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INSIGHTS

Machine Learning

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Introduction

- **Machine Learning ("ML") and Artificial Intelligence ("AI")** have generated tons of excitement and buzz in the marketplace, based on the promise of self-correcting algorithms driving increased intelligence and automation across a number of mission critical applications and use cases

- While there is real innovation and traction occurring in ML, in some cases it is **difficult to understand** where certain companies **truly play in the ML ecosystem** and the unique value that each brings to the table – this presentation aims to provide a framework to understand the ML landscape

- First we explore Machine Learning technology, both the underlying algorithms as well as **data science platforms, operational frameworks and advanced analytics solutions** which leverage and / or optimize core ML technologies

- We also take a look at selected **vertical application players** that leverage Machine Learning, which are often gaining traction faster than horizontal technologies, as there can be a sharper value proposition and path to market where customers can clearly understand the benefits / use cases associated with ML

- **Horizontal platforms** which can provide data science frameworks and / or advanced analytics solutions across a number of verticals, as well as the underlying software platforms to ingest and clean data feeds, test and QA models, and train new models, may take longer to gain traction, but could ultimately represent the most valuable opportunities in the space
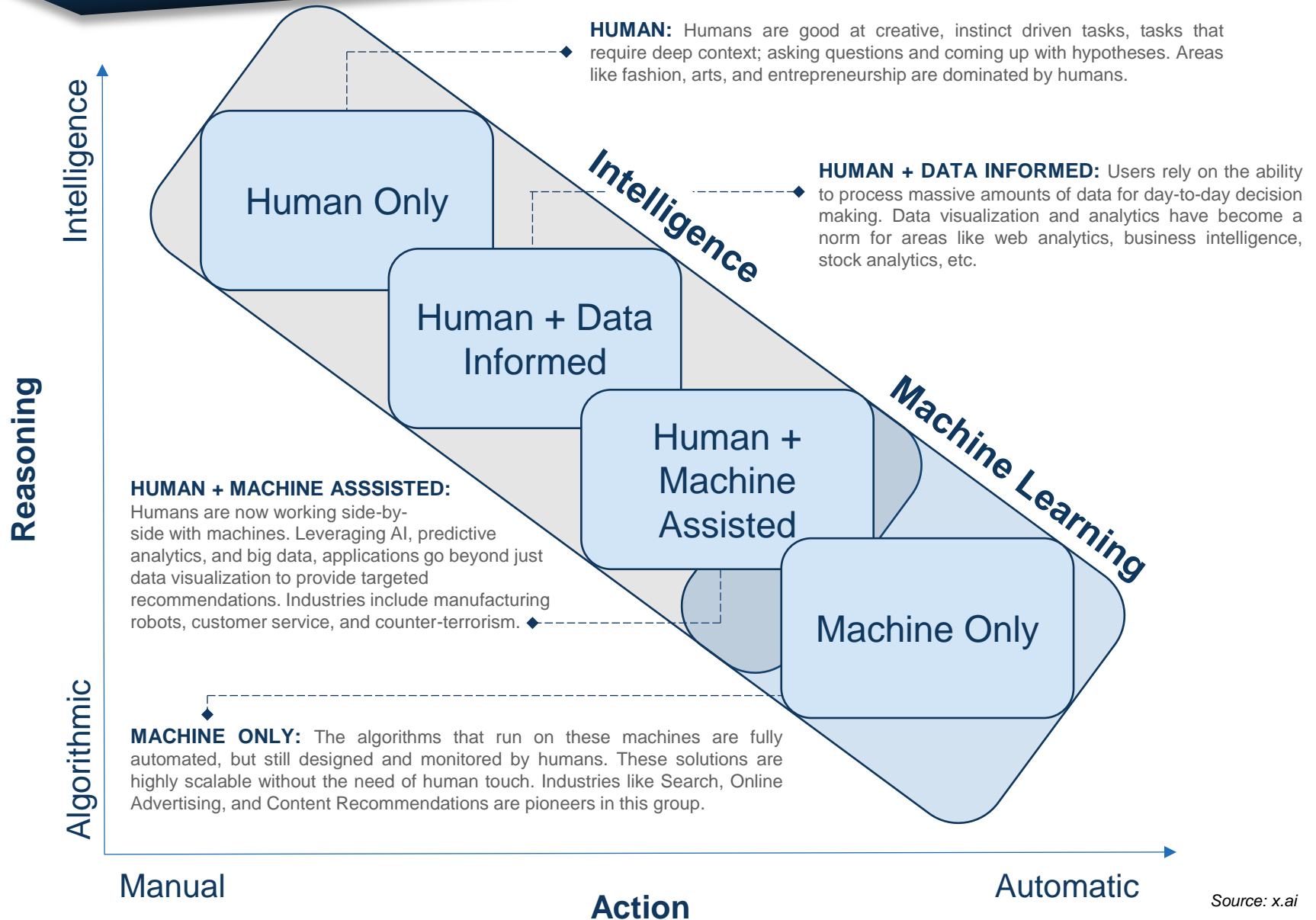
Source: AGC Partners

Predictive Analytics and Machine Learning (PAML) provide the platform and tools to build and deploy predictive models using statistical algorithms

› *Artificial Intelligence:* the ability of machines to perform tasks that require human intelligence (e.g., visual perception, speech recognition, decision-making, translation)

› *Cognitive Computing:* the simulation of human thought processes in a computerized model through self-learning systems that mimic the way the human brain works (e.g., data mining, pattern recognition and natural language processing)

› *Machine Learning:* a subset of AI techniques which use statistical methods to automate the ability of a system to iteratively learn from data and extract insights without being explicitly programmed through algorithms

› *Deep Learning:* a branch of Machine Learning that data scientists use to build models based on artificial neural networks (good for image recognition, etc.)

Artificial Intelligence

Machine Learning

$f(x)$

Deep Learning
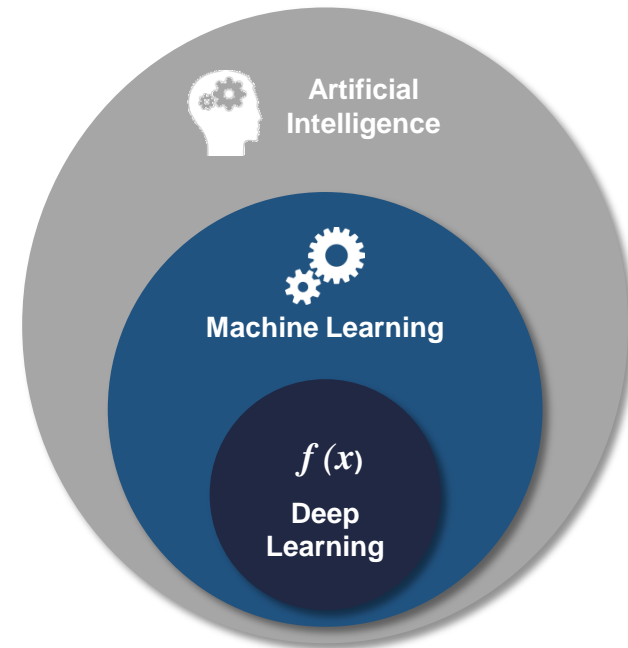
Machine Learning is based on algorithms that can learn from data without relying on rules-based programming

Source: McKinsey & Company, Forrester, IBM, SAS

Path to Machine Learning

HUMAN: Humans are good at creative, instinct driven tasks, tasks that require deep context; asking questions and coming up with hypotheses. Areas like fashion, arts, and entrepreneurship are dominated by humans.

HUMAN + DATA INFORMED: Users rely on the ability to process massive amounts of data for day-to-day decision making. Data visualization and analytics have become a norm for areas like web analytics, business intelligence, stock analytics, etc.

HUMAN + MACHINE ASSSISTED: Humans are now working side-by-side with machines. Leveraging AI, predictive analytics, and big data, applications go beyond just data visualization to provide targeted recommendations. Industries include manufacturing robots, customer service, and counter-terrorism.

MACHINE ONLY: The algorithms that run on these machines are fully automated, but still designed and monitored by humans. These solutions are highly scalable without the need of human touch. Industries like Search, Online Advertising, and Content Recommendations are pioneers in this group.

Human Only

Human + Data Informed

Human + Machine Assisted

Machine Only

Intelligence

Machine Learning

Intelligence

Reasoning

Algorithmic

Manual

Automatic

Action

Source: x.ai

Machine Learning Market Opportunity

- More than 50% of enterprise IT organizations are experimenting with Artificial Intelligence in various forms such as Machine Learning, Deep Learning, Artificial Neural Networks, and more

- The Artificial Intelligence (AI) market is forecasted to reach over $50 billion in the next five years, growing at a CAGR of 56% from 2016 to 2022

- The market for Machine Learning as a Service ("MLaaS") is estimated to grow from $613 million in 2016 to $3.8 billion by 2021, at a CAGR of 43.7%

- The increasing demand for Machine Learning is being driven by a number of trends, including the ongoing data explosion, the rapid adoption of cloud, mobile & IoT technologies and strong need for deep and predictive intelligence

  › The unimaginable volume and complexity of the big data that the world is now "swimming in" has increased both the potential of Machine Learning and the need for it

  › The movement of applications and infrastructure into the Cloud (where lots of data also resides) provides a strong platform for the development of ML frameworks and applications, while the proliferation of mobile & IoT devices allows that data to be created, accessed and processed at the edge

Artificial Intelligence Market

($B)

Machine Learning as a Service Market

($B)
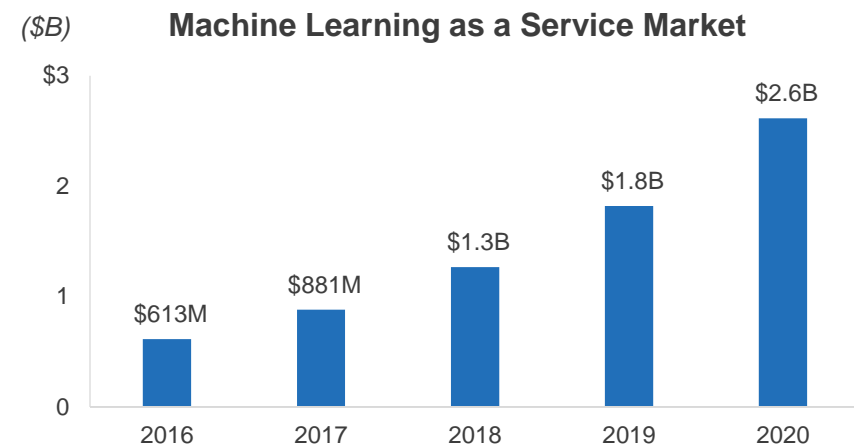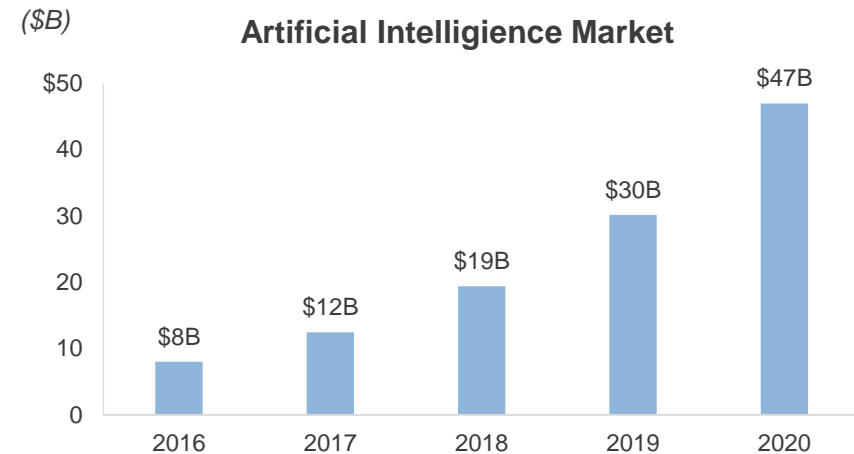
Source: MarketsandMarkets, Statistica, IDC

Machine Learning in the Business World

"Any organization that is not a math house now or is unable to become one soon is already a legacy company." – Ram Charan

