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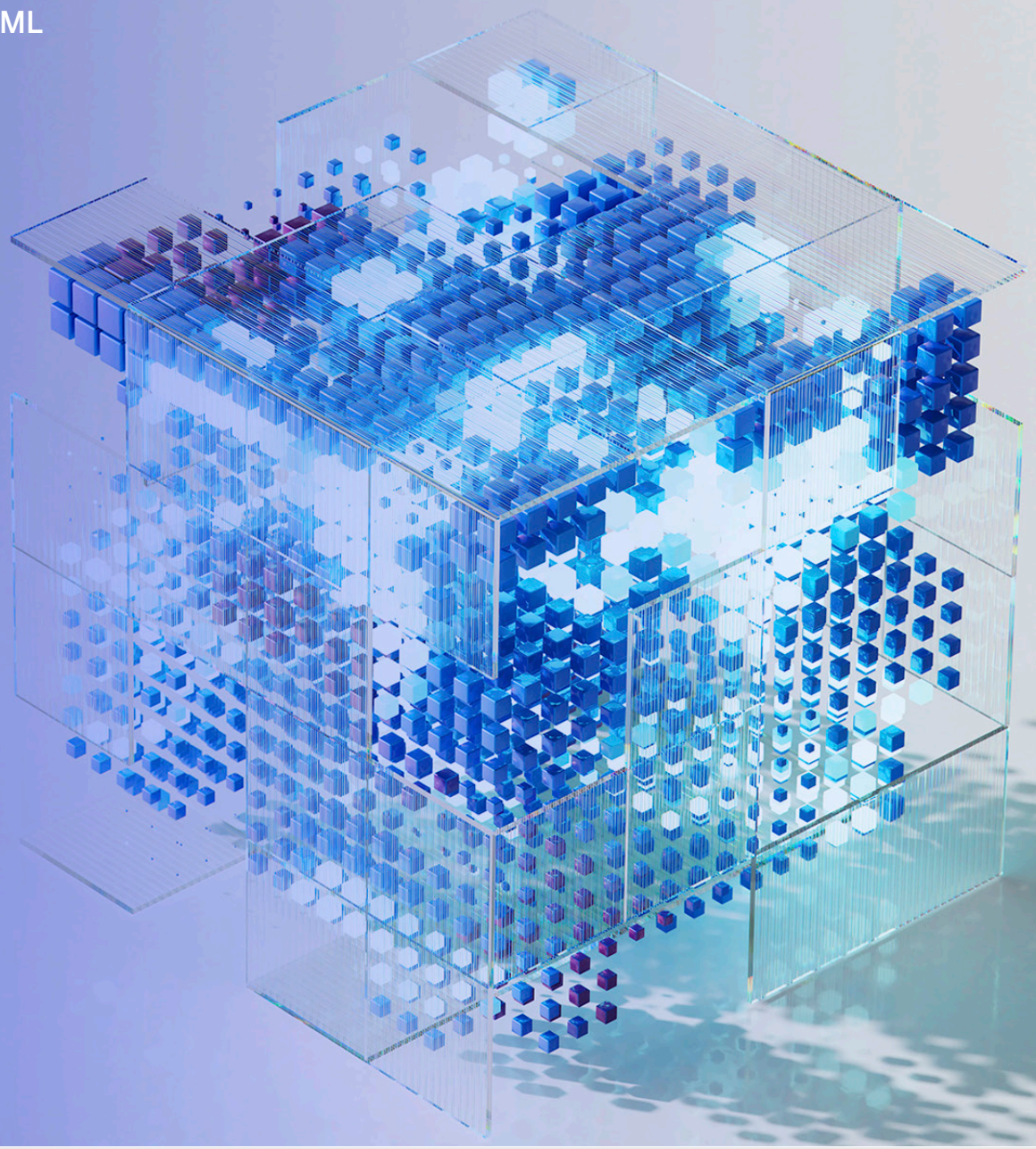
A Financial Services Executive Guide to AI and ML

Advances in AI-Powered Cloud Banking

How artificial intelligence and machine learning are reshaping banking and capital markets



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The world of financial services is rapidly evolving thanks to advancements in artificial intelligence (AI), machine learning (ML) and cloud computing. These cutting-edge technologies are revolutionizing the way financial institutions manage money — providing greater efficiency, cost-effectiveness, enhanced automation and personalized solutions for individuals and businesses alike. With the ability to analyze vast amounts of data and make complex decisions in real-time, AI-powered cloud services are transforming the way we think about money and capital management.

