Artificial Intelligence and Machine Learning

Description

Rather than serving as a replacement for human intelligence and ingenuity, Artificial Intelligence (AI) is generally seen as a supporting tool. AI is proficient at processing and analyzing large amounts of data, discovering patterns, developing insights and identifying relationships not readily observable by humans. AI software and systems can then return with prioritized courses of action and present them to the human user. In this way, humans can use artificial intelligence to "game out" the possible consequences of each action while accelerating and improving the quality of the decision-making process. These AI-enabled capabilities are making descriptive, predictive and prescriptive analytics a more tangible reality in the business world. These enhanced analytics capabilities make artificial intelligence a highly valuable technology across many industries.

Major Vendors:

MATLAB

Open Source Programming Languages R and Python

Google Cloud AI / TensorFlow / AutoML

Azure Machine Learning Studio

IBM Watson Studio / Machine Learning

AWS SageMaker

SAS Enterprise Miner

Rapid Miner

In a business setting, some examples of the application of AI would include:

- Business process automation: specifically serve as an adjunct to robotic process automation (e.g., to infer human responses to business activities and tasks based on prior actions)
- Reduction of operating costs: intelligent call routing in contact centers based on previous customer interactions, chatbots to address routing customer queries, predictive maintenance to reduce unplanned equipment downtime, enhanced customer demand forecasting to reduce inventory levels and related working capital
- Increase revenue: early discovery of customer purchase patterns and trends that improve conversion (e.g., from prospect to order), classification of micro customer personas with unique but unmet demands (e.g., refurbishable prosthetics for disabled veterans) or identification of new sources of revenue (e.g. niche, but growing source of consumer spend)

It is important to note that Artificial Intelligence, Machine Learning, Deep Learning, Natural Language Processing and Understanding, are terms often used interchangeably, but in fact, they are different in their algorithms, models, objectives and approaches.

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Machine Learning

Machine learning (ML) is a subset of artificial intelligence (AI) that enables predictions (outcomes) to be made from data (inputs). ML uses mathematical algorithms and statistical models to analyze and draw inferences from patterns of data. These predictions or inferences can and do change over time as the data changes, hence the "learning" in machine learning. ML can be further divided into three categories of learning: supervised, unsupervised and reinforcement. In supervised learning, the algorithms are provided with a set of training data extracted from a larger data set. The training data describes both the data inputs and related outputs so that the inputs can be mapped to specific outputs. In unsupervised learning, no guidance is given as to the inputs and expected outputs. The algorithms discover the inherent and often non-obvious relationships between the data. Finally, in reinforcement learning, the algorithms use data, determine its relationship to a desired set of outcomes (rewards) and try to optimize the outcomes.

Deep Learning

Deep Learning (DL) is a subset of ML which uses neural networks to analyze different factors with a structure that resembles that of the human neural system. DL is very good at analyzing large amounts of structure and unstructured data to solve complex problems. In fact, deep artificial neural networks are a set of algorithms that are uniquely able to address complex problems, such as image recognition, sound recognition, recommender systems, natural language processing, language translation, etc.

Application

Marketing

AI tools are used to enhance the effectiveness of the marketing message, timing and channels based on customer context (e.g., demographic, past purchases) and preferences (e.g., clicks through ads on Facebook).

- Marketing analytics: AI solutions used to track media activity and provide insights to highlight which channels and which messages are driving customer engagement, traffic, conversion and revenue. As a result, companies can improve the return on their marketing investment.

- Personalized Marketing: Companies can target marketing campaigns with more precision based on individual customer insights. This allows companies to personalize the value proposition to individual customers based on both explicit and implicit preferences with the support of AI-enabled models and algorithms.

- Context-Aware Marketing: Tools like machine vision and natural language processing (NLP) can be leveraged to understand the context where ads will be served. With context-aware advertising, companies can ensure brand protection and increase marketing efficiency by confirming that the message fits its context, making static images on the web very relevant.

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Sales

Pre-Sales

- Sales Forecasting: AI allows automatic and accurate sales forecasts based on all customer contacts across multiple channels (e.g., web, voice, chat, email, etc.) and previous sales outcomes.

- Lead generation: Comprehensive data profiling of site visitors to identify which prospects the sales reps need to contact. Generate leads for sales reps leveraging databases and social networks.

Sales Conversion

- Sales Data Input Automation: Data from various sales activities can be effortlessly and intelligently copied into the company's CRM application. This will result in better sales visibility and analytics while allowing more time for sales activities.

- Predictive sales/lead scoring: Artificial Intelligence helps score leads to prioritize sales force actions. Sales forecasting is automated with increased accuracy based on lead scores and sales rep performance.

- Sales Rep Chat/ Email Bot: Chatbots can be used as resources to answer customer questions 24/7 and support the conversion of initial contacts to leads. High value, responsive leads can be followed up immediately by sales agents, increasing sales effectiveness and conversion rates.

- Retail Sales Bot: Bots can also be used on the retail floor to answer customer's questions and promote products. Computer vision can recommend appropriate actions based on the visual characteristics and actions of the customer.