- The competitive advantage gained from business models turbocharged by Machine Learning has the potential to grow exponentially

- C-level executives will best exploit Machine Learning if they see it as a tool to craft and implement a strategic vision
  - › Without strategy as a starting point, Machine Learning risks becoming a tool buried inside a company's routine operations: it will provide a useful service, but its long-term value will probably be limited to an endless repetition of "cookie cutter" applications

- Companies must have two types of people to unleash the potential of Machine Learning:
  - › "Quants" who are schooled in its language and methods
  - › "Translators" can bridge the disciplines of data, Machine Learning, and decision making by re-framing the quants' complex results as actionable insights that generalist managers can execute

- There's a much more urgent need to embrace the prediction stage, which is arguably happening right now
  - › Today's cutting-edge technology already allows businesses not only to look at their historical data but also to predict behavior or outcomes in the future

Source: McKinsey & Company

Machine Learning Methods

Two of the most widely adopted Machine Learning methods are **supervised learning** and **unsupervised learning** – while other forms are also emerging

- Supervised learning
  - › The algorithm is trained by receiving a set of inputs along with the corresponding correct outputs; it modifies its model until the actual output equals the correct outputs
  - › Commonly used where historical data predicts future events, e.g., predicting fraud

- Unsupervised learning
  - › The algorithm must explore data and find some structure within; the system is not shown the "right answer"
  - › Works well on transactional data, e.g., identifying similar segments of customers for marketing campaigns

- Semi-supervised learning
  - › The algorithm receives some labeled data (i.e., correct answers) as training and a large amount of unlabeled data
  - › Useful when the cost of fully-labeled data is too high, e.g., identifying a person's face on a web cam

- Reinforcement learning
  - › The algorithm discovers through trial and error which actions yield the greatest rewards over a given amount of time
  - › Often used for robotics, gaming, and navigation

Source: SAS

Machine Learning Technology Landscape

Data Science Platforms

ALGORITHMIA · Alpine DATA LABS · bigml · BONSAI AI · CONTINUUM ANALYTICS · CrowdFlower · DataRobot · data iku · DATASCIENCE.COM · DOMINO · H2O.ai · kaggle · nervana SYSTEMS · Numenta · rapidminer · PETUUM · sqlstream · seldon · SIGOPT · yhat · yseop

ML-Based Advanced Analytics

Angoss Predict. Act. Perform. · ARIMO · AYASDI · Cerebri · CognitiveScale · Dataminr · Digital Reasoning · Lattice · loop ai Labs · SI SCALED INFERENCE · sparkcognition · SPARKBEYOND · sentient technologies · Voyager Labs · Wave Computing · YOTTAMINE ANALYTICS

Open Source-Focused Vendors / Platforms

ActiveState · BONSAI AI · confluent · CONTINUUM ANALYTICS · databricks · H2O.ai · Open for Innovation KNIME · Numenta · rapidminer · skymind

Streaming Analytics / Data Integration

algebraixdata · ADEPTIA · alteryx · ATTIVIO · CASK · confluent · dataArtisans · DATALOGUE · DATASIFT · DATATORRENT · DATAWATCH · diffbot · EsperTech · Flowthings.io · import io · Keen IO · MAGNITUDE SOFTWARE · PEAXY · Paxata · parsehub · snapLogic · sqlstream · STREAMANALYTIX · StreamSets · striim · tamr · TRIFACTA · WorkFusion

Cloud Platform Players

Apple · amazon · CISCO · facebook · Google · Microsoft · ORACLE · rackspace · SAP · salesforce

Broader BI / Big Data Analytics Platforms

ClearStory DATA · DOMO · GoodData · Information Builders · IBM SPSS COGNOS · Logi ANALYTICS · looker · Microsoft · MicroStrategy · OPENTEXT · ORACLE | Hyperion · Palantir · Qlik · SAS · software AG · sumologic · tableau · TIBCO · ZOOMDATA

Technology Landscape Definitions

Data Science Platforms

- Data science platforms are generally frameworks and tools for bringing data pipelines / ML algorithms into production apps
- Leverage heavy ML expertise and IP but are generally agnostic to specific types of analytics and the resulting applications

ML-Based Advanced Analytics

- Predictive analytics and other categories of advanced analytics use sophisticated quantitative methods to produce insights above and beyond traditional query and reporting
- Generally offer specific types of analytics solutions across a targeted range of verticals

Open Source-Focused Vendors / Platforms

- Vendors adding value or commercial support on top of specific open source platform
- Often developed in a collaborative and public manner, which generates a more diverse design perspective and evolution of the core platforms

Streaming Analytics / Data Integration

- Data integration involves preparing, normalizing and transforming data across disparate sources on-premise or in the Cloud
- These solutions allow ML and analytics solutions to be more effective out of the box

Cloud Platform Players

- Manage the infrastructure and platforms required to support the complete lifecycle of building and delivering analytics applications
- Many have launched or are developing ML solutions which can run in their Cloud platforms

Broader BI / Big Data Analytics Platforms

- These vendors are more established providers of data processing, analytics, and presentation of business information
- Many of these players have leveraged ML technologies over time and should continue to develop and acquire ML-related offerings going forward

Data Analytics vs. Data Science

Data analytics and data science are two separate but interconnected disciplines:

- Data analytics provides observations into issues that we either know we know, or know we don't know

  - › Descriptive analytics quantitatively describes the main features of a collection of data

  - › Predictive analytics, that focus on correlative analysis, predicts relationships between known random variables or sets of data in order to identify how an event will occur in the future

- Data Science provides strategic actionable insights where we don't know what we don't know

  - › Predictive causal analytics precisely identifies the cause for an event

  - › Prescriptive analytics couples decision science to predictive capabilities in order to identify actionable outcomes that directly impact a desired goal

	Data Analytics	Data Science	
"Machine Learning 1.0" Descriptive	75%	25%	Knowing What We Know
Predictive (Correlation)	75%	25%	
"Machine Learning 2.0" Predictive (Causation)	25%	75%	Knowing What We Don't Know
Prescriptive	0%	100%	
"Machine Learning 3.0" Machine Learning	0%	100%	Not Knowing What We Don't Know

Legend: ○ 0% Effort | ◔ 25% Effort | ◕ 75% Effort | ● 100% Effort

Source: Data Scientist Insights, McKinsey

Data Science and Analytics: Select Company Case Studies

Data Science	Data Science	Data Science	Advanced Analytics	Advanced Analytics
DataRobot	**bigml**	**rapidminer**	**AYASDI**	**Cerebri ≥**
Founded: 2012	**Founded:** 2011	**Founded:** 2007	**Founded:** 2008	**Founded:** 2015
HQ: Boston, MA	**HQ:** Corvallis, OR	**HQ:** Boston, MA	**HQ:** Menlo Park, CA	**HQ:** Austin, TX
Employees: 220	**Employees:** 50	**Employees:** 100	**Employees:** 130	**Employees:** 20
Invested Capital: $111M	**Invested Capital:** $2M	**Invested Capital:** $36M	**Invested Capital:** $106M	**Invested Capital:** $1.4M
Description: DataRobot offers a Machine Learning platform for data scientists of all skill levels to build and deploy accurate predictive models. The Company's technology addresses the critical shortage of data scientists by changing the speed and economics of predictive analytics.	**Description:** BigML has pioneered the Machine Learning as a Service (MLaaS) wave of innovation through its consumable, programmable, and scalable software platform streamlining the creation and deployment of smart applications powered by state-of-the-art predictive models.	**Description:** RapidMiner provides enterprises with predictive analytics in any business process, closing the loop between insight and action. The Company's solution makes predictive analytics lightning-fast for today's modern analysts, radically reducing the time to unearth opportunities and risks.	**Description:** Ayasdi Care is an advanced analytics company that offers a machine intelligence platform and intelligent applications. The Company enables its users to solve their big data and complex data analytics challenges and to automate formerly manual processes using their own unique data.	**Description:** Cerebri provides enterprise software and Machine Learning models developed for production in enterprise grade software infrastructure. Cerebri offers real-time data inputs and Machine Learning models in a multi-model setup for enterprise class service: production, failover, QA, and learning models, all running simultaneously. Cerebri focuses on customer retention and acquisition, across multiple global Fortune 500 companies.

Technology: Fundamental Analytics Tools

- **SAS is the traditional market leader in the commercial data analytics space**
  - › Software suite that captures, stores, modifies, analyzes and presents data; offers statistical functions and a GUI for more rapid learning and query language similar to SQL
  - › Popular in academics and research, as well as the corporate world

- **R is an open-source interpreted programming language and software environment for statistical computing and graphics**
  - › Open-source counterpart of SAS, making its way into the business world via growing support and incorporation into commercial BI software
  - › Easily extensible, with an active community contributing functions and extensions
  - › Can produce publication-quality graphics, including mathematical symbols

- **Python is a versatile open-source interpreted language, known for its simplicity and clarity**
  - › Widely used in web development and scientific computing, it has grown to incorporate libraries and functions for a vast array of statistical operations
  - › R functionality can be accessed from Python scripts, but Python is a general-purpose language
  - › Popular in operations on structured data

- **Apache Spark is an open-source, primarily in-memory cluster computing platform**
  - › Spark provides an interface for programming entire clusters with implicit data parallelism and fault-tolerance; developed in response to limitations in the MapReduce paradigm
  - › Employs a data structure called the resilient distributed dataset (RDD), useful in iterative algorithms that continually query a dataset (e.g., training algorithms), as opposed to MapReduce which forces a linear "split-apply-combine" strategy

- **TensorFlow is an open-source software library for numerical computation using data flow graphs**
  - › Originally developed by researchers and engineers working on the Google Brain Team for the purposes of conducting Machine Learning and deep neural networks research, but now applicable in a wide variety of other domains

- There is a wide range of open source Machine Learning frameworks available in the market
  - › Some of the most popular are displayed to the right
- Apache Spark serves as the basis for many open source implementations
  - › Spark ML, a set of Machine Learning libraries that data scientists are increasingly interested in using, is deployed on top of Spark
  - › Most PAML vendors have moved from a Hadoop strategy for analyzing big data to an Apache Spark strategy because of the available Machine Learning libraries and speed of in-memory processing
  - › In addition to Spark ML, other machine libraries such as H2O.ai's Sparkling Water and IBM's SystemML run on Spark
  - › RapidMiner provides an integrated environment for Machine Learning, data mining, text mining, predictive analytics and business analytics

Project	Description
Apache Singa	Provides a simple programming model and works across a cluster of machines. It is primarily used in natural language processing (NLP) and image recognition.
Shogun	Toolbox of algorithms and data structures designed for unified large-scale learning for a broad range of feature types and learning settings, like classification, regression, dimensionality reduction, clustering, etc.
Apache Mahout	Provides Java libraries and Java collections for various kinds of mathematical operations. Implemented on top of Apache Hadoop using the MapReduce paradigm.
Apache Spark MLlib	Distributed Machine Learning framework on top of the Spark Core. Due to the distributed memory-based Spark architecture, is almost nine times as fast as the disk-based implementation used by Apache Mahout.
TensorFlow	Developed by the Google Brain Team for various sorts of perceptual and language understanding tasks, and to conduct sophisticated research on Machine Learning and deep neural networks.
Oryx 2	Realization of Lambda architecture built on Apache Spark and Apache Kafka for real-time large scale Machine Learning. It is designed for building applications.
Accord.NET	Framework for scientific computing, and consists of multiple libraries for diverse applications like statistical data processing, pattern recognition, linear algebra, artificial neural networks, image and signal processing, etc.
Amazon Machine Learning (AML)	Machine Learning service for developers. It has many visualization tools and wizards for creating high-end sophisticated and intelligent Machine Learning models without any need to learn complex ML algorithms and technologies.

