Applying AI — Techniques and Infrastructure

Published 26 July 2021 - ID G00745079 - 7 min read

By Analyst(s): Farhan Choudhary, Bern Elliot

Initiatives: Artificial Intelligence

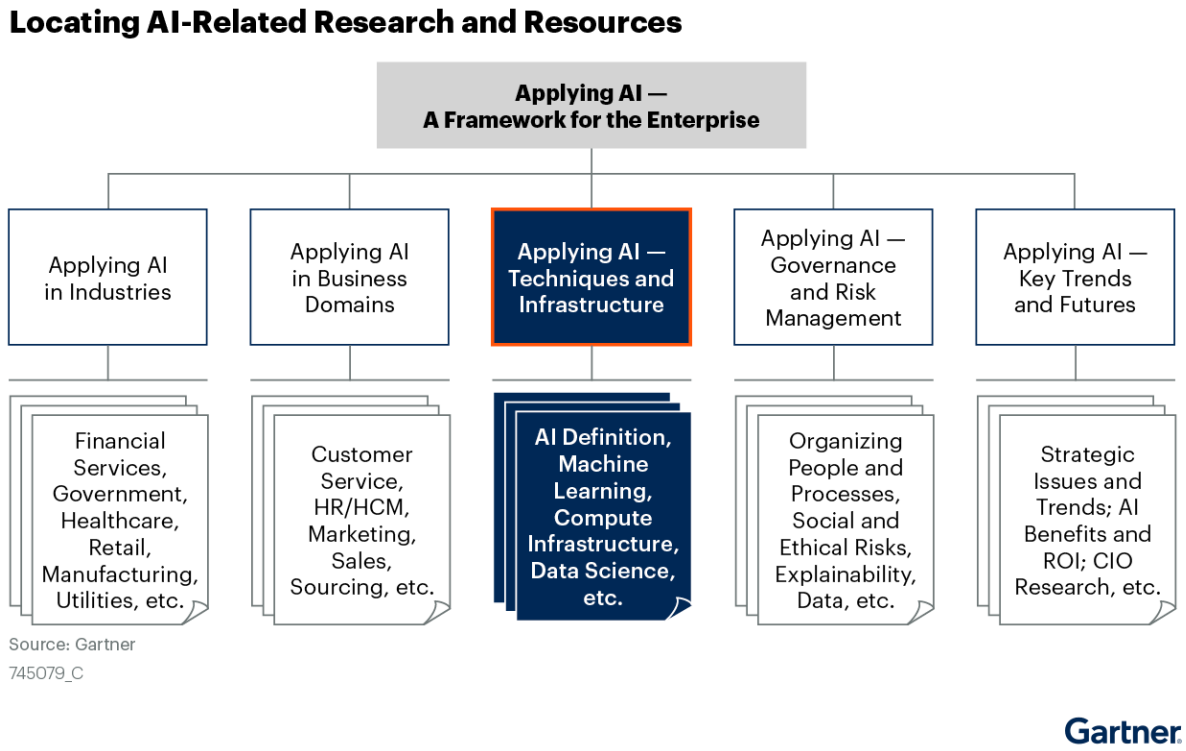
The discipline of AI consists of a broad range of techniques and capabilities. These include, but are not limited to algorithms, data management and AI engineering. This report provides an overview of Gartner's AI-related research and coverage relevant to AI techniques, technologies, capabilities and infrastructure.

Analysis

Artificial intelligence (AI) is a part of over 50 separate research areas within Gartner. To make research and resources easier to locate, Gartner divides this broad topic into the research areas below. The top-level document is called Applying AI — A Framework for the Enterprise.

This report focuses on AI techniques and infrastructure.

Figure 1: Locating AI-Related Research and Resources



The links below take you directly to the documents outlined in Figure 1.

- Applying AI in Industries describes where and how AI is applied in industries such as financial services, healthcare, retail, manufacturing and government.
- Applying AI in Business Domains describes where and how AI is applied within business domains and enterprise departments, such as customer service, HR, marketing and sales.
- **Applying AI — Techniques and Infrastructure** (this document) includes the fundamental techniques and practices that comprise AI and AI engineering.
- Applying AI — Governance and Risk Management includes strategies and methods related to transparency, interpretability, ethics, privacy and security issues. It also addresses personnel and skills development, staffing, developing AI centers of excellence, and defining the ROI for AI projects.
- Applying AI — Key Trends and Futures focuses on the key trends and the future of AI, both in terms of strategic emerging technologies and key skills and governance options. It includes a focus on CIO and CTO executive priorities.