The AI market is poised for explosive growth in the coming years:

- The AI industry is projected to grow to $1.6 trillion by 2030 from $128 billion in 2022, with a CAGR of 37.0%, according to Market Research Future.[1]
- The global AI market is projected to expand by 37.3% year-over-year by 2030, according to Grand View Research.[2]
- Emerging technologies like generative AI, edge AI and explainable AI are expected to revolutionize various industries in 2023.
- LabLab.ai highlights that the global AI market is projected to grow at a CAGR of 11.2% from 2022 to 2023.[3]

Understanding Artificial Intelligence and Machine Learning

In this eBook, we will explore the dramatic impact of AI on financial services and banking today.

Classifications of Artificial Intelligence and Machine Learning

Let's first understand what AI and ML are, including a few of their subcategories:

> **One final investment area that I'll mention, that's core to setting Amazon up to invent in every area of our business for many decades to come, and where we're investing heavily is Large Language Models and Generative AI... Let's just say that LLMs and Generative AI are going to be a big deal for customers, our shareholders and Amazon."**
>
> — **Andy Jassy,** CEO of Amazon

- AI refers to the development of intelligent machines that can perform the sorts of complex tasks that typically require human intelligence — such as speech recognition, decision-making and problem-solving.
- ML, on the other hand, is a subset of an AI algorithm that enables machines to learn from data and improve performance over time, without being explicitly programmed.
- Deep learning, a subset of machine learning, is based on artificial neural networks with multiple layers of hidden neurons. Deep learning itself can be supervised, unsupervised or reinforcement learning.

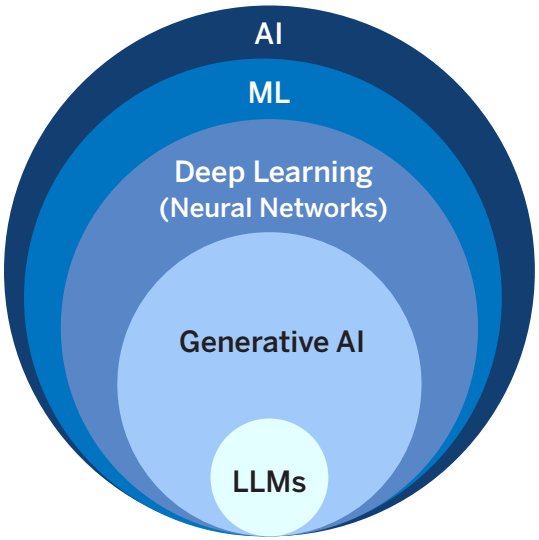
[1] www.marketresearchfuture.com/reports/artificial-intelligence-market-1139
[2] www.grandviewresearch.com/industry-analysis/artificial-intelligence-ai-market
[3] lablab.ai/blog/ai-industry-trends-in-2023

- Generative AI, a sub-specialization of AI, is capable of learning patterns in training text, images or audio, then producing new data with similar characteristics.
- Language learning models (LLMs), a type of generative AI, analyze and interpret complex human languages using natural language processing (NLP). LLMs can be applied to a broad range of operations, such as text generation, translations, summarizations, keyword extractions, and more.