Source: Forrester, OpenSource.com

Technology: Open Source Vendors

- Open-source Machine Learning engines are becoming increasingly pervasive

  › Commercial software vendors are already responding to this challenge in different ways, typically focusing on the top of the stack (the end user experience), while the middle and bottom of the analytics stack increasingly becomes open source

  › Many Machine Learning frameworks are using Open Source Platforms for data stream mining and to deploy computation

- In addition to specialized vendors offering commercial support, many large tech companies are investing in, or acquiring, open source products and services

  › Turi, which has promoted open-source GraphLab, was acquired by Apple; PredictionIO was acquired by Salesforce; in 2015, Microsoft acquired Revolution Analytics; SAP acquired Hadoop-as-a-service startup Altiscale

  › IBM has become a major player in the world of Hadoop projects with more than 100 Hadoop deployments, and many customers with petabytes worth of data

  › Microsoft's public cloud Windows Azure's HDInsight product is a Hadoop as a service offering based on Hortonworks' distribution of the platform but specifically designed to run on Azure

Representative Companies

Confluent designs and develops a real-time data platform for organizations. It offers Apache Kafka, an open source technology that operates as a scalable messaging system and is used for collecting user activity data, logs, application metrics, stock ticker data, and device instrumentation. Confluent was incorporated in 2014 and is based in Mountain View, California.

Databricks provides a cloud platform that helps traditional and disruptive organizations to turn data into value. It offers Databricks, a just-in-time data platform that is used for simplifying data integration, real-time experimentation, and robust deployment of production applications for developers and data scientists. The Company was incorporated in 2013 and is based in San Francisco, California.

Continuum Analytics provides a subscription based data analytics platform that helps companies to adopt open data science analytics architecture. The Company offers Anaconda, an open data science platform that connects expertise and curiosity with data to explore and deploy analytic applications to solve problems. Continuum Analytics was founded in 2011 and is headquartered in Austin, Texas.

Technology: Key Platform Players

- Many large tech companies see cognitive technologies as a way to reinvent themselves to more effectively compete in the future – essentially, as a basis for business model transformation
  - › In January 2014, IBM invested $1 billion to launch the IBM Watson Group business unit; of this $1 billion, $100 million was earmarked as an investment fund to support its Watson Developers Cloud ecosystem
  - › In March 2017, IBM and Salesforce announced plans to offer integrated AI services that weave IBM's Watson capabilities with Salesforce's more sales-oriented Einstein technology
- Cognitive technology development platforms
  - › Intel's RealSense Technology Platform for development of "perceptual computing," i.e., gesture, touch, voice, and other sensory technologies
  - › Nvidia's Digits 2 and CUDA Deep Neural Network for GPU-accelerated Deep Learning, reportedly doubling performance for data scientists and researchers
- Cognitive technology PaaS
  - › AWS Machine Learning automates many of the labor-intensive steps in statistics and data analysis and reduces their complexity, making Machine Learning more accessible to software developers
  - › Microsoft Azure Machine Learning incorporates the open-source R programming language, providing an advanced analytics service for rapid application development
- Other vertical solutions
  - › HPE's Haven Predictive Analytics for IT operations
  - › SalesforceIQ, Oracle Social Cloud and Pegasystems' Pega 7 for social CRM
  - › Cisco's Cognitive Threat Analytics for advanced network security

Technology: Data Integration

Machine Learning solutions are more effective with high quality and fully integrated data, which often resides in disparate silos in an organization. The value of analyzing an integrated data set is often greater than the sum of the parts of analyzing each silo alone

There are two aspects of data integration relevant to Machine Learning:

- › The traditional definition of data integration: combining data from disparate sources into a single view, for use in Machine Learning applications
- › Using Machine Learning to automate the more labor-intensive, time-consuming, and error-prone tasks in the data integration process

- By automatically learning mappings between data sources, Machine Learning can eliminate much of the effort involved in building data integration applications

- › After a subset of data sources has been manually mapped to a mediated schema, Machine Learning programs propose mappings to subsequent data sources

- Data pipelines can be used to feed and train Machine Learning algorithms

- › As opposed to batch-oriented processing strategies typical of ETL tools and frameworks, data pipelines incorporate a series of elaborate data processing steps into a near-realtime stream

Representative Companies

TRIFACTA

Trifacta develops and provides data wrangling solutions for business, IT, and data analysts in the United States and internationally. The Company offers Wrangler, a solution for the preparation of data on desktop for analytic uses, Wrangler Enterprise that enables analysts to explore and transform data in Hadoop without writing code, and Wrangler Edge that addresses the data preparation challenges, including wrangling data sources outside of a Hadoop data lake. The Company was incorporated in 2012 and is based in San Francisco, California.

tamr

Tamr designs and develops a commercial-grade solution to tackle the challenge of connecting and enriching data. The Company offers Tamr, an enterprise data preparation platform that combines Machine Learning and data science with collective human insight to identify internal and external data sources, understand relationships, and curate siloed data at scale. The Company was incorporated in 2012 and is based in Cambridge, MA.

Technology: Traditional BI

Machine Learning seeks to transform BI into a system that helps leaders make their business decisions, rather than simply reporting on what happened in the past

- Advanced, predictive analytics are about calculating trends and future possibilities, predicting potential outcomes and making recommendations
  - › This requires more sophisticated methods like statistics, descriptive and predictive data mining, Machine Learning, simulation and optimization that look for trends and patterns in the data

- The process to achieve business automation may take several iterations to achieve
  - › The first phase is not just understanding what happened, but why it happened, e.g., understanding why sales went down in the last quarter
  - › The next phase is being able to make predictions, e.g., based on the current sales forecast, the business might not make its target for the month
  - › The final phase is recommendation and decision automation, e.g., the system automatically predicts the business might miss its sales forecast, and suggests running promotions ahead of schedule

- Machine Learning is not (yet) the silver bullet for BI, and adoption may be determined more by organizational and cultural forces than by technical factors
  - › Because it is based on algorithms that learn from data rather than relying on rules-based programming, effective Machine Learning is dependent on relevant and reliable data – and lots of it
  - › Machine Learning is ultimately guided by human decision making – humans will decide what problems the technology will be used to solve, humans will develop the algorithms to employ, and humans don't necessarily operate on logic

Source: CIO Magazine, Digitalist/SAP, Microsoft

Case Study: IBM Watson

IBM Watson Machine Learning is a full-service Bluemix offering that makes it easy for developers and data scientists to work together to integrate predictive capabilities with their applications

- Built on IBM's proven SPSS analytics platform, IBM Watson's Machine Learning allows users to develop applications that make smarter decisions, solve tough problems, and improve user outcomes

- IBM Watson Products:
  - › *Watson Discovery:* a cognitive search and content analytics engine that helps developers extract value from unstructured data by converting, normalizing and enriching the data to find hidden patterns and answers, enabling better decisions across teams

  - › *Watson Conversation:* leverages a visual dialog builder to create natural conversations between apps and users, allowing users to quickly build, test and deploy bots or virtual agents across mobile devices, messaging platforms or even on a physical robot

  - › *Watson Virtual Agent:* offers a cognitive, conversational self-service experience that can provide answers and take action using pre-built content to quickly configure virtual agents with company information engage with customers in a conversational, personalized manner, on any channel

  - › *Watson Knowledge Studio:* cloud-based application that enables developers and domain experts to collaborate and create custom annotator components for unique industries. These annotators can identify mentions and relationships in unstructured data and be easily administered throughout their lifecycle using one common tool

Source: IBM

Case Study: Amazon
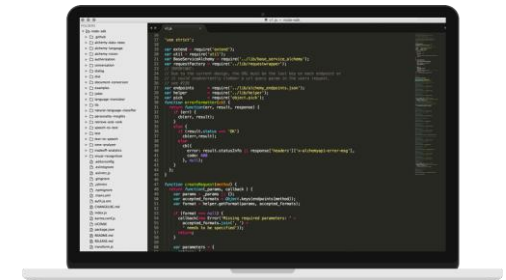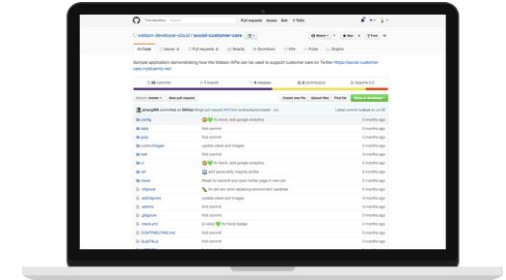
- Amazon provides a managed service for building ML models and generating predictions, enabling the development of robust, scalable smart applications. Amazon Machine Learning provides users with access to powerful Machine Learning technology without requiring an extensive background in Machine Learning algorithms and techniques.

- The process of building ML models with Amazon Machine Learning consists of three operations: data analysis, model training, and evaluation:
  - › Data analysis: computes and visualizes data distribution, and suggests transformations that optimize the model training process
  - › Model training: finds and stores the predictive patterns within the transformed data
  - › Evaluation: evaluates the model for accuracy

- Amazon Machine Learning combines powerful Machine Learning algorithms with interactive visual tools to guide users to easily create, evaluate, and deploy Machine Learning models. Its built-in data transformations ensure that input datasets can be seamlessly transformed to maximize the model's predictive quality. Once a model is built, the service's intuitive model evaluation and fine-tuning console help users understand its strengths and weaknesses, and adjust its performance to meet business objectives.

Data Visualization And Exploration

- High-quality data is critical to building accurate predictive models, but real world datasets are frequently incomplete or inconsistent
- AML provides interactive charts to visualize, explore, and understand data content and distribution and spot missing or incorrect data attributes

Machine Learning Algorithms

- Uses scalable and robust implementations of industry-standard ML algorithms
- Developers can create models that predict values of binary attributes (binary classification), categorical attributes (multi-class classification), or numeric attributes (regression)
- For example, a binary classification model can be used to predict whether a website comment is spam

Modeling APIs

- Provides APIs for modeling and management that allow users to create, review, and delete data sources, models, and evaluations
- Allows users to automate the creation of new models when new data becomes available
- APIs also inspect previous models, data sources, evaluations, and batch predictions for tracking and repeatability

APIs for Batch and Real-time Predictions

- Provides APIs to obtain predictions from ML algorithms to easily build smart applications
- Batch prediction API retrieves a large number of data records and generates predictions all at once
- Real-time prediction API generates predictions synchronously and with low-latency

Source: Amazon Web Services

Case Study: Google

Google Cloud Platform

Google Cloud Machine Learning provides modern Machine Learning services, with pre-trained models and a service engine for users to easily build their own customized models on any type and size data

Google Cloud Machine Learning Features Include:

› **Predictive Analytics at Scale:** Seamlessly transition from training to prediction, using online (currently in Beta) and batch prediction services. Integration to Google global load balancing enables users to automatically scale their Machine Learning applications, and reach users world-wide

› **Hypertune:** allows data scientists to build better performing models faster by automatically tuning hyperparameters, instead of manually discovering values that work for their model, to automatically improve predictive accuracy

› **Scalable Service:** managed distributed training infrastructure that supports CPUs and GPUs to accelerate model development, and build models of any data size or type by training across many number of nodes, or running multiple experiments in parallel

› **Integrated:** works with Cloud Dataflow for feature processing, Cloud Storage for data storage and Cloud Datalab for model creation

› **Managed Service:** automates all resource provisioning and monitoring, allowing users to focus on model development and prediction without worrying about the infrastructure

› **Portable Models:** through open source TensorFlow SDK, Google Cloud Machine Learning trains models locally on sample data sets and can be scaled through the Google Cloud Platform as well as downloaded and shared for local execution or mobile integration using Cloud Machine Learning Engine

Many of Google's customary features run on its Machine Learning platform to improve search results, including: Photos, Voice Search, Translate, and Inbox (smart reply)

Source: Google Cloud Platform

Case Study: Facebook

Facebook formed its Applied Machine Learning team in September 2015, the group runs a company-wide internal platform for Machine Learning called FBLearner Flow. FBLearner Flow combines several Machine Learning models to process several billion data points, drawn from the activity of the site's 1.5 billion users, and forms predictions about thousands of things: which user is in a photograph, which message is likely to be spam. The algorithms created from FBLearner Flow's models help define ranking and personalizing News Feed stories, filtering out offensive content, highlighting trending topics, ranking search results, advertisements and more.