- Sales Rep Augmented Solutions

  o Response Suggestions: AI can suggest responses during live conversations or written messages with leads. Bots will listen in on agents' calls suggesting best practice answers to improve sales effectiveness.

  o Next Action Suggestions: Sales reps' actions and leads will be analyzed to suggest the next best action. Situational solutions help representatives find the right way to deal with customer questions and issues.

- Sales Content Personalization and Analytics: Customer preferences and browsing behavior of high priority segment leads are analyzed to match them with the right content. Recommendation engines are an example of this application.

- Prescriptive Sales: Prescriptive sales systems prescribe the content, interaction channel, frequency and price based on data on similar customers.

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Sales Analytics

Sales analytic systems provide functionality that support the discovery, diagnostic and pre-diction of sales outcomes and make recommendations to improve sales effectiveness by indicating which sales activities are the most impactful.

- Customer Sales Contact Analytics: Analyze all customer contacts, including phone calls or emails, to understand what behaviors and actions drive sales. Derive insights (e.g., senti-ment analysis) using voice-to-text translation of customer conversations.

- Sales attribution: Analyze marketing campaigns and sales activities to determine which efforts improve customer conversion rates.

- Sales Compensation: Determine the right compensation levels for sales personnel. Decide on the right incentive mechanism for the sales representatives.

Business Analytics

Generalist solutions

- Analytics Platform: Empower employees with insights on business, department and individual performance to quickly identify problems, opportunities, trends, etc. that can be used to inform and change employee behavior.

- Automated Machine Learning: Machines helping data scientists optimize machine learning models. AutoML provides guidance on a mix of algorithms (i.e., ensembles) that improve the accuracy of outcomes.

Specialized solutions

- Geo-Analytics Platform: Enables analysis of granular satellite imagery for predictions related to weather, agriculture, land usage, resource conservation, mining, petroleum, etc.

- Conversational Analytics: Discovers insights based on human-to-human conversational interactions using AI-based tools like natural language processing and natural language understanding.

- Image Recognition and Visual Analytics: Analyze visual data with advanced image and video recognition systems.

- E-Commerce Analytics: Specialized analytics designed to deal with the explosion of e-commerce data. These usually serve to optimize the sales funnel and customer traffic to maximize profits.

Finance and FinTech

- Fraud Detection: Leverage machine learning to detect fraudulent and abnormal financial behavior. Use AI to improve regulatory compliance. Lower operational costs by limiting exposure to fraudulent activities.

- •Insurance & InsurTech: Leverage machine learning to quote optimal prices, manage claims effectively, and improve customer satisfaction while reducing costs. Define customer's risk profile and recommend the appropriate insurance products.

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- Financial Analytics Platform: Leverage machine learning, natural language processing, and other AI techniques for financial analysis, algorithmic trading and other investment strategies and tools.

- Travel & Expense Management: Use deep learning to improve data extraction from receipts of all types including hotel, gas station, taxi, grocery purchases. Use anomaly detection and other approaches to identify fraud and non-compliant spending. Improve the productivity of expense report review and approval process.

- Credit Lending and Scoring: Use of predictive models to uncover potentially non-performing loans and act upon results. See the potential credit scores of customers before they apply for a loan and provide custom-tailored plans.

- Billing: Utilize ML to identify customers at risk of non-payment or delayed payments. Encourage customers to pay. Increase loan recovery ratios.

- Robo-Advisory: Use AI chatbots and mobile app assistant applications to monitor personal finances.

- Regulatory Compliance: Use computer vision and natural language processing to quickly scan legal and regulatory text for compliance issues. Process thousands of financial transactions to identify regulatory compliance issues and challenges.

- Data Gathering: Use AI to efficiently gather external data such as customer sentiment and other market-related data. Analyze data for enhancing financial models and trading approaches.

- Debt Collection: Leverage AI to ensure a compliant and efficient debt collection process. Effectively handle disputes and improve debt collection.

Customer Solutions

- Social Listening and Ticketing: Leverage natural language processing and machine vision to identify customers to contact and respond to them automatically or assign them to relevant agents, increasing customer satisfaction. Use the data available in social networks to uncover whom to sell and what to sell.

- Intelligent Call Routing: Route calls to most capable agents available. Intelligent routing systems incorporate data from all customer interactions optimizing customer satisfaction and increasing net promoter scores.

- Call Classification: Leverage natural language processing to understand what the customer is trying to achieve enabling agents to focus on higher value-added activities. Before channeling the call, detect the nature of customers' needs and forward call to the appropriate department.

- Voice Authentication: Authenticate customers without passwords by leveraging biometry (voice signature) to improve customer satisfaction and reduce issues related to forgotten passwords.

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- Call Intent Discovery: Leverage natural language processing and machine learning to estimate and manage customer's intent to improve customer satisfaction. Sentiment analysis is done through the customer's voice level, pitch and words used (via voice-to-text conversion). Used to detect the micro-emotions that drive the decision-making process.

- Customer Service Response Suggestions: Bots will listen in on agents' calls suggesting best practice answers to improve customer satisfaction and standardize customer experience. These methods can be used to Increase upsells and cross-sells by providing the right suggestion.