The data sets used to train AI and ML models are usually categorized as the following:

- Training data
- Validation data
- Test data

Figure 1: AI and Machine Learning Classes Based on Algorithm Types

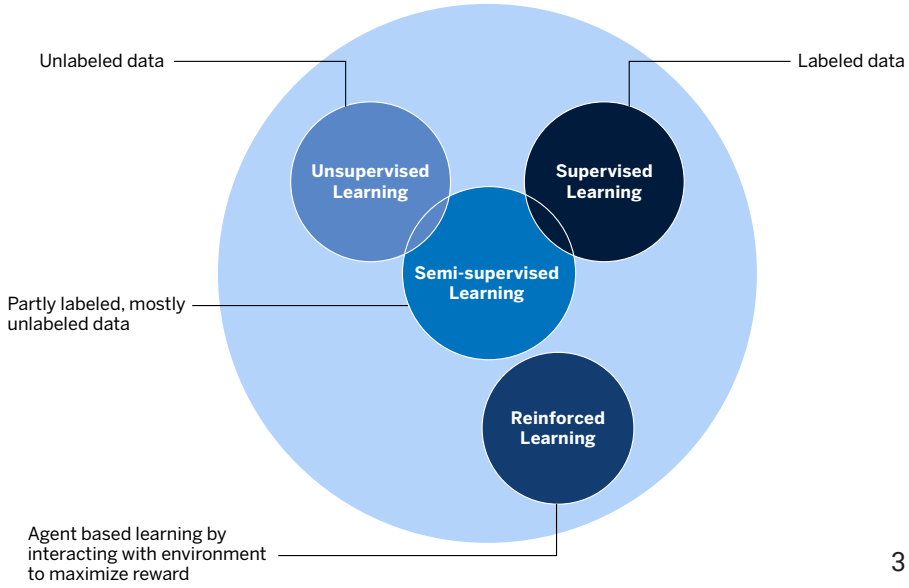


The test data set is not available to the model for learning and is used to ensure that the model generalizes well on new 'unseen' data. The validation data set on the other hand is used to measure performance and fine-tune the selected model.

Machine learning models can be classified into the following categories, according to the training method used:

- Supervised learning: Training data is labeled — for example, "good vs. bad", "true vs. false," etc.
- Unsupervised learning: Training data is not labeled, and the algorithm automatically detects patterns during the training process.
- Semi-supervised learning: In situations where large amounts of training data are not available, models can be trained using small amounts of labeled or supervised data and large amounts of unsupervised data.
- Reinforcement learning (RL): Neither supervised nor unsupervised, RL uses an intelligent agent to interact with the environment and maximizes its rewards.

Figure 2: Machine Learning Classes Based on Training Methodology



The Amazonification of Financial Services Data (Search, Shop & Ship)

"Amazonification" in the context of banking and financial services refers to the adaptation of strategies and technologies like those used by Amazon, particularly in terms of data usage, customer experience and innovation. Here are some examples of how this concept might be applied in the banking and financial sector:

Personalized Customer Experience: Just as Amazon uses customer data to personalize shopping experiences, banks can leverage data analytics to offer personalized financial products. For instance, customized loan offers, or investment advice based on a customer's spending habits and financial history.

Automated Customer Service: Implementing AI-driven chatbots and virtual assistants for customer service, much like Amazon's Alexa, to provide instant, 24/7 support for basic banking inquiries and transactions.

Advanced Data Analytics: Utilizing big data analytics for risk assessment, fraud detection and market trend analysis, similar to how Amazon uses data for market analysis and to predict consumer behavior.

Seamless Multi-Channel Services: Offering a unified experience across various platforms (mobile, online, in-branch), akin to how Amazon provides a seamless shopping experience whether on desktop, mobile, or through smart devices.

Innovative Payment Solutions: Like Amazon's one-click checkout, banks could offer streamlined, secure payment solutions that simplify transactions for users, integrating with various e-commerce platforms.

Tailored Marketing and Advertising: Using data to target potential customers with personalized marketing, much like Amazon's targeted product recommendations and advertisements based on user browsing and purchasing history.

Cloud-Based Services: Employing cloud computing for data storage and processing, enhancing scalability and operational efficiency, drawing from Amazon's expertise as a leading cloud service provider.

Data-Driven Product Development: Just as Amazon leverages customer feedback and buying patterns for product development, banks can use client data to develop or modify financial products and services to better meet customer needs.