FBLearner Flow is capable of easily reusing algorithms in different products, scaling to run thousands of simultaneous custom experiments, and managing experiments with ease. This platform provides innovative functionality, like automatic generation of UI experiences from pipeline definitions and automatic parallelization of Python code. FBLearner Flow is used by more than 25% of Facebook's engineering team. Since its inception, over one million models have been trained, and the prediction service has grown to make **more than 6 million predictions per second.**

Where Facebook is Using Artificial Intelligence / Machine Learning

› **Textual Analysis:** "DeepText" tool extracts meaning from words by learning to analyze the context of user's posts. Neural networks analyze the relationship between words to understand how their meaning changes depending on other words around them. As a form of "semi-unsupervised learning", the algorithms do not necessarily have reference data to understand the meaning of every word, instead, it learns for itself based on how words are used. This tool is used to direct people towards products they may want to purchase based on conversations they are having

› **Facial Recognition:** "DeepFace" is a Deep Learning application to teach Facebook to recognize people in photos. Facebook's most advanced image recognition tool is more successful than humans in recognizing whether two different images are of the same person or not – with DeepFace scoring a 97% success rate compared to humans with 96%.

› **Targeted Advertising:** Facebook uses deep neural networks – the foundation stones of Deep Learning – to decide which advertisements to show to which users by tasking machines themselves to find out as much as they can about users, and cluster users together in the most insightful ways to deliver advertisements

› **Designing AI Applications:** Facebook has even decided that the task of deciding which processes can be improved by AI and Deep Learning can be handled by machines. A system called "Flow" has been implemented which uses Deep Learning analysis to run simulations of 300,000 Machine Learning models every month, to allow engineers to test ideas and pinpoint opportunities for efficiency.

Source: Facebook

Case Study: Microsoft
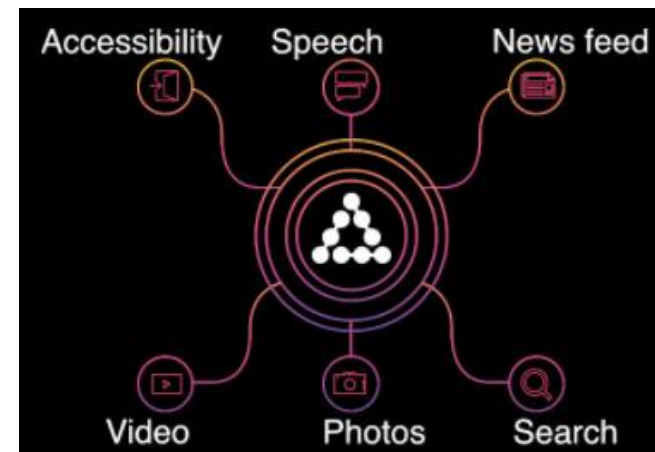
- Microsoft has been investing in the promise of artificial intelligence for more than 25 years – and this vision has come to life with new chatbot Zo, Cortana Devices SDK and Skills Kit, and expansion of intelligence tools. In 2016, Microsoft became the first in the industry to reach parity with humans in speech recognition. Microsoft has also built perhaps the world's biggest knowledge graph. Thanks to work in Bing and Office 365, it's possible to understand billions of entities – people, places and things. We now have the opportunity to connect this "world knowledge" with peoples' "work knowledge"

  "Across several industry benchmarks, our computer vision algorithms have surpassed others in the industry – even humans. But what's more exciting to me is that our vision progress is showing up in our products like HoloLens and with customers like Uber building apps to use these capabilities."
  – Harry Shum, Executive Vice President, Artificial Intelligence and Research, Microsoft (December 2016)

- Microsoft's deep investments in AI are advancing the state of the art in machine intelligence and perception, enabling computers that understand what they see, communicate in natural language, answer complex questions and interact with their environment. The research, tools and services that result from this investment are woven into existing and new products and, as well as accessible to the broader community in a bid to accelerate innovation, democratize AI and solve the world's most pressing challenges.

Cortana

- *Cortana* is an AI-based personal assistant; integrates with over 1,000 apps; available in 8 languages; Cortana can set reminders, recognize natural voice without the requirement for keyboard input, and answer questions using information from Microsoft Bing; over 145 million users across platforms

- *Cortana Skills Kit* allows developers to leverage bots to create new skills and personalize their experiences by leveraging Cortana's understanding of users' preferences and context, based on user permissions

Zo (zo.ai)

- *Zo* is a social chatbot, built using the vast social content of the Internet – has held conversations with over 100,00 users – she learns from human interactions to respond emotionally and intelligently, providing a unique viewpoint, along with manners and emotional expressions

- *Zo* is currently on the Kik mobile messaging platform, Microsoft plans to bring *Zo* to other social and conversational channels such as Skype and Facebook Messenger; Microsoft also has Chinese and Japanese chatbots – *Xiaoice* and *Rinna*

Skype Translate

- Skype Translator enables people to understand each other, in real time, using the company's new intelligent language and speech recognition capability

- Microsoft Translator can simultaneously translate between groups speaking multiple languages in-person, in real-time, connecting people and overcoming barriers (works across 9 languages)

Source: Microsoft

Case Study: Microsoft – Maluuba Acquisition

In January 2017, Microsoft acquired Maluuba, a Deep Learning start-up with one of the world's most impressive Deep Learning research labs for natural language understanding for the advancement of AI at Microsoft

Maluuba	**Microsoft**
Provides deep Machine Learning research studies and develops human-generated natural language processing datasets for the artificial intelligence research community, Maluuba provides one of the world's most impressive Deep Learning research labs for natural language understanding	At Microsoft, researchers in artificial intelligence are harnessing the explosion of digital data and computational power with advanced algorithms to enable collaborative and natural interactions between people and machines that extend the human ability to sense, learn and understand. The research infuses computers, materials and systems with the ability to reason, communicate and perform with humanlike skill and agility

› Maluuba's expertise in Deep Learning and reinforcement learning for question-answering and decision-making systems will help Microsoft advance their strategy to democratize AI and to make it accessible and valuable to everyone — consumers, businesses and developers. This acquisition enables Microsoft to reach new milestones for speech and image recognition using Deep Learning techniques through Maluua's machine reading and writing capabilities

› Maluuba's vision is to advance toward a more general artificial intelligence by creating literate machines that can think, reason and communicate like humans – in line with Microsoft. Maluuba's impressive team is addressing some of the fundamental problems in language understanding by modeling some of the innate capabilities of the human brain, from memory and common sense reasoning to curiosity and decision making

› *"Imagine a future where, instead of frantically searching through your organization's directory, documents or emails to find the top tax-law experts in your company, for example, you could communicate with an AI agent that would leverage Maluuba's machine comprehension capabilities to immediately respond to your request. The agent would be able to answer your question in a company security-compliant manner by having a deeper understanding of the contents of your organization's documents and emails, instead of simply retrieving a document by keyword matching, which happens today. This is just one of hundreds of scenarios we could imagine as Maluuba pushes the state-of-the-art technology of machine literacy." – Harry Shum, EVP, AI, Research*

Source: Company Press Release

Case Study: Industrial IoT

Machine Learning capabilities continue to prove pervasive into more conservative and industrial industries, such as energy and utilities, that are often seen as technology laggards

- With additional sensors from the emerging Industrial Internet of Things (IIoT), there is a growing amount of data generation

- Many utilities are currently operating under a model with separate siloed data across business units (Generation, Transmission & Distribution, Energy Trading & Risk Management, and Cybersecurity)

  › Machine Learning can be incorporated to gain insight from all of the various data uniformly across divisions, allowing once separate business units to merge as one and put data to work to promote a better Internet of Energy (IoE) Experience

- Industrial problems that benefit from Machine Learning:

  › Energy disaggregation

  › Power voltage instability monitoring

  › Grid maintenance

  › Machine repair monitoring

  › Fueling recommendation engines

DECISIONS TO ANALYZE RISK

Years		Data Growth
2025		1500 TB
2020		20 TB
2015		5 TB
2010		1 TB

PLANTS • CYBER • T&D • ETRM

Source: SparkCognition
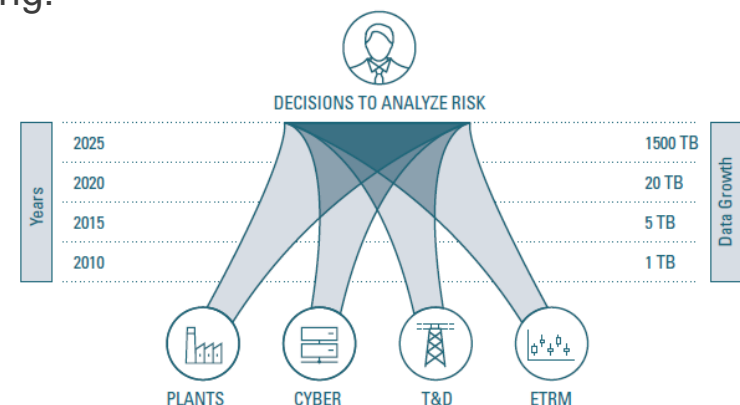
Machine Learning "Vertical Application" Landscape

Sales & Marketing / Customer Experience Optimization

6sense, gumgum, AIRPR, InfiniteAnalytics, Albert, INSIDE SALES.COM, Appier, Lattice, Artifacia, LAYER 6 AI, AVISO, LEXALYTICS, bloomreach, LiftIgniter, brightfunnel, MINTIGO, Cerebri, MONA, CHORUS, msg.ai, clari, NETBASE, collective[i], [PERSADO], conversica, RADIUS, DigitalGenius, RESCI, drawbridge, SIDECAR, evergage, SiteZeus, fuse|machines, wayblazer, Gavagai, Zensight

Audio / Call Intelligence
deep gram, INVOCA, TalkIQ

Industrials / IoT / Robotics

affectiva, KONUX, nanit, optoro, SIGHT MACHINE Manufacturing Analytics, VERDIGRIS, vicarious

Autonomous Vehicles
AIMOTIVE, nauto, drive.ai, nexar, JAYBRIDGE ROBOTICS, nuTonomy

FinTech

Affirm, alphasense, BINATIX, Brighterion, CAPE ANALYTICS, Dataminr, feedzai, FinGenius, FinTech Studios, ITRS see more, Kabbage, KENSHO, LendUp, NUMERAI, personetics, SBDA group, TrueAccord, zest finance

Cybersecurity

Anodot, Brainspace, BLUVECTOR, CYLANCE, DARKTRACE, DEMISTO, EASYSOLUTIONS, graphistry, LEAPYEAR, OPAQ Networks, SentinelOne, Shift Technology, sift science, SIGNALSENSE, sparkcognition, THETARAY, VECTRA Security that thinks., ZIMPERIUM

Healthcare

Appistry, Atomwise Better medicines faster., babylon, BenevolentAI, CLOUD MEDX, deep genomics, enlitic, epidemico, eviCore healthcare, Booz Allen, freenome, iCarbonX 碳云智能, TeraRecon, Lunit, two AR, Welltok Optimizing Health, Maximizing Rewards., WPC HEALTHCARE, intermedix, zebra MEDICAL VISION

Machine Learning Verticals: Select Company Case Studies

Sales & Marketing / Customer Experience Optimization	Industrials / IoT / Robotics	FinTech	Cybersecurity	Healthcare
Lattice	**nuTonomy**	**KENSHO**	**sparkcognition**	**freenome**
Founded: 2006	**Founded:** 2013	**Founded:** 2013	**Founded:** 2013	**Founded:** 2015
HQ: San Mateo, CA	**HQ:** Cambridge, MA	**HQ:** Cambridge, MA	**HQ:** Austin, TX	**HQ:** San Francisco, CA
Employees: 130	**Employees:** 70	**Employees:** 90	**Employees:** 100	**Employees:** 30
Invested Capital: $65M	**Invested Capital:** $20M	**Invested Capital:** $68M	**Invested Capital:** $66M	**Invested Capital:** $71M
Description: Lattice Engines provides SaaS based predictive applications for marketing and sales organizations. The Company offers Score & Segment, a predictive lead scoring and account solution to find leads. The Company also provides data-driven data applications for marketing purposes.	**Description:** nuTonomy develops software for self-driving vehicles. The Company's software provides point-to-point mobility via large fleets of autonomous vehicles including software for navigation in urban environments, smartphone-based ride hailing, and teleoperation.	**Description:** Kensho combines natural language search queries, graphical user interfaces, and secure cloud computing to create a new class of analytics tools for investment professionals. The Company addresses three big challenges of Wall Street investment analysis: speed, scale, and automation.	**Description:** SparkCognition is a global leader in cognitive computing analytics. The Company's technology is capable of harnessing real time sensor data and learning from it continuously, allowing for more accurate risk mitigation and prevention policies to intervene and avert disasters.	**Description:** Freenome operates as a data-driven health company that brings accurate, accessible and non-invasive disease screenings to patients and doctors. The Company's platform utilizes big data analytics to detect oncoming problems before they become consequential.