- Chatbot: Chatbots can understand more complicated queries as AI algorithms improve. Thus, businesses understand their customers intentions since chatbots collect information from customers while interacting with them and spot certain clues. There are other benefits like 24/7 availability and reduced costs, as bots can handle more tasks as they learn more.

- Customer Service Chatbot (Self – Service Solution): Implementation of 24/7 functioning, intelligent, self-improving chatbots to handle most queries and transfer customers to live agents when needed. Reduce customer service costs and increase customer satisfaction. Reduce the number of calls managed by customer service representatives and make them focus on specific needs of your customers.

- Call Analytics: Advanced analytics using call center data can uncover insights to improve customer satisfaction and increase efficiency.

- Survey & Review Analytics: Leverage natural language processing to analyze text fields in surveys and reviews to uncover insights to improve customer satisfaction. Automate the process by mapping keywords to scores.

- Customer Contact Analytics: Advanced analytics on all customer contact data to uncover insights to improve customer satisfaction and increase efficiency. Utilize natural language processing for higher customer satisfaction rates.

- Chatbot Analytics: Analyze how customers are interacting with chatbots. See the overall performance of chatbots. Pinpoint its shortcomings and improve chatbot performance. Detect the overall satisfaction rate of customer with chatbot interaction.

- Chatbot Testing: Semi-automated and automated testing frameworks facilitate bot testing. Simulate the performance of your chatbot before deploying. Prevent catastrophic chatbot failures.

Operations

- Robotic Process Automation (RPA): Automate user interface system tasks in weeks without replacing legacy systems, which can take years. Bots can operate on legacy systems learning from user actions. Increase productivity, accuracy, compliance and quality through the deployment of RPA bots.

- Predictive Maintenance: Monitor critical equipment operation and predict failures (via vibrational analysis, oil conductivity, heat, etc.) in order to perform maintenance before equipment failures. Improve equipment uptime and reliability.

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- Manufacturing Analytics: Also called industrial analytics systems, these systems enable analysis of manufacturing process from production to logistics to save time, reduce cost, and increase efficiency.

- Inventory & Supply Chain Optimization: Leverage machine learning to optimize inventory and improve supply chain management. Visualize possible scenarios regarding swings in customer demands and the impact on fulfillment ratios and time. Reduce stock and maximize inventory turnover ratios.

- Collaborative Robot: "Cobots" provide a flexible method for automation. Cobots are flexible robots that learn by mimicking human workers' behavior. Smart engineering systems for solutions still requiring human oversight.

- Cashier less Checkout: Self-checkout that allow retail companies to serve customers in their physical stores without the need for cashiers. AI is underpinning these systems by leveraging advanced sensors to identify purchased merchandise and charge customers automatically.

- Invoicing: Invoicing is a highly repetitive process that many companies perform manually. This results in human errors and high costs in terms of time, especially when a high volume of documents needs to be processed. Thus, companies can process these repetitive tasks with AI, automate invoicing procedures, and save significant time while reducing invoicing errors.

Some application examples courtesy of AI Multiple

How To Get Started

Launching a machine learning project can be a daunting task. Although the approach varies greatly based on the nature of the problem, the type and quality of the data and the applicability of machine learning as a tool to provide insights, the following provides high level guidance on what steps are involved in a machine learning project.

- Define the Problem or Opportunity:
  o What is the problem or opportunity?
  o Why does this problem need to be solved or opportunity to be pursued?
  o How would you solve this problem manually?

- Prepare the Data:
  o Select the data – structured, unstructured, identify outliers
  o Preprocess the data – format, clean up, determine data sample (supervised learning)
  o Transform the data – scale, decompose, aggregate
  o Discover features

- Identify Appropriate Algorithms to Use:
  o Evaluate pros and cons of several algorithms to identify which will provide the most accurate outcomes
  o Spot check the algorithms for accuracy and appropriateness

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- Validate Results:
  - Tune algorithms using parameters to prevent under and over fitting
  - Utilize ensemble methods for algorithms to aggregate predictions to improve accuracy
  - Pursue feature engineering to reduce dependencies (e.g. covariance) and non-linear relationships within the data
- Present Results:
  - Provide the context for the machine learning initiative (i.e., define problem and/or opportunity)
  - Report on the approach used (which algorithms and why) to develop the outcomes
  - Present findings/discoveries with a link to the initial problem definition or opportunity
  - Describe limitations which addresses where the model/s worked, didn't work and why

Our Services

Business Agility	Digital Transformation	Customer Experience
Advanced Analytics	Artificial Intelligence	IT Performance Improvement
Technology Architecture	Interim CIO, CDO & CTO	Critical Initiative Leadership

About Cimphoni

Cimphoni is built on the premise that technology, when properly applied and led, can deliver innovative solutions that transform businesses. The Cimphoni team is comprised of technology, operations and business consultants with a thirst for innovation and a passion for leveraging emerging technologies to deliver exceptional, measurable results for our clients. Founded in 2012, Cimphoni serves customers throughout the United States from its headquarters in suburban Milwaukee. More information can be found at cimphoni.com

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