models in production and a 200-person AI research group looking at solving problems and new frontiers in finance.[9] The bank also has an "interdisciplinary team of ethicists helping us prevent unintended misuse". While most banks aren't going to dedicate nearly the same percentage of staff, it's worth noting

[9] https://reports.jpmorganchase.com/investor-relations/2022/ar-ceo-letters.htm

both the level of commitment the largest U.S. bank has to AI and the emphasis it places on data management.

For those institutions and organizations that don't have the budget of a mega-bank, the JP Morgan example does provide a blueprint for creating an AI staffing plan:

- The bulk of attention and resources are needed around core information, meaning locating, labeling, cleansing, and securitizing data. Each potential use case presented must be examined to ensure complete data is available and the information must be easily accessible, which likely means that engineers focused on cloud development will be involved.
- Engineers will be needed to develop models, test, and monitor results as they evolve.
- Teams keeping a pulse on AI developments within the technology community and with the broader market are needed to highlight the use cases that could be best deployed for a specific organization and provide competitive parity or advantage. AI-designated specialists embedded within product and product strategy groups, operations and risk management groups are key, as they will have the best knowledge to understand how new use cases can be deployed for maximum effect.
- Particularly at this relatively early stage of the evolution of AI in banking, governance oversight should be inserted into the process to monitor the use and deployment of AI models. The results need to fit with the organizations' objectives, culture and comply with the ever-evolving regulatory front. This is likely a role for Risk Management and executive management and can be folded into existing risk review processes.

For most financial institutions and financial services companies, most of these activities will be outsourced. When reviewing current or prospective outsourcers, understanding how they manage their staffing, testing and governance for products and services that include AI is an important objective for third party risk reviews. Just because a financial institution or other financial services provider outsources AI based solutions doesn't mean that they are excused from understanding how they work and are managed. Following the disciplines described above, a good outline for questions to ask vendors includes:

- How are vendors staffed for data management activities and what steps are taken to validate knowledge?
- How does the AI staff determine which use cases are prioritized and launched for customers?
- How are AI solutions monitored and governed?
- How is transparency of AI models disclosed?
- How aware and active are vendors in the evolving regulatory compliance environment?

Regulatory Environment

Staying Current on AI

While artificial intelligence and machine learning have been around for years, regulation around their use has ramped up in the past few years. Legislators at state and federal levels are looking to introduce

new laws governing its use in financial services, bureaus, and agencies like the Federal Trade Commission (FTC), Department of Justice Civil Rights Division (DOJ), Equal Employment Opportunity Commission (EEOC), and Consumer Financial Protection Bureau (CFPB) and the White House all have initiatives to look at the areas where their mission and span of control intersects with the use of AI. Discussions are focused on how to protect the privacy to data used in artificial intelligence models, how its use should be governed to prevent biased decisions based on flawed data that can be amplified using artificial intelligence, and the need for financial services organizations to be able to explain their use of AI clearly and completely.

Sam Altman, CEO of Open AI, in testimony to the Senate Judiciary Committee in May 2023, called for a more active participation by regulators in the U.S. to help prevent some of the more potentially damaging aspects of AI. Key areas highlighted in his testimony included:

- The U.S. government should consider a combination of licensing or registration requirements for development and release of AI models above a crucial threshold of capabilities, alongside incentives for full compliance with these requirements.
- The U.S. government should consider facilitating multi-stakeholder processes, incorporating input from a broad range of experts and organizations, that can develop and regularly update the appropriate safety standards, evaluation requirements, disclosure practices, and external validation mechanisms for AI systems subject to license or registration.
- It will be important for policymakers to consider how to implement licensing regulations on a global scale and ensure international cooperation on AI safety, including examining potential intergovernmental oversight mechanisms and standard setting.

Given the evolving nature of regulation of AI tools, it's not too early for those in financial services to begin to create internal expertise on the direction of AI regulation. Even those that aren't taking an active approach to developing these tools likely are outsourcing activity to third parties who are, and a clear understanding of where AI is being used is important and will become critical.