<$25M

$25 M - $75 M

$75M - $150M+

Source: S&P Capital IQ, Crunchbase

27

Most Active Financial Investors

Financial Buyers - # of Deals

Investor	# of Deals
NEA	5
ACCEL PARTNERS	5
StartX	5
FIRSTMARK	4
SEQUOIA	3
NORWEST VENTURE PARTNERS	3
lux capital	3
intel capital	3
General Catalyst Partners	3
salesforce ventures	3
SAMSUNG VENTURE INVESTMENT	3
QUALCOMM VENTURES	3
VISIONNAIRE VENTURES	3
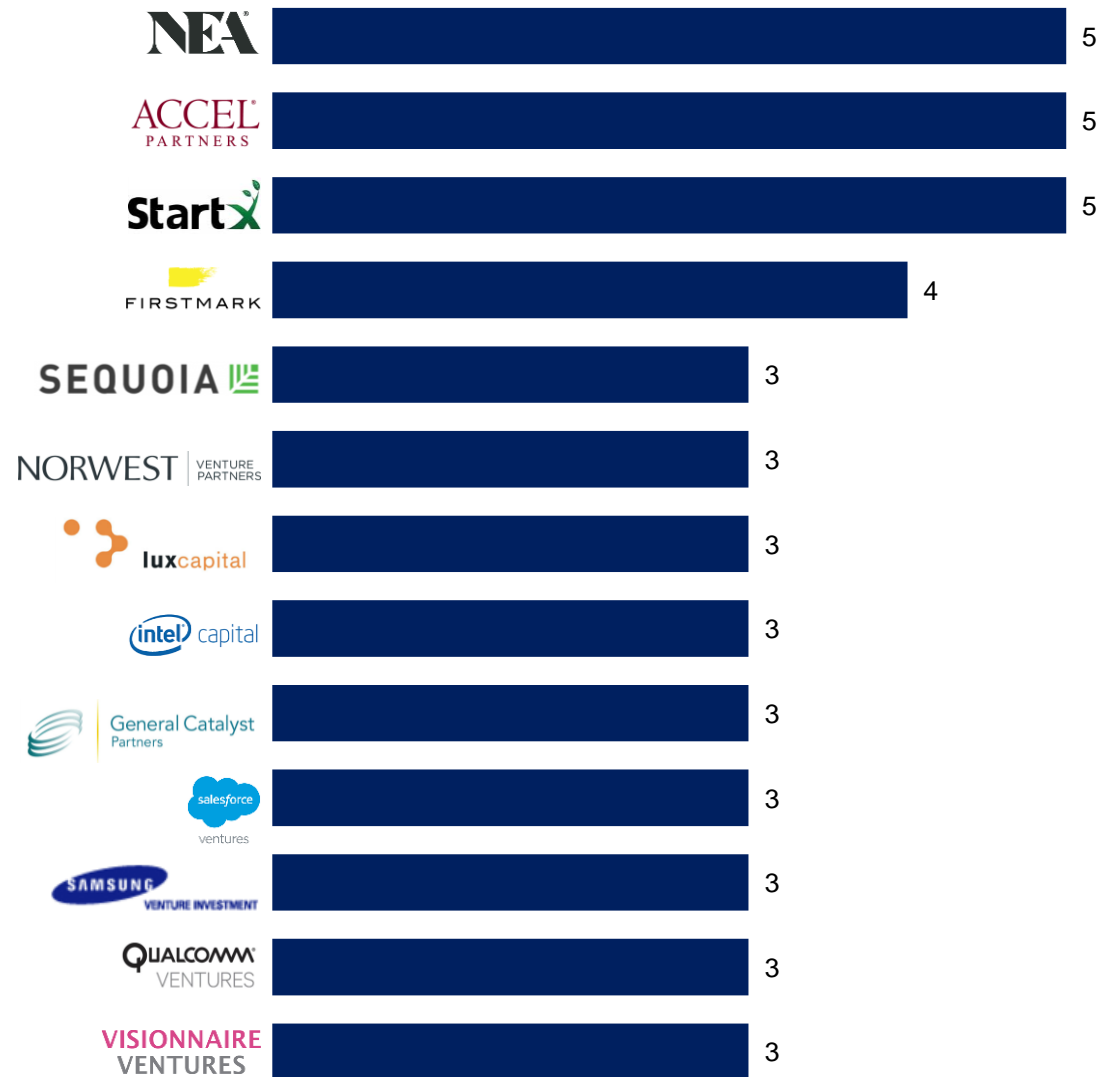
- New Enterprise Associates, Accel Partners, and StartX Fund have each completed 5 Machine Learning deals to date, the most of any financial buyers

- Portfolio companies of the largest investors include DataRobot (NEA), Paxata (Accel and Intel), Zoox (Lux) and Drawbridge (Sequoia)

- More than half the venture firms most active in AI / ML are based in the Bay Area

- As the market for Machine Learning continues to grow and companies mature, we anticipate more financial investors to become increasingly active in the space

Large Potential Buyer Base

- Machine Learning is continuing to gain traction, and interest in it is widespread – with everything from autonomous vehicles to automated medical diagnoses – driving a diverse buyer base across all verticals

- Machine Learning appears to be an almost foundational technology when we consider the broad pool of buyers

- Given the sheer breadth of Machine Learning products and services, large tech vendors are continually looking to diversify their offerings and differentiate from the competition

- Any company that is looking to make its products more efficient could be viewed as a potential acquirer of Machine Learning technology

- Buyers' increased awareness of ML is being driven by the unprecedented volumes of data and hyper-scale computing power available through the cloud

Potential Strategic Buyers

(Apple, amazon, IBM, intel, Google, SAP, Microsoft, Twitter, accenture, Deloitte, facebook, ORACLE, pwc, salesforce)

Characteristics of Desired Targets:

› IP or differentiating features

› Innovative and disruptive solutions

› Proven in the market

› Strong customer profile

› Easily integrated into existing platforms

Machine Learning Market Trends

- Companies that provide ML technology are becoming an increasing popular target for acquirers with the trend of adding 'smarts' to technology continuing to drive momentum in 2017

- As tech giants like Google and Facebook are releasing innovative AI and ML technologies, other tech giants are using M&A to catch up

  › In 2016, the biggest surge of AI-related M&A came from Salesforce, which bought about half a dozen little companies leading up to its Einstein AI-as-a-service platform announcement last fall

  › Other top tech players are jumping on the trend including Apple, eBay, Google, IBM and Intel

- AI and Machine Learning is the top-ranked theme for driving acquisition activity in 2017, with 82% of respondents in 451 Research's Tech Banking Outlook Survey predicting an uptick in M&A activity

- Historically, the majority of ML and AI targets that were being acquired have been companies that apply AI and ML technology to a specific vertical (i.e. Amazon's acquisition of Harvast.ai that uses AI to detect cyber intrusions)

- We are now seeing an uptick in the emergence horizontal technologies as potential targets for tech giants, to provide the foundation to create their own Machine Learning technology platform

M&A Trends

Bar values (Number of Transactions):
- 2014: 10
- 2015: 18
- 2016: 38
- 2017 YTD: 24

Legend:
- Number of Transactions
- Total Disclosed Transaction Value

Private Placement Trends

Bar values (Number of Transactions):
- 2014: 22
- 2015: 33
- 2016: 39
- 2017 YTD: 24

Legend:
- Number of Transactions
- Total $ Invested

Source: 451 Research, Wall Street Journal

About AGC
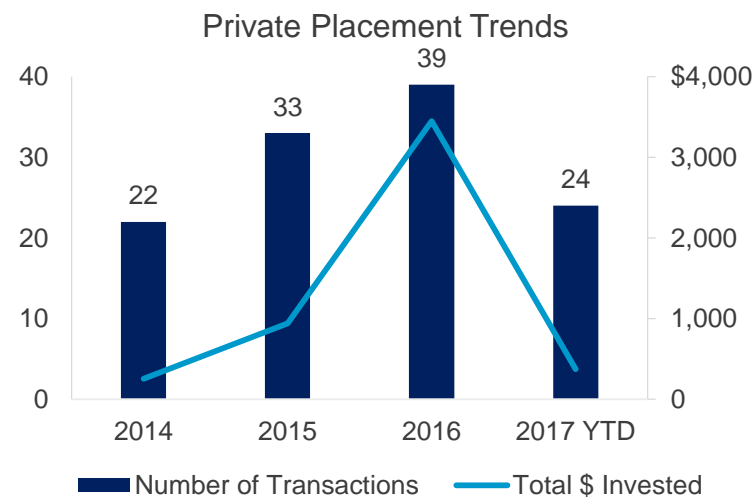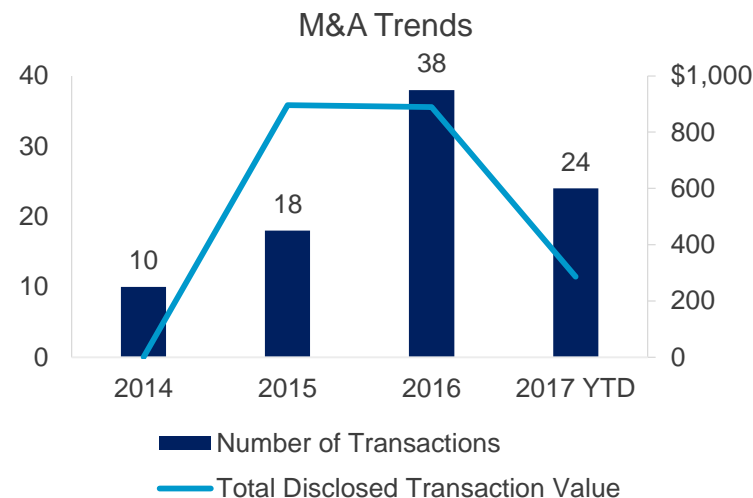
AGC is a leading investment bank with a focus on providing strategic advisory services to technology companies, helping them achieve their vision. With more than 50 investment banking professionals across the Americas and in Europe, we provide global coverage across all products and sectors, from software and digital media to tech-enabled services and mobile communications. Since our inception in 2003, AGC Partners has completed 310 investment banking transactions for emerging growth companies.