Using Generative AI and LLMs for Reverse Engineering in Software Development

Reverse engineering in software development involves analyzing a system's components (Code) and their interrelationships to create representations of the system at a higher level of abstraction. Generative AI and LLMs can be used to reverse engineer code to generate architecture, design, data access layer, and business logic, thus future-proofing Banks and Financial Institutions. By analyzing code, AI can reconstruct system architecture diagrams, identify architectural patterns and provide guidance on decoupling monolithic services into loosely coupled microservice architectures, increasing operational efficiency and integration cost reduction. Similarly, using an application's data analysis patterns, Gen-AI can use database management tools to generate an optimal database schema. Additionally, by investigating code structure and comments, AI can decipher complex business logic and detect modules where business rules can be implemented.

Today's AI Opportunities: Current Use Cases in Financial Services

Financial institutions are increasingly leveraging AI and ML, and as a result, applications will grow further in coming years. Cloud infrastructure allows banks and financial institutions to easily scale their AI and ML capabilities based on demand, ensuring that they can handle peak loads and accommodate future growth. This minimizes the need for large upfront investments in hardware and software infrastructure, making AI and ML accessible to firms of all sizes.

As with any new technology, there are certain challenges to overcome, including data privacy and the need for robust and ethical algorithms. Nevertheless, as technology continues to advance, AI and ML are likely to play an even greater role in shaping the future of financial services. Here's a closer look at the many ways that financial institutions are already deploying and benefiting from AI and ML.

Cost Savings

The application of AI across multiple business domains can achieve significant cost savings and high operational and financial efficiency. For example, initiatives such as AI-driven product recommendations, personalized marketing campaigns, AI-enabled supply chain optimization, AI-enabled customer service, automated fraud detection and demand forecasting can help in considerable human capital savings which can then be invested in customer-centric product innovation. Not only that, for financial institutions who own their on-premises data centers (for regulatory concerns), AI can be leveraged to optimize data center cooling and energy usage, thus cutting down operational costs.

On the other hand, businesses which are partially or completely onboarded to the cloud (hybrid or public cloud infrastructure), can leverage managed services such as AWS Compute Optimizer that recommends optimal compute capacity for workloads using AI and machine learning based analytics. This mechanism can achieve an operating cost reduction of up to 25-30%.

Real World Example: Organizations are using a tool called AWS Cost Explorer to access a visual representation of current costs and usage trends and gleaning business insights to better manage future cost savings.

Risk and Compliance

Regulatory compliance and monitoring are critical areas where AI and ML are making a significant impact. The heightened regulatory environment requires banks to review and document interactions and correspondences among parties involved in transactions. Computer vision techniques that leverage AI for the interpretation of visual data help eliminate human error and collate responses through automation to meet regulatory obligations such as consent order, *matter require attention* (MRA) and *matter require immediate attention* (MRIA).

By analyzing historical data and utilizing ML algorithms, banks can identify potential risks and take proactive measures to mitigate them. The cloud provides the scalability and computing power necessary to process and analyze vast amounts of data, allowing organizations to make informed decisions in real-time and ensure compliance with regulatory requirements. This saves time and resources while reducing the risk of fines, business disruption and revenue loss from non-compliance. By automating the

compliance process, organizations have the potential to meet regulatory obligations more effectively, with less expense.

Real World Example: A leading global investment management firm and a growing discount brokerage fintech are already using AI algorithms to enhance risk management.

Consumer Credit Scoring

Currently, the sophistication of credit scoring in consumer lending varies considerably across different product lines, with many credit processes still requiring intensive manual work. Many credit risk models are relatively basic, employing only a small share of auto-decisioning. By leveraging AI and advanced analytics, consumer banking can increase the effectiveness of credit models while driving straight-through processing of new loans.

Real World Example: Financial institutions are now using AI-based credit scoring systems that consider a wide range of real-time factors, including income levels, credit history, work experience and user transaction analysis.