In the following sections, we provide an overview of Gartner's written and analyst resources related to the following AI techniques and infrastructure:

Research Highlights

Some recommended content may not be available as part of your current Gartner subscription.

AI Definition

Back to top

Gartner defines AI as a discipline that applies advanced analysis and logic-based techniques, including machine learning, to interpret events, support and automate decisions, and take actions.

The term "AI" has evolved over the years, along with the underlying technologies. Examples of current, more-advanced forms of AI include deep learning or deep neural networks (DNN), ambient intelligence, symbolic reasoning, knowledge representation, and the allied areas of natural language technologies (NLT) and computer vision (CV). However, many valuable and useful technologies and techniques that were once closely associated with AI are now taken for granted. For instance, machine learning using regression or decision trees. However those established methods remain part of the AI toolset.

Analyst resources: Whit Andrews, Mike Rollings, Bern Elliot

Research resources:

- Artificial Intelligence Primer for 2021
- Artificial Intelligence Maturity Model

- Magic Quadrant for Cloud AI Developer Services

App Dev, DevOps, ITOps, and Enterprise Architecture

Back to top

AI is influencing how applications and enterprise architectures are evolving. DevOps has matured into a legitimate form of engineering, with many methods and tools that support it. Likewise, technical professionals have adopted a more pragmatic approach to AI. While many feel that DevOps and AI don't interoperate well, technical professionals are finding that DevOps and AI are powerful, complementary tools with a mutually beneficial relationship toward delivering IT solutions. Application architects and developers must determine how to access and integrate the power of ML into the applications and solutions they are delivering.

Analyst Resources:

- DevOps — Manjunath Bhat, Jim Scheibmeir, Joachin Hershmann, Thomas Murphy
- ITOps — Gregory Murray, Pankaj Prasad, Padraig Byrne
- Enterprise architecture — Dixie John, Avivah Litan, Kaitlynn Sommers, Ranadip Chandra

Research resources:

- Infographic: Top 10 Technology Trends Impacting DevOps
- Predicts 2021: Artificial Intelligence in Enterprise Applications

Machine Learning

Back to top

Formally defined, machine learning (ML) is a technical discipline that aims to extract knowledge or patterns from a series of observations. Deep learning is a variant of machine learning algorithms that use multiple layers to solve problems through extraction of knowledge from raw data and transforming it at every level.

Analyst resources: Pieter den Hamer, Erick Brethenoux, Jim Hare, Carlie Idione, Alexander Linden, Svetlana Sicular, Farhan Choudhary, Chirag Dekate, Soyeb Barot, Sumit Agarwal, Georgia O'Callaghan, Shubhangi Vashisth, Afraz Jaffri

Research resources:

- Magic Quadrant for Data Science and Machine Learning Platforms
- Magic Quadrant for Cloud AI Developer Services
- Emerging Technologies: Neuromorphic Computing Impacts Artificial Intelligence Solutions
- Innovation Tech Insight for Deep Learning

AI Engineering

Back to top

IT leaders struggle to integrate AI within applications, wasting time and money on AI projects that are never put in production. AI engineering brings together many disciplines to tame the AI hype, while providing a clear path to value when operationalizing MLOps and ModelOps, the combination of multiple AI techniques.

Analyst resources: Erick Brethenoux, Soyeb Barot, Chirag Dekate, Farhan Choudhary, Sumit Agarwal, Shubhangi Vashishth, Pieter den Hamer, Robert Thanaraj, Georgia O'Callaghan

Research resources:

- Top Strategic Technology Trends for 2021: AI Engineering
- Demystifying XOps: DataOps, MLOps, ModelOps, AIOps and Platform Ops for AI
- Operational AI Requires Data Engineering, DataOps and Data-AI Role Alignment
- Five Steps to Practically Implement AI Techniques

Compute Infrastructure

Back to top

A critical element of success of machine learning is the speed, scalability and workload affinity of the underlying compute infrastructure which is also evolving rapidly. Along with the rise of Edge computing — which places content, data and processing closer to the applications, things and users that consume and interact with them — the infrastructure needed to construct these applications are changing.

Analyst resources: Arun Chandrasekaran, Chirag Dekate, Martin Reyolds, Pieter den Hamer, Erick Brethenoux, Alan Priestley, Bob Gill

Research resources:

- 2021 Strategic Roadmap for Edge Computing
- Hype Cycle for Compute Infrastructure, 2021
- 2020 Strategic Roadmap for Compute Infrastructure

Natural Language Technology

Back to top

Natural language technology (NLT) enables intuitive forms of communication between humans and systems, as well as the analysis of the contents of communications. NLT encompasses the broad areas of natural language processing (NLP), natural language understanding (NLU), natural language generation (NLG), text analytics, dialogue systems, language knowledge graphs, machine translation, text summarization, speech-to-text, text-to-speech, chatbots, virtual assistants and others.