Scott Card
Partner

- Scott is a Partner in the Investment Banking Group and founding team member at AGC Partners, focused on Enterprise Infrastructure sectors including Cloud Infrastructure, Data Analytics, Storage & Security
- In his 20 plus years as an investment banker, Scott has completed more than 50 M&A and debt / equity financing transactions
- Prior to joining AGC Partners, Scott was part of Deutsche Bank Alex Brown's Technology Investment Banking Group in Boston
- Previously, Scott was an Associate in Global Mergers & Acquisitions at SBC Warburg and an Analyst in the Financial Institutions Group at Merrill Lynch & Co. in New York
- Scott holds a B.S. in Electrical Engineering from Cornell University and an M.B.A. from the Amos Tuck School at Dartmouth College

Jon Guido
Partner, COO

- Jon is a founding Partner at AGC with a focus on the Business Services, Software and Internet / Digital Media sectors
- Over the span of his 15-year career in investment banking, Jon has completed more than 65 transactions
- As Chief Operating Officer for AGC, Jon works on developing and implementing the firm's financial, operational, and business development strategies
- Jon helped found AGC in February 2003, coordinating the infrastructure build, capital raise, and recruiting effort
- Prior to AGC, Jon worked in SG Cowen's Mergers & Acquisitions Group

Hugh Hoffman
Partner

- Hugh is a partner in the Investment Banking Group at AGC Partners, focusing on Life Sciences and HCIT out of the firm's Minneapolis office
- Hugh is a 25-year technology M&A veteran who ran Piper Jaffray's M&A practice in Software and Services for more than 8 years before joining Craig-Hallum Capital Group in 2006, where he led their M&A practice
- He has completed more than 150 transactions during his career and has worked at Dain Rauscher Corporation, where he started the firm's software practice, and Dillon, Read and Co. Inc. in New York and London
- He received an M.B.A. from Harvard Business School and graduated Summa Cum Laude from the University of Denver

Dennis Rourke
Partner

- Dennis brings more than 25 years of experience in investment banking to his role at AGC and has been a Partner with AGC since it was founded in early 2003
- Dennis has completed more than 80 transactions, primarily for software companies
- Previously, Dennis was a Managing Director at Banc of America Securities and a Founding Member of Montgomery Securities' East Coast Technology Group
- He holds a B.A. in English from Middlebury College, an M.A. in German Literature from the Johannes Gutenberg Universität in Mainz, Germany, and an M.S. in Finance from the MIT Sloan School of Management

Private Placement and M&A Deal Appendix

Machine Learning Private Placements 2014 – 2017 YTD

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Jun-17	Cognitive Scale	Intel Capital; Norwest Venture Partners; The Westly Group	$15	Offers Insights Fabric, a cloud platform that delivers insights as a service from various types of social, public, private, and device data and context signals.
Jun-17	CrowdFlower	Canvas Management Company; Industry Ventures; Microsoft Accelerator; Salesforce Venture	$20	Offers data enrichment platform that helps data scientists to collect, clean, and label data.
Jun-17	SparkCognition	ND	$35	Provides cognitive security analytics solutions.
May-17	StreamSets	Accel Partners; Battery Ventures; New Enterprise Associates	$20	Provides data ingest technology for big data applications.
May-17	KIANA Systems	BearingPoint	ND	Operates a business intelligence and enterprise software company. The Company builds solutions that classify, cluster, and make predictions about text, image, video, time series, and sound to locate and quantify patterns.
May-17	DeePhi Technology	Xilinx; MediaTek; GSR Ventures Management; Tsinghua; Banyan Capital; Sigma Square Capital	ND	Develops deep learning artificial intelligence computing applications. The Company develops automation flow of compression, compiling, and acceleration that achieves joint optimization between algorithm, software, and hardware.
May-17	Ninoh	CRV; Franklin Resources; Microsoft Accelerator; Point72 Ventures	$4	Builds and provides an artificial intelligence driven global intelligence platform to create summaries from user's information in real-time.
May-17	Bonsai AI	Microsoft Accelerator; New Enterprise Associates; ABB Technology Ventures; Samsung NEXT; Siemens	$8	Provides an AI platform that empowers developers to build, teach and use intelligent systems by simplifying the programming of control and optimization to create more intelligent systems and business processes.
Apr-17	Domino Data Lab	Coatue Management; Zetta Venture Partners; Sequoia Capital	$27	Provides on premise and cloud-based enterprise data science platform for analysis applications.
Apr-17	Skymind	ND	ND	Operates a business intelligence and enterprise software company. The Company builds solutions that classify, cluster, and make predictions about text, image, video, time series, and sound to locate and quantify patterns.
Apr-17	Motivo	ND	$3	Develops software for data analytics, combinatorial optimization, and machine learning solutions.
Mar-17	Ripjar	Winton Ventures	$5	Operates a data intelligence platform that provides techniques in natural language processing, machine learning, and visual analytics for enterprises.
Mar-17	SafeGraph	IDG Ventures	$16	Collects, stores, and processes information on servers for machine learning, deep learning, and artificial intelligence.
Mar-17	Looker Data Sciences	CapitalG; Geodesic Capital; Kleiner Perkins Caufield & Byers	$82	Develops a browser-based data platform that offers data analytics, exploration, and insights to various functions of a business.
Mar-17	Knime	The Invus Group	$21	Offers open-source enterprise solutions and services.

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Mar-17	Seematics Systems	Samsung Ventures Israel	ND	Develops a deep learning engine that runs on the user end devices.
Feb-17	Retrieva	The University of Tokyo Edge Capital	$2	Develops, supports, and sells software solutions based on natural language processing and machine learning.
Feb-17	Confluent	Index Ventures; Sequoia Capital	$50	Designs and develops a real-time data platform for organizations.
Feb-17	Integrate.ai	Georgian Partners	$5	Develops artificial intelligence enterprise software for large enterprises to train AI-enabled solutions that drive customer engagement and revenue growth. The Company's solution combines machine learning and big data to bridge the gap between AI and enterprises.
Jan-17	XIX.AI	Y Combinator Management	ND	Provides a machine learning and artificial intelligence technology for smart phones.
Jan-16	Zoomdata	Accel Partners; Columbus Nova Technology Partners; Comcast Ventures; New Enterprise Associates	$25	Develops and deploys data visualization and analytics systems for big data.
Jan-17	Datalogue	NVIDIA; Flybridge Capital Partners; Bloomberg Beta	$2	Develops and automates the process of data wrangling by leveraging machine learning and distributed computing to find patterns in the structures of datasets and transform them into formats that data scientists, developers, and researchers can analyze.
Jan-17	WorkFusion	Mohr Davidow Ventures; iNovia Capital; Nokia Growth Partners; Greycroft Partners; Georgian Partners; RTP Ventures	$35	Operates a SaaS data processing platform for enterprise data operations. The Company's platform monitors, extracts, and processes data by pairing human workforces with machine learning automation solutions.
Jan-17	LotaData	MOX	ND	Develops and provides mobile location insights and predictive analytics solutions through machine learning for apps, cities, and businesses.
Dec-16	Altocloud	ACT Venture Capital; Allied Irish Banks	$2	Operates a cloud-based contextual communications and analytics platform. The Company's platform uses live data analytics, reporting, and machine learning to discover, analyze, and understand customer behavior patterns.
Dec-16	Micropsi Industries	Coparion; Vito Ventures Management	$3	Provides services to make sense of industrial process data using artificial intelligence. The Company's machine learning framework technology allows users to optimize complex production processes.
Dec-16	Databricks	Andreessen Horowitz; New Enterprise Associates	$60	Provides a cloud platform that helps traditional and disruptive organizations to turn data into value.
Dec-16	Neurala	DFJ; Pelion Venture Partners; IDInvest Partners; Motorola Venture Capital; 360° Capital Partners; SKVentures; Sherpa Ventures	$14	Develops software solutions for robots, drones, and intelligent devices that adapt to perform useful tasks.
Dec-16	Element AI	Microsoft Accelerator	ND	Operates an online platform that helps organizations identify opportunities to use artificial intelligence and machine learning in ways that impact their business.
Nov-16	Singular Me	Carao Ventures	ND	Develops a machine learning and deduction engine that uses data science and big data algorithms in order to generate the content and conditional rules that capture customer's behaviors and beliefs.

Machine Learning Private Placements 2014 – 2017 YTD (Cont.)

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Nov-16	Nexosis	ND	$5	Develops and provides an automated machine learning platform to enable data driven decisions. The Company offers Axon, a machine learning platform which ingests multiple data sources to create actionable insights.
Nov-16	Petuum	Northern Light Venture Capital; Intertrust Corporate Services; Tencent Holdings; Oriza Ventures	$15	Develops and operates an artificial intelligence and machine learning solution development platform. The Company's product enables enterprises to build practical AI/ML deployments for the real world.
Nov-16	SnapLogic	Andreessen Horowitz; Capital One Growth Ventures; Ignition Partners; NextEquity	$40	Delivers cloud Integration Platform-as-a-Service solutions for citizen integrators.
Nov-16	DT42	Zeroth.ai	ND	Develops artificial intelligence software. The Company offers deep learning, computer vision, model optimization, and embedded integration solutions.
Nov-16	Matelabs Innovations	Zeroth.ai	ND	Provides artificial intelligence based solutions to build, train, and use machine learning. It offers Mate, an AI and machine learning-based conversational search engine that incorporates a user's context and emotions to deliver more personalized search results.
Nov-16	Cogito	OpenView Venture Partners; Romulus Capital; Salesforce Ventures	$19	Develops and delivers an artificial intelligence and behavioral analytics software solution that analyzes human voice and provides real-time guidance to enhance behavior.
Nov-16	Voyager Labs	Horizons Ventures	$100	Develops an artificial intelligence engine that combines expert systems with deep-learning algorithms, as well as extracts dynamic, real-time, and tailored insights into human behavior.
Oct-16	XCube R&D	Beacon Angels	ND	Provides software infrastructure that automates testing and training process for machine learning algorithms.
Oct-16	Dataiku	Alven Capital Partners; FirstMark Capital	$14	Provides a software platform for data applications.
Oct-16	BrainChip	Metals X	$4	Provides software and hardware solutions for artificial intelligence and machine learning applications. The Company offers Spiking Neuron Adaptive Processor that has ability to learn autonomously, evolve, and associate information like the human brain.
Oct-16	Paxata	Accel Partners, AirTree Ventures; Cisco Investments; Intel Capital	$34	Provides adaptive data preparation platform that delivers raw data to ready data for business analysts.
Oct-16	RapidMiner	ND	ND	Develops an open source data science platform for organizations.
Sep-16	Prowler.io	Amadeus Capital Partners; SGInnovate; Passion Capital	$2	Develops machine learning algorithms to improve artificial intelligence decisions.
Sep-16	Skymind	GreatPoint Ventures; Y Combinator Management; SV Angel; Mandra Capital; Tencent Holdings	$3	Operates a business intelligence and enterprise software company. The Company builds solutions that classify, cluster, and make predictions about text, image, video, time series, and sound to locate and quantify patterns.
Sep-16	Flashback Technologies	ND	$2	Develops CipherSensor, a computational engine that provides predictive decision support solutions for data analysis needs across various industries.

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Aug-16	DefinedCrowd	Portugal Capital Ventures; Amazon; Sony Innovation Fund	$1	Operates as a next-generation data science company that focuses on building data refinery platforms for machine learning and artificial intelligence.
Aug-16	Relativity6	ND	ND	Develops predictive statistical models and machine learning algorithms tailored specifically to discover ways to bring back lapsed customers.
Jun-16	Keen Labs	Amplify Partners; Hewlett Packard Ventures; Pelion Venture Partners	$15	Builds a customizable analytics platform for developers to collect, explore, and visualize data, as well as to turn data into insights for teams and customers.
Jun-16	DeepLIFT Technologies	Pear Ventures	ND	Develops predictive models that offer understanding on any deep learning process by looking at inputs and identifying recurring patterns.
Jun-16	Nexosis	Techstars Retail Accelerator	ND	Develops and provides an automated machine learning platform to enable data driven decisions. The Company offers Axon, a machine learning platform which ingests multiple data sources to create actionable insights.
Jun-16	Avata Intelligence	Aristos Ventures Management	$3	Provides an artificial intelligence platform to support various organizations in solving their analytics questions.
Jun-16	Qlik Technologies	Thoma Bravo	$2,999	Provides user-driven business intelligence solutions that enable customers to make business decisions.
May-16	Digital Reasoning Systems	Lemhi Ventures; HCA Holdings; NASDAQ	$40	Builds data analytic solutions for processing and organizing unstructured data into meaningful data automatically.
Apr-16	Cogito	ND	$1	Develops and delivers an artificial intelligence and behavioral analytics software solution that analyzes human voice and provides real-time guidance to enhance behavior.
Apr-16	SparkCognition	Alameda Ventures	$6	Provides cognitive security analytics solutions.
Apr-16	Versium Analytics	ND	$2	Delivers automated predictive analytics solutions for businesses.
Mar-16	Data Artisans	Intel Capital; Tengelmann Ventures	$6	Provides Apache Flink, a general-purpose data processing engine for the Hadoop ecosystem.
Feb-16	Trifacta	Accel Partners; Cathay Capital; Greylock Partners	$35	Develops and provides data wrangling solutions for business, IT, and data analysts
Feb-16	Skymind	Plug and Play Tech Center	ND	Operates a business intelligence and enterprise software company. The Company builds solutions that classify, cluster, and make predictions about text, image, video, time series, and sound to locate and quantify patterns.
Jan-16	Maluuba	Emerillon Capital; Nautilus Ventures	$6	Designs and delivers deep learning mobile applications for natural language processing.