Asset Price Modeling

Stock and asset price prediction is an important pillar of wealth and portfolio management. Automated trading algorithms frequently leverage predictive models in high frequency trading (HFT). HFT firms can use AI to devise new trading strategies and refine existing ones based on vast amounts of market data. AI/ML advisors can also provide automated portfolio management and personalized product recommendations based on these predictions. Another example is portfolio management and trading strategy optimization. ML algorithms can constantly monitor and adjust portfolios based on market conditions, ensuring optimized returns for customers.

Real World Example: A large U.S. based brokerage firm currently leverages AI for portfolio management.

Market Analysis and Forecasting

By analyzing historical market data and utilizing ML algorithms, financial institutions can make predictions about stock prices and market trends. This helps investors make more informed decisions and maximize returns.

Real World Example: To date, an American credit card issuer has already made advancements in financial forecasting using AI.

Fraud Detection

With the scalability and computing power of the cloud, banks can analyze data at scale, detecting and preventing fraud more effectively. Suspicious activity reporting (SAR) and anomaly detection are crucial for identifying potential money laundering activities and fraudulent transactions. By leveraging AI and ML in the cloud, financial institutions can detect suspicious patterns and anomalies, improving the effectiveness of their risk management strategies. This not only saves institutions from significant financial losses but also enhances overall security and trust.

Real World Example: A global payment processing network and a leading financial holding company are already using AI-based detection to combat fraud.

Security

ML algorithms are also being used for enhancing security. Biometric verifications like voice, face and fingerprint recognition improve security in online transactions and banking operations.

Real World Example: A payment processing platform serving small- and medium-sized businesses is currently using biometric verification backed by ML algorithms.

Anti-Money Laundering (AML)

Present-day AML processes remain largely manual for many banks and financial institutions, meaning there are often challenges around poor

data quality, manual judgement-based decisioning and high rates of false positives. This field is ripe for AI-powered innovation to automate complex processes such as detecting high-velocity suspicious activities, identifying funnel account activities and routing of transfers through multiple jurisdictions. AI and ML can help identify potential money laundering activities by analyzing patterns and anomalies in financial transactions, reducing the risk of money laundering and ensuring compliance with regulations.

Real World Example: A large international bank is using an AI-powered AML system to detect suspicious activities from vast amounts of customer data, resulting in much greater accuracy and processing times that are orders of magnitude faster. This AI-powered system replaced a rule-based transaction analysis process which required manual configuration and intervention.

Improved Debt Management

Financial institutions can leverage AI/ML algorithms to easily classify debt papers into clusters based on customer characteristics. AI can be used to assess and predict the effectiveness of customer service personalization. Banks can also use ML algorithms to automate debt collection campaigns based on debtor responses to different parameters, such as time of day, channel, etc.

Real World Example: A well-known Canadian bank is using AI framework and machine learning models for underwriting, pricing, cash distribution and debt collection.

Data Analysis and Data Quality

Machine learning techniques are being used to discover deep insights from Big Data. Techniques like classification, clustering and regression help in the

discovery of good vs. bad data and can deploy automatic data correction techniques. These emerging use cases stand to be of tremendous value to financial analysts who depend on high quality data to derive insights.

Real World Example: A large multinational bank is using classification algorithms, such as random forest and gradient boosting, to distinguish between good and bad data. This, in turn, lets them train ML models with better precision and accuracy.

Process Automation

Banks and financial institutions can leverage process automation across a variety of business domains to increase productivity and reduce operational expenditure. Time-consuming tasks that are ripe for automation include input data validation, document processing and workflow orchestration.

Real World Example: A European bank has adopted robotic process automation to streamline its loan administration process, which had been largely manual, involving multiple employees spending several hours every day to complete the same task.

Personalization and Customer Experience

AI enables the design of financial products tailored to individual customer needs, such as customized advice or products based on spending habits, savings and financial goals. Robo-advisors can provide automated, data-driven advice on investing and wealth management, leveraging AI to predict which products or services customers are interested in. Optimizing marketing campaigns allows leaders to analyze market conditions, historical data and individual financial situations to provide personalized investment strategies.