The following documents will provide a starting point for understanding the direction of AI regulation in the U.S. Note that this is a quickly evolving area and new proposals are published frequently and some specific to individual states or applications:

Publisher	Title/Link	Date
FTC, CFPB, CRT and EEOC	Joint Statement on Enforcement Efforts Against Discrimination and Bias in Automated Systems	April 2023
CFPB	CFPB Acts to Protect the Public from Black-Box Credit Models Using Complex Algorithms	May 2022
White House	Biden-Harris Administration Announces New Actions to Promote Responsible AI Innovation that Protects Americans' Rights and Safety	May 2023
NIST	Artificial Intelligence: The Vitals	March 2023

Conclusion

The deployment of AI in financial services will be transformative and perhaps even worthy of some of the recent hype. AI will create operating efficiencies saving time and resources and smartly capturing growth opportunities for those who deploy its power scrupulously. The inclusion of AI in financial services will be as impactful as the broad availability of the internet and mobile smart phones has been to support digital transformation.

The benefits are likely to evolve over time as there is a need to take time to thoughtfully consider the associated risks and avoid unintended consequences. AI applied without guardrails can abuse consumer and business privacy, result in false outcomes, create results that are discriminatory or illegal in other ways.

Whether AI initiatives are an internally staffed imperative, a completely outsourced activity, or something in between, bear in mind:

- Accurate, up-to-date, complete, non-siloed, share-able, and easily accessible data are critical. As financial service providers think about their uses of AI, they often begin with the exercise to ensure their data is sufficient and reliable. This often includes deploying more cloud services to house information and make it easily accessible.
- Regardless of complexity of AI models deployed, financial organizations need to understand how their models are composed so that they can be managed but also clearly disclosed to customers and regulators.
- Governance programs around AI model development and the acquisition of AI services from a third party will need to be woven into existing risk management processes.

Despite the evolving nature of AI, it's not too early to put strategies together for its expanded use with a particular focus on the regulatory trends. Like the evolution of digital banking, the use of AI will create a clear delineation between the haves and the have-nots. Those that can expertly deploy the use of AI with effective governance will be more competitive, have a lower cost structure and acquire more customers. Organizations that don't plan for the use of AI may find themselves struggling to compete with a more costly, less responsive operations environment, less effective client services, and weaker customer acquisition capabilities.

We will end this whitepaper with a disclosure that may become commonplace or even regulated some day:

AI Disclosure: The content of this paper is 99.953% human and .046% AI generated.

About the Author

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Sarah has over 25 years of executive leadership in the traditional banking, Banking-as-a-Service, payments, and fintech industries. Her background includes experience in product innovation, development and launch, plus strategic and business planning. She is a frequent participant as an industry speaker, writer, and subject matter expert with a focus on topics including debit, prepaid, ACH, real-time payments and emerging banking and payments technologies.

Appendix

1. **Artificial Intelligence** – The overarching development of machines and systems that perform intelligent behavior and would typically require human intelligence.
2. **Generative Artificial Intelligence** – A form of artificial intelligence that creates output in the form of text, images, sound, or video.
3. **Machine Learning** – A subset of artificial intelligence that focuses on the development of algorithms and models that allow systems to learn from data, making predictions or decisions without explicit programing.
4. **Algorithms** – A step-by-step procedure or set of rules followed to solve a specific problem or achieve a particular outcome in artificial intelligence and machine learning.
5. **Narrow AI** – Algorithms used in artificial intelligence designed to complete a single task.
6. **Deep Learning** – A specific type of machine learning that involves using neural networks with multiple layers allowing the model to extract complex patterns from large amounts of data automatically.
7. **Neural Networks** – Models inspired by the structure of the human brain consisting of interconnected nodes that process and transmit information.
8. **Natural Language Processing** – Artificial intelligence that uses interactions between computers and human language enabling machines to interpret and generate human language.
9. **Large Language Models** – Typically a generative artificial intelligence model that intends to understand, interact, and communicate with language in a human way.
10. **Computer Vision** – Artificial intelligence that enables machines to interpret visual information from images, including object recognition, image classification and image generation.
11. **Artificial Intelligence Training** – The process of providing additional data to an AI model and adjusting its internal parameters to learn patterns and enhance the ability to make predictions or decisions.
12. **Reinforcement Learning** – A machine learning model that enhances the model's ability to make decisions by interacting with an environment and receiving feedback through rewards or penalties.
13. **Artificial Intelligence Bias** – Unfair preferences or prejudices that artificial intelligence models may conclude from training data resulting in discriminatory outcomes.
14. **Hallucinations** – Incorrect responses from an artificial intelligence model, often a result of insufficient data or misclassification of data.
15. **Artificial General Intelligence** – The hypothetical development of artificial intelligence that can understand, learn, and perform any intellectual task like a human.
16. **Augmented Intelligence** – The combining of human intelligence with AI technology to assist humans in decision making and problem solving.