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Jan-16	Iterate Studio	ND	$1	Provides an AI based platform and related services to various industries worldwide.
Jan-16	Import.io	Wellington Ventures; Oxford Capital; AME Cloud Ventures	$13	Provides a SaaS based product that enables users to convert the mass of data on web sites into structured, machine readable data.
Jan-16	Sentenai	Flybridge Capital Partners; Founder Collective; Project 11; Hyperplane Venture Capital	$2	Develops a cloud-based platform for automating data engineering for machine learning and predictive applications in IoT and logistics.
Dec-15	Preferred Networks	Toyota Motor	$8	Operates as a software development company that focuses to apply real-time machine learning technologies to new applications in the emerging field of the Internet of Things.
Dec-15	Deepsense.io	CodiLime	$4	Develops and delivers Seahorse, a big data analytics platform that provides code-free big data manipulation and predictive analytics.
Dec-15	Skymind	Y Combinator Management	ND	Operates a business intelligence and enterprise software company. The Company builds solutions that classify, cluster, and make predictions about text, image, video, time series, and sound to locate and quantify patterns.
Dec-15	PointGrab	ABB Technology Ventures; EcoMachines Ventures; Flextronics Lab IX	$5	Develops machine learning technology software solutions for optical IoT devices for home and building automation systems.
Dec-15	DataScience	Greycroft Partners	$22	Provides a human and machine powered solution for extracting knowledge from data.
Dec-15	Semantic Machines	ND	$12	Develops artificial intelligence technology that enables computers to communicate, collaborate, understand goals, and accomplish tasks.
Dec-15	Osaro	Morado Venture Partners; AME Cloud Ventures	$3	Develops products based on deep reinforcement learning technology. The Company offers automation solutions for computer and robotic systems driven by advanced machine learning software.
Nov-15	H2O.ai	Nexus Venture Partners; Transamerica Ventures; Paxion Capital; Capital One Growth Ventures	$20	Develops an open source parallel processing prediction engine for machine learning and predictive analytics on big data.
Oct-15	Cogito	Romulus Capital; Salesforce Ventures	$6	Develops and delivers an artificial intelligence and behavioral analytics software solution that analyzes human voice and provides real-time guidance to enhance behavior.
Oct-15	DataRobot	New Enterprise Associates; New York Life Insurance; Intel Capital; IA Ventures; Recruit Strategic Partners; Accomplice	$33	Develops machine learning automation software for enterprises. The Company offers DataRobot, a predictive analytic cloud and on premises platform that offers a real world project-based curriculum to help users gain insights from data scientists.
Oct-15	Cask Data	Battery Ventures; Ignition Partners; Safeguard Scientifics	$20	Develops technologies that enable customers to overcome their big data challenges.
Aug-15	Arundo Analytics	ND	$3	Develops analytics products that analyze data from the client's assets and predicts the likely failures to enhance their operations. The Company's analytics solutions allow clients to make operational and maintenance decisions.

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Aug-15	Ninoh	Field Management Capital	ND	Builds and provides an artificial intelligence driven global intelligence platform to create summaries from user's information in real-time.
Aug-15	Preferred Networks	Fanuc	$7	Operates as a software development company that focuses to apply real-time machine learning technologies to new applications in the emerging field of the Internet of Things.
Jul-15	PurePredictive	ND	$4	Provides a machine learning platform for predictive analytics. The Company offers PurePredictive, a cross enterprise solution that empowers and distributes data driven business analysis.
Jul-15	Continuum Analytics	General Catalyst Partners; BuildGroup Management	$24	Provides a subscription based data analytics platform that helps companies to adopt open data science analytics architecture.
Jun-15	Nexosis	ND	ND	Develops and provides an automated machine learning platform to enable data driven decisions. The Company offers Axon, a machine learning platform which ingests multiple data sources to create actionable insights.
Jun-15	Macromeasures	ER Accelerator	ND	Provides customer intelligence solutions for brands, data vendors, social tools, and agencies. The Company offers PeopleData API, a machine learning framework that takes raw social data and turns it into structured profiles.
Jun-15	Diffbot	Bloomberg Beta	$1	Operates a robot that examines the web using computer vision and natural language processing. The Company's computer vision and machine learning services include structure web data with better-than-human-level accuracy.
Jun-15	Nexosis	ND	$1	Develops and provides an automated machine learning platform to enable data driven decisions. The Company offers Axon, a machine learning platform which ingests multiple data sources to create actionable insights.
Jun-15	Lattice Engines	Blue Cloud Ventures; New Enterprise Associates; River Cities Capital Funds	$28	Provides SaaS based predictive applications for marketing and sales organizations.
May-15	Sumo Logic	Accel Partners; Draper Fisher Jurvetson; Greylock Partners; Sequoia Capital	$80	Provides a cloud-native machine data analytics service to build, run, and secure applications.
Apr-15	Albeado	Brillio	$3	Develops and delivers decision support systems for organizations to understand their business process.
Apr-15	Versium Analytics	ND	ND	Delivers automated predictive analytics solutions for businesses.
Apr-15	DataTorrent	AME Cloud Ventures; August Capital; GE Ventures; Morado Venture Partners	$15	Owns and operates real-time stream processing platform that enables users to process, monitor, analyze, and act on data instantaneously.
Apr-15	Domo	Glynn Capital Management; BlackRock; Canyon Capital Advisors	$431	Develops a cloud-based business management platform.
Mar-15	Cloudera	Firsthand Capital Management; Firsthand Technology Value Fund	ND	Operates a data management, machine learning, and analytics software platform. The Company's platform delivers an integrated suite of capabilities for data management, machine learning, and analytics to customers for transforming their businesses.

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Mar-15	Ayasdi	Centerview Capital Holdings; Citi Ventures; Draper Nexus Venture Partners; FLOODGATE Fund; Kleiner Perkins	$55	Develops machine intelligence applications for healthcare payers and providers, and financial services companies.
Feb-15	Dataminr	Credit Suisse Asset Management; Fidelity Investments; Goldman Sachs Investment Arm	$130	Provides real-time information discovery services.
Jan-15	gluru	Gecad Ventures; Playfair Capital	$2	Develops a machine-learning platform that enables mobile users to find and organize their files.
Jan-15	Zoomi	ND	$4	Provides data analytics services. The Company captures fine granular behavioral data, subjects the data to machine learning algorithms, and delivers insight through data visualization whilst tailoring the user experience in real time.
Jan-15	Giant Gray	ND	$1	Develops a multi-sensor software platform that teaches itself to recognize and alert abnormal behavior patterns. The Company's platform provides insights from a many data sources across multiple sensor types.
Jan-15	Turi	Madrona Venture Group; New Enterprise Associates; Vulcan Capital; Opus Capital	$19	Develops a machine learning platform that enables data scientists and application developers to create intelligent applications. The Company's platform enables users to extract, transform, and load data from various sources.
Dec-14	MetaMind	Khosla Ventures	$8	Provides artificial intelligence solutions for enterprises. The Company's enterprise AI solutions are powered by deep learning.
Nov-14	Codetrails	High-Tech Gründerfonds Management	ND	Develops software tools for data analysis and machine-learning. The Company provides software development and integration services designed to improve knowledge transfer among developers.
Nov-14	Sentient	Access BridgeGap Ventures; Horizons Ventures; Tata Communications	$104	Develops a data-analysis technology to distribute artificial intelligence software platform to graphics and computer processors
Oct-14	PurePredictive	ND	$2	Provides a machine learning platform for predictive analytics. The Company offers PurePredictive, a cross enterprise solution that empowers and distributes data driven business analysis.
Oct-14	Argyle Data	ND	$5	Provides a real-time big data analytics platform for the processing and analysis of time-critical data.
Oct-14	Preferred Networks	Nippon Telegraph and Telephone Corporation	$2	Operates as a software development Company that focuses to apply real-time machine learning technologies to new applications in the emerging field of the Internet of Things.
Aug-14	Algorithmia	Deep Fork Capital; Rakuten Ventures; Madrona Venture Group	$2	Provides a marketplace that enables algorithm developer to explore, create, and share algorithms as a web services.
Jul-14	Arimo	Bloomberg Beta; Andreessen Horowitz; Lightspeed Venture Partners	$13	Delivers data intelligence applications for enterprises.
Jul-14	TappingStone	Azure Capital Partners; StartX; XG Ventures; Ironfire Capital; Kima Ventures; Quest Venture Partners; CrunchFund; Sood Ventures	$3	Provides an open source machine learning server for software developers.

Date Announced	Target Name	Buyers/Investors	Size ($M)	Target Business Description
Jun-14	Context-Based 4casting	Sequoia Capital Israel	$6	Provides precise predictive analytics solutions. The Company offers a solution that automatically builds a granular model for products at stores using data compression and machine learning algorithms.
May-14	Tamr	New Enterprise Associates; GV	$16	Designs and develops a commercial-grade solution to tackle the challenge of connecting and enriching data.
May-14	Predictry	Malaysian Development	ND	Provides predictive behavior, machine learning, and artificial intelligence services that help clients to make sense of data.
May-14	NLP Logix	ND	ND	Operates a cloud-based platform that specializes in predictive modeling and machine learning. The Company's platform uses the clients data to provide insights through predictive modeling.
Apr-14	Apigee	Bay Partners; Focus Ventures; Norwest Venture Partners; Sapphire Ventures; BlackRock; Wellington Management Group	$60	Develops a software platform that enables API-based digital strategies and business insights for enterprises.
Mar-14	ClearStory Data	Andreessen Horowitz; DAG Ventures; Khosla Ventures	$21	Designs and develops a web-based tool that gathers and explores diverse, dispersed sets of data from corporate data sources.
Mar-14	SetuServ	ND	ND	Develops a platform that enables users to derive insights from unstructured data using machine learning and curation.
Feb-14	PurePredictive	ND	$2	Provides a machine learning platform for predictive analytics. The Company offers PurePredictive, a cross enterprise solution that empowers and distributes data driven business analysis.
Feb-14	DataRPM	InterWest Partners; CIT GAP Funds	$5	Develops and provides a cognitive data science platform that automates machine learning on-cloud or on-premise for enterprises.
Feb-14	PredicSis	Innovacom Gestion	$1	Develops and provides machine learning solutions for predicting customer behavior and managing commercial environment.
Feb-14	TappingStone	500 Startups	ND	Provides an open source machine learning server for software developers.
Jan-14	Crosswise	ND	$2	Provides machine-learning based cross-device mapping data.
Jan-14	Wise.io	Voyager Capital	$4	Develops machine learning applications for the customer experience market.

Machine Learning M&A 2014 – 2017 YTD

Date Announced	Target Name	Acquirer Name	Enterprise Value ($M)	EV / LTM Revenue	LTM Revenue	Target Business Description
Jun-17	YhaT	Alteryx	ND	ND	ND	Provides a data science platform that allows data scientists to productionize, scale, and monitor predictive models in production applications, automate and track data science; and analyze data that runs natively on client's laptop.
May-17	Statistica	TIBCO Software	ND	ND	ND	Provides predictive analytics SaaS to businesses. The Company's software provides features for data monitoring and aggregation, standardized reporting and data deployment to sensors, smart devices and IoT equipment.
May-17	Lattice Data	Apple	ND	ND	ND	Offers data analytics solutions. The Company processes unstructured data including text and images.
May-17	Jemsoft	Xped	$1	ND	ND	Provides cognitive computing products and solutions for enterprises and developers. The Company also builds and implements artificially intelligent technologies that supplement media research and analytics systems for customers operating in the marketing sector.
May-17	MindMeld	Cisco Systems	$125	ND	ND	Provides artificial intelligence, conversation-based mobile user interface development software for developers.
May-17	ROKITT	Io-Tahoe	ND	ND	ND	Offers a data discovery software tool that enables companies to discover information about its data and data relationships through machine learning algorithms.
Apr-17	Birst	Infor Global Solutions	$75	1.9x	$40	Provides networked business intelligence analytics and reporting SaaS for businesse including data processing and aggregation, data warehouse automation, and the reporting and analysis.
Apr-17	PVCube	Element Data	ND	ND	ND	Provides an artificial intelligence and machine learning platform to predict and quantify human behavior.
Apr-17	Skytree	Infosys Technologies	ND	ND	ND	Provides big data and predictive analytics software and SaaS that analyzes data from databases and machine learning libraries for businesses.
Apr-17	ViDi Systems	Cognex	ND	ND	ND	Provides artificial intelligence and machine learning image analysis software to distinguish between acceptable variations and defects in the industrial sector.
Apr-17	Bosonit	Hiberus Tecnologías de la Información	ND	ND	ND	Designs and develops data visualization, big data, and machine learning solutions.
Mar-17	DataRPM	Progress Software Corporation	$30	ND	ND	Provides machine-learning and algorithm-enabled predictive analytics SaaS for industrial IoT connected device management.
Mar-17	Datacratic	Element AI	ND	ND	ND	Develops a machine learning and artificial intelligence technology platform that enables real-time machine based decisions to deploy into a range of applications.
Mar-17	Kaybus	Prysm	ND	ND	ND	Focuses on building solutions to problems in knowledge automation and presentation. The Company engages in building solutions using big data, analytics, mobility, social networking, and machine learning.
Mar-17	Kaggle	Google	ND	ND	ND	Provides a platform for data prediction competitions.
Mar-17	Sonalytic	Spotify	ND	ND	ND	Engages in developing of audio detection technology for the identification, monitoring, and discovery of music.