Chatbots and virtual assistants are transforming the customer service experience in the financial services industry by providing personalized recommendations and financial advice. These AI- and ML-powered chatbots can analyze customer data, such as spending habits and financial goals, and offer tailored solutions in real-time. This not only improves customer satisfaction and loyalty but also streamlines the customer service process, reducing the need for human intervention.

Real World Example: One leading investment and securities firm and two of the top three U.S. global banks have successfully implemented these approaches to leverage classification and anomaly detection techniques that enhance client experiences. Currently, a leading U.S. global bank is using computer vision algorithms — a subdiscipline of AI that enables computer systems to analyze and interpret visual information — to process visual data sets and enhance operations.

Sentiment Analysis

Sentiment analysis is also being transformed by AI and ML. Financial institutions can use AI algorithms to analyze social media feeds, news articles, and customer reviews to gauge market sentiment and make informed investment decisions. This helps investors stay ahead of market trends and optimize their investment strategies.

Real World Example: A large international bank started a social media campaign to collect feedback on products such as mobile banking, branch banking, etc. Using sentiment analysis, it categorized these reviews into positive, negative and neutral, and then was able to pinpoint and act upon specific products that needed improvement.

NTT DATA's AI/ML Checklist for Banking and Financial Services

1. Data Quality and Management
Ensure that data is accurate, clean and well-organized. AI/ML models are only as good as the data they're trained on. Investing in robust data management systems is essential.

2. Identifying Key Areas for AI/ML Application
Analyze your business processes to identify where AI/ML can add the most value. This could be in enhancing customer experience, improving operational efficiency or innovating product offerings.

3. Custom AI/ML Solutions
Generic models may not fit your specific needs. Developing custom AI/ML solutions tailored to your firm's unique challenges and data can lead to better outcomes and higher monetization potential.

4. Integrating AI/ML into Existing Systems
Ensure that AI/ML solutions can be integrated smoothly with existing IT infrastructure to minimize disruption and leverage existing investments.

5. Skilled Workforce
Invest in training your workforce or hiring skilled professionals complementing banking taxonomy/domain with AI/ML competencies. Their expertise will be crucial in developing, implementing, and maintaining effective AI/ML systems.

6. Compliance and Ethics
Ensure that use of AI/ML complies with relevant laws and regulations. Also, consider the ethical implications of using AI/ML, especially in terms of data privacy and bias.

NTT DATA Achieves AWS Mainframe Migration Software Competency

NTT DATA is the second company globally to hold both AWS Services and Software competencies for Mainframe Modernization with AWS. With more than 30 years of production application experience and more than 1,300 implementations worldwide, NTT DATA's UniKix Mainframe Re-hosting services and software help businesses reduce the costs and complexities associated with migrating legacy systems and applications. Re-hosting with UniKix allows businesses to maintain a competitive advantage by keeping pace with evolving business needs, while extending the life of mission-critical workloads.

Learn more about NTT DATA's AWS Mainframe Migration Competency

7. Continuous Learning and Improvement
AI/ML models should continuously learn and improve from new data. Establishing mechanisms for ongoing training and model refinement is critical.

8. Partnerships and Collaborations
Partnering with AI/ML experts, universities, or technology providers can enhance your capabilities and open new avenues for monetization.

9. Measuring ROI
Develop clear metrics to measure the return on investment of AI/ML initiatives. This helps in assessing their effectiveness and guiding future investments.

10. Customer-Centric Approaches
Use AI/ML to gain deeper insights into customer behavior and preferences, enabling personalized services and products — these can lead to increased customer satisfaction and revenue.

11. Diversification of Revenue Streams
Explore how AI/ML can open new revenue streams, such as through predictive analytics services or enhanced data-driven products.

Resources for Financial Institutions Starting Their AI Journey

Leading cloud providers and hyper-scalers like Amazon Web Services (AWS), have extensive AI- and ML-based offerings for banking modernization. Here's a closer look at Amazon's suite of key technologies that financial institutions can choose for their AI transformation.