Analyst resources: Anthony Mullen, Magnus Revang, Van Baker, Stephen Emmott, Erick Brethenoux, Svetlana Sicular, Jessika Ekholm, Martin Reynolds, Shubhangi Vashisth, Soyeb Barot, Annette Jump, Bern Elliot, Farhan Choudhary.

Research resources:

- Hype Cycle for Natural Language Technologies, 2021
- 2021 Strategic Roadmap for Enterprise AI: Natural Language Architecture
- Architecture of Conversational AI Platforms

- Craft a Chatbot Initiative Based on Your Business Requirements and Solution Complexity

Computer Vision

Back to top

Computer vision provides the opportunity to connect artificial intelligence (AI) tools to physical environments by helping everything from robots to mapping software make use of visual information. Computer vision is used in diverse areas and industries — supply chain, defense and intelligence, healthcare, robotics, mining, security and others.

Analyst resources: Nick Ingelbretch, Tracy Tsai, Tuong Nguyen, Shubhangi Vashisth, Farhan Choudhary

Research resources:

- Emerging Technologies: Tech Innovators for Computer Vision
- Venture Capital Growth Insights: Computer Vision
- Market Insight: How Sensors Drive New Interactions in the Future Connected Home

Data Science

Back to top

Data Science is a multidisciplinary field aimed at extracting insights, enabling review and exploration of structured or unstructured data through processes, tools and various techniques leveraging machine learning techniques (among others) to produce insights.

Analyst resources: Carlie Idoine, Jim Hare, Alexander Linden, Peter Krensky, Pieter den Hamer, Shubhangi Vashisth, Erick Brethenoux, Farhan Choudhary, Afraz Jaffri, Svetlana Sicular

Research resources:

- Trends in Data Science and Machine Learning Talent
- Staffing Data Science Teams: Mapping Capabilities to Key Roles

- How Augmented DSML Makes Data Science Projects More Efficient

Data for AI

Back to top

Accessing, exploring and managing data in AI workflows has been an ever-demanding concern. With the advent of DataOps that aims to address inefficiencies in the data handling process — while also overcoming change management concerns — organizations now understand that AI and ML requires a robust data engineering and management practice. Several techniques embracing small and wide data approaches (i.e., zero, one, few and end-shot learning), synthetic data and augmented data preparation keep coming up in our conversations.

Analyst resources: Robert Thanaraj, Pieter den Hamer, Erick Brethenoux, Nick Heudecker, Ted Friedman, Alan Dayley, Anthony Mullen, Alexander Linden, Jim Hare, Afraz Jaffri, Ehtisham Zaidi

Research resources:

- Operational AI Requires Data Engineering, DataOps and Data-AI Role Alignment
- Data and Analytics Essentials: DataOps
- Introducing DataOps Into Your Data Management Discipline
- 3 Ways to Deliver Customer Value Faster Using DataOps

Analytics and Business Intelligence

Back to top

Analytics has emerged as a catch-all term for a variety of different business intelligence (BI) and application-related initiatives. BI is an umbrella term that includes the applications, infrastructure and tools, and best practices that enable access to and analysis of information to improve and optimize decisions, enable decision support and performance. Analytics and BI are characterized by easy-to-use functionality that supports a full analytic workflow, with an emphasis on self-service usage and augmented user to enable us with better decision making in the simplest way possible.

Analyst resources: James Richardson, Austin Kronz, Rita Sallam, Gareth Herschel, Julian Sun, Kurt Schlegel, Afraz Jaffri, Carlie Idoine, Alan Duncan

Research resources:

- Magic Quadrant for Analytics and Business Intelligence Platforms
- Top Trends in Data and Analytics for 2021
- Hype Cycle for Analytics and Business Intelligence, 2021

Recommended by the Authors

Some documents may not be available as part of your current Gartner subscription.

Uncovering Artificial Intelligence Business Opportunities in Over 20 Industries and Business Domains

Understanding MLOps to Operationalize Machine Learning Projects

Cool Vendors in AI Core Technologies

- AI Definition
- App Dev, DevOps, ITOps, and Enterprise Architecture
- Machine Learning
- Compute Infrastructure
- Natural Language Technology
- AI Engineering
- Computer Vision
- Data Science
- Data for AI
- Analytics and Business Intelligence