- *Amazon SageMaker*: A fully-managed environment for data scientists and developers to test, train and deploy ML models. Users can create endpoints for inference and integrate with other services to store data and results. Banks can also leverage a vast selection of Jumpstart-trained models that are available within Sagemaker for one-click deployment.
- *Amazon Comprehend*: A natural-language processing (NLP) service that uses machine learning to analyze textual data for sentiment analysis, document classification and extracting valuable insights from unstructured data. This allows banks to derive deep insights from text data.
- *Amazon Lex*: A service for building conversational interfaces like chatbots using voice and text. Lex V2 provides the deep functionality and flexibility of natural language understanding (NLU) and automatic speech recognition (ASR) so banks can build highly engaging user experiences with life-like, conversational interactions and create new categories of products.
- *Amazon Fraud Detector*: A fully-managed fraud detection service that automates the detection of potentially fraudulent online activities, such as unauthorized transactions or the creation of fake accounts.
- *Amazon Bedrock*: This service makes a range of foundation models from Amazon and other AI companies accessible through an API.

It can be used by data scientists and analysts who want more control over their model environment. Capabilities include text and image generation apps, chat playground and a library of use cases available to load.

- *Amazon Kendra*: An intelligent enterprise search service that uses NLP and advanced ML algorithms to return specific answers to search questions. Financial institutions can use it to add search capabilities to their applications for both internal- and external-facing FAQs.
- *Amazon Personalize*: Banks can use this fully-managed ML service to generate personalized recommendations for customers based on their data. Other use cases include creating personalized emails, targeted marketing campaigns and real-time next best action recommendations.
- *Amazon Rekognition*: An image and video analysis tool which uses computer vision and ML techniques to be able to identify objects, people, text, as well as facial analysis and search. Financial services use cases could include Know Your Customer (KYC) procedures and document verification through scanning.
- *Amazon Textract*: This ML service automatically extracts text, handwriting, layout elements, and data from scanned documents for faster and more accurate processing. With its Analyze Lending API, lenders can automate the classification of loan documents and then route the classified pages to the proper analysis operation for further steps.
- *Amazon Polly*: This cloud service converts text into lifelike speech in multiple languages and voices. Polly's text-to-speech is based on NLP and can be applied effectively to interactive voice response (IVR) systems for better customer support management.

Overcoming Challenges of Bias, Harm and Environmental Impact in AI and ML Implementation

Data Privacy and Bias

Implementing AI and ML in financial applications comes with its fair share of challenges. As AI technologies advance, there is always the critical need to protect data privacy, ensure ethical AI practices and address the potential for bias. Banks and financial institutions are rightfully concerned about developing robust frameworks and algorithms that prioritize fairness, transparency and accountability. Another risk is catastrophic forgetting, in which Generative-AI models at times forget previously learned information when new data is introduced, leading to inaccurate results. To overcome this, continuous learning and adaptation of models are necessary to ensure they remain accurate and up to date.

Energy Demands

Further, the energy demand for AI infrastructure is significant and can contribute to environmental concerns. Cost and performance implications are important factors to consider. Training AI models can be resource intensive, requiring large amounts of computing power and storage. Implementing AI in the cloud can mitigate these challenges by providing scalable infrastructure and reducing upfront costs. However, financial institutions must carefully manage cloud resources to optimize costs and ensure high-performance AI models.

Regulatory Challenges

Financial institutions, as always, must comply with government regulations and ensure they have robust data governance and security measures in place. Data privacy and security regulations, such as the General Data Protection Regulation (GDPR) and Payment Card Industry Security Standards Council (PCI SS) can impact the collection, storage, and use of data in AI systems.

Financial institutions must always consider the interpretability of AI models, meaning they need to be able to explain the reasoning behind AI-driven decisions, especially when it comes to compliance and regulatory requirements. Explainable AI techniques address this challenge by providing transparency around how AI models arrive at their decisions.

Overcoming the challenges of emerging technologies requires collaboration between financial institutions, technology providers and regulators. All stakeholders must prioritize ethics, invest in robust training methodologies, optimize cost and performance and adhere to government regulations. By addressing these challenges head-on, organizations can fully harness the power of AI in cloud financial services and drive innovation in the industry.

Future Perspectives: What's Next for AI and ML in Cloud Financial Services

In coming years, the integration of AI and ML with cloud computing will continue to reshape the financial services industry. Some of the most promising developments on the horizon are in the areas of customer engagement and blockchain integration. Financial institutions that focus on these areas for AI and ML implementation can effectively monetize their data, leading to enhanced competitiveness and profitability.

Customer Engagement

With the rise of digital banking and online financial services, institutions are constantly seeking to enhance customer experiences and provide personalized solutions. AI-powered chatbots and virtual assistants have already made significant strides in this area, but we can expect these virtual assistants to improve in sophistication — for example, using NLP and deep learning to understand customer preferences and tailor financial advice. Additionally, voice-activated AI assistants may become more prevalent, allowing customers to interact with financial institutions in a more intuitive and convenient way.

Blockchain Integration

The integration of AI and ML with blockchain technology holds immense potential for financial services. Blockchain technology offers secure, transparent, and decentralized solutions for various financial transactions, such as payments, remittances, and identity verification. By combining AI and ML with blockchain, organizations can enhance security, reduce fraud, and streamline processes. For example, AI algorithms can be used to detect and prevent fraudulent transactions on the blockchain, while ML models can analyze patterns in transaction data to identify potential risks.

This combination of technologies has the potential to revolutionize financial transactions, making them more efficient, secure, and accessible.

Key Takeaways

1. Explosive Growth in AI Market:

- The AI industry is projected to reach $1.6 trillion by 2030 from $128 billion in 2022 (CAGR of 37.0%).
- The Global AI market is expected to expand by 37.3% YoY by 2030.
- Emerging technologies like generative AI, edge AI and explainable AI will revolutionize all industries by 2023.

2. Understanding AI and ML:

- AI involves developing intelligent machines for complex tasks; ML is a subset learning from data.
- Deep learning, generative AI, and language learning models (LLMs) are sub-specializations.
- Classification of AI and ML models is based on training methodology: supervised, unsupervised, semi-supervised, reinforcement learning.

3. Amazonification of Financial Services Data:

- Banks are adopting the application of Amazon-like strategies for data usage, customer experience, and innovation.
- Examples include personalized customer experience, AI-driven chatbots, advanced data analytics, and cloud-based services.

4. AI Opportunities in Financial Services Today:

- Financial executives can implement AI/ML applications across various domains for cost savings, risk and compliance, consumer credit scoring, asset price modeling, market analysis, fraud detection, security, AML, debt management, data analysis, process automation, personalization, and customer experience.

5. AI/ML Checklist:

- Emphasizes data quality, identifying key AI/ML application areas, custom solutions, integration, skilled workforce, compliance, continuous learning, partnerships, measuring ROI, customer-centric approaches, and diversification of revenue streams.

6. Resources for Financial Institutions:

- Leading cloud providers offer AI/ML solutions: Amazon SageMaker, Comprehend, Lex, Fraud Detector, Bedrock, Kendra, Personalize, Rekognition, Textract, Polly.

7. Challenges in AI and ML Implementation:

- Data privacy, bias, and ethical concerns.
- Energy demands of AI infrastructure and environmental impact.
- Regulatory challenges, interpretability and explainability of AI models.

8. Future Perspectives for AI and ML in Cloud Financial Services:

- The continued integration of AI/ML with cloud computing reshaping the industry.
- There are promising developments happening in customer engagement with advanced virtual assistants using NLP and deep learning.
- Financial executives will rely on blockchain integration with AI and ML for enhanced security, reduced fraud and streamlined financial transactions.

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NTT DATA

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Our strategy for present-and-future-proof banking is known as Banking 4^x. Banking 4^x focuses on four pillars: experience, efficiency, exponential value, and end-to-end coverage. Our key capabilities center on digitizing the core, optimizing new product and platform launches, monetizing enterprise data, modernizing operating models, and accelerating innovation to transform the enterprise, while developing hyper personalized customer experiences. Banking & Financial Services Consulting Practice