Date Announced	Target Name	Acquirer Name	Enterprise Value ($M)	EV / LTM Revenue	LTM Revenue	Target Business Description
Mar-17	Salford Systems	Minitab	ND	ND	ND	Provides predictive analytics, data mining, statistical analysis and web analytics software for businesses and educational institutions globally.
Feb-17	Neokami	Relayr	ND	ND	ND	Develops and markets machine-learning-as-a-service solutions that enable businesses to make predictive decisions in various areas.
Feb-17	Rover	Revcontent	ND	ND	ND	Provides content recommendation engine software based on machine-learning for consumers via web, iOS and Android mobile applications.
Feb-17	RealFace	Apple	ND	ND	ND	Develops face recognition software for biometric logins on mobile devices.
Feb-17	mldb.ai	Element AI	ND	ND	ND	Operates an open-source database designed for machine learning. The Company offers data science as a service that provides data and infrastructure audits and recommendations, isolates the type of user needs, and develops applications.
Feb-17	MiCampaña.com	ADEXT	ND	ND	ND	Provides a cloud based, big data, machine learning, and artificial intelligence marketing platform.
Feb-17	Niara	Hewlett Packard	$55	27.5x	$2	Provides machine learning-enabled behavioral analytics SaaS for enterprises. The Company's software provides features for the detection and forensic analysis of network security anomalies for the purposes of detecting threats and attacks.
Jan-17	Maluuba	Microsoft	ND	ND	ND	Provides deep machine learning research studies and publications online and develops human-generated natural language processing datasets for the artificial intelligence research community.
Dec-16	Surround.io	UIEvolution	ND	ND	ND	Develops machine learning software to aid computer vision for businesses in automotive and other sectors.
Dec-16	Twin Prime	Salesforce.com	ND	ND	ND	Provides software to businesses and developers to improve the performance and network connectivity of their mobile applications. The Company's software is optimized via machine learning algorithm analysis.
Dec-16	Geometric Intelligence	Uber Technologies	ND	ND	ND	Provides software development and research in artificial intelligence and machine learning.
Dec-16	Zementis	Software AG	$65	6.5x	$10	Provides IoT predictive analytics, data mining and event processing software and SaaS for businesses.
Nov-16	BrightTarget	Sidetrade	ND	ND	ND	Develops SaaS based predictive solutions for B2B sales and marketing professionals. The Company's software is used for customer profiling and retention, product recommendation, and predictive lead scoring.
Nov-16	Wise.io	GE Digital	ND	ND	ND	Provides machine learning customer service automation and predictive analytics software for businesses.
Nov-16	Brainspace Corporation	BC Partners	ND	ND	ND	Provides machine learning SaaS and software integration services for e-discovery and government agencies. The Company's software provides features for digital investigations, data analysis, natural language processing and document management.
Oct-16	Timbr.io	DigitalGlobe	ND	ND	ND	Provides a platform for collaborative intelligence for data science applications.

Date Announced	Target Name	Acquirer Name	Enterprise Value ($M)	EV / LTM Revenue	LTM Revenue	Target Business Description
Oct-16	AugmentIQ Data Sciences	Larsen & Toubro Infotech	ND	ND	ND	Provides big data BI analytics software and SaaS for businesses.
Oct-16	Viv	Samsung	$215	ND	ND	Develops an artificial intelligence interface that enables to interact with devices, services, and other platforms for individuals.
Sep-16	Altiscale	SAP	ND	ND	ND	Provides big data platform-as-a-service software featuring Hadoop, Spark, Apache Hive, Apache Pig and support for third-party applications such as H2O, Alation and AtScale
Sep-16	Tuplejump Software	Apple	ND	ND	ND	Provides big data, machine-learning predictive analysis software that enables developers to build scalable, intelligent applications.
Sep-16	Api.ai	Google	ND	ND	ND	Provides a natural language recognition application program interface (API) SaaS for use by developers to create conversational user interfaces for bots, applications, services and devices.
Sep-16	Blackbird Technologies	Etsy	ND	ND	ND	Develops proprietary machine learning technology that deliver search relevance and recommendations.
Sep-16	Movidius	Intel	ND	ND	ND	Develops and markets vision processing solutions.
Aug-16	SAIPS	Ford Motor Company	ND	ND	ND	Develops and implements algorithm-based software for 3D image and video processing and enhancement, deep learning, signal processing, recognition of patterns and anomalies, behavior prediction, and detection and tracking.
Aug-16	BeyondCore	Salesforce.com	$110	22.0x	$5	Provides big data and predictive analytics SaaS.
Aug-16	Nervana Systems	Intel	$400	ND	ND	Provides machine learning and AI-focused software for robotics, hardware, deep neural networks, and the automated processing of big data and software development across many markets.
Aug-16	Turi	Apple	ND	ND	ND	Provides open source, big data, machine-learning predictive analysis software that enables developers to build scalable, intelligent applications.
Jul-16	2338 Technologies	Predictive	ND	ND	ND	Develops machine learning technologies.
Jun-16	Spikenet Technology	BrainChip	$2	ND	ND	Provides AI-based computer vision software that uses machine learning to enable pattern recognition, intrusion detection, crowd demographics, traffic analysis, surveillance systems, shape recognition, and automatic inventory management applications.
Jun-16	Vibrant Data	Slice Technologies	ND	ND	ND	Provides machine learning-enabled data discovery, analysis and visualization SaaS for manufacturers and retailers. The Company's software enables the detection of obscure patterns and trends in multi-dimensional data for predictive modeling.
Jun-16	Magic Pony Technology	Twitter	ND	ND	ND	Provides machine learning and related image processing software and research for use on mobile and online devices. The Company's software enables enhanced image data for use in augmented reality applications.
Jun-16	Wand Labs	Microsoft	ND	ND	ND	Develops a mobile application that allows users to share music, videos, and locations.

Date Announced	Target Name	Acquirer Name	Enterprise Value ($M)	EV / LTM Revenue	LTM Revenue	Target Business Description
May-16	Itseez	Intel	ND	ND	ND	Provides open-source computer vision, machine learning and algorithmic pattern recognition software for automotive, robotics, surveillance, computer and electronics manufacturers.
May-16	ProbaYes	La Poste Group	ND	ND	ND	Provides probabilistic modeling, machine learning and predictive analytics software for enterprises globally.
May-16	Expertmaker	eBay	ND	ND	ND	Provides cloud-based AI-enabled search and recommendation engine optimization software for companies.
Apr-16	Crosswire	Oracle	$50	ND	ND	Develops novel device mapping technology used for cross-device advertising.
Apr-16	MetaMind	Salesforce.com	$48	ND	ND	Provides artificial intelligence solutions for enterprises powered by deep learning.
Mar-16	Encore Alert	Meltwater Group	ND	ND	ND	Owns and operates an online application that identifies key mentions and trends from social media and sends proactive alerts with recommended immediate actions.
Mar-16	EagleEye Analytics	Guidewire Software	ND	ND	ND	Offers predictive analytics software and consulting services.
Mar-16	Sense	Cloudera	ND	ND	ND	Provides enterprise big data analytics, data science modeling and related collaboration SaaS for use by data software engineers and data scientists.
Mar-16	Content Analyst Company	kCura	ND	ND	ND	Provides unstructured data and text analytics SaaS that enables machine learning-based digital discovery of correlations and insights within large amounts of unstructured content.
Mar-16	Framed Data	Square	ND	ND	ND	Provides machine learning-based data mining, insights and predictive modeling software that enables businesses to predict customer engagement and marketing strategy.
Feb-16	PredictionIO	Salesforce.com	ND	ND	ND	Provides an open-source machine learning virtual application server that enables software developers to design applications with predictive features such as personalization, recommendation and content discovery.
Feb-16	Mineset	ESI Group	ND	ND	ND	Provides data mining and business intelligence analytics and reporting SaaS for enterprises, research organizations, and US government agencies.
Feb-16	Swiftkey	Microsoft	ND	ND	ND	Develops keyboard applications that provide text predictions.
Jan-16	Gallop Labs	Big Viking Games	ND	ND	ND	Operates a prescriptive mobile marketing platform that aligns data science and in-app behavioral analytics to help brands and mobile publishers find and connect with audiences on Facebook and Twitter.
Jan-16	Emotient	Apple	ND	ND	ND	Operates a software platform that usees artificial intelligence technology to read people's emotions by analyzing facial expressions.
Dec-15	QuantumBlack Visual Analytics	McKinsey & Company	ND	ND	ND	Provides big data analytics and data visualization software development services and SaaS that enable organizational performance optimization though using machine-learning to combine data from disparate sources.

Date Announced	Target Name	Acquirer Name	Enterprise Value ($M)	EV / LTM Revenue	LTM Revenue	Target Business Description
Nov-15	Kreara Solutions	Innovation Incubator	ND	ND	ND	Provides prescriptive and predictive data analytics solutions worldwide.
Nov-15	Elastica	Blue Coat Systems	$280	ND	ND	Provides cloud security solutions for businesses and their employees. The Company offers a platform that enables transaction level security for cloud applications by combining data science, machine learning, real-time processing, visualization, and intuitive controls.
Oct-15	Saffron Technology	Intel	ND	ND	ND	Operates an artificially intelligent, cognitive computing platform that learns, reasons, and anticipates like clients and for clients.
Oct-15	Perceptio	Apple	ND	ND	ND	Develops an artificial intelligence software that allows phones to do advanced calculations without storing user data in the cloud.
Oct-15	Vocal IQ	Apple	ND	ND	ND	Builds a platform for voice interfaces for voice enable devices and applications.
Oct-15	Orbeus	Amazon	ND	ND	ND	Offers a cloud-based image analysis solution that identifies faces, scenes, and objects.
Aug-15	1010data	Advance Communication	$500	10.0x	50	Provides big data discovery and data sharing solutions for business and technical users. The Company's products enable business to perform predictive modeling and forecasting, machine learning solutions, and more.
Jun-15	Sunstone Analytics	CEB	$6	ND	ND	Develops machine learning based analytics tools to identify the features and phrases most associated with high performers, and screen and score applications against them.
Jun-15	Whetlab	Twitter	ND	ND	ND	Develops machine learning technologies based on artificial intelligence software.
May-15	Tempo AI	Salesforce.com	ND	ND	ND	Designs and develops enterprise mobility management solutions.
May-15	ColdLight Solutions	PTC	$100	13.8x	$7	Provides automated predictive analytics SaaS for companies and software developers in the retail, manufacturing and healthcare industries. The Company's software enables the analysis of large data sets for the detection of patterns to create predictive models.
Apr-15	TellApart	Twiter	ND	ND	ND	Operates a personalized predictive marketing platform. Its platform helps companies leverage customer data to drive sales through personalized marketing across digital channels and devices.
Apr-15	SequenceIQ	Hortonworks	$10	ND	ND	Provides an API and platform that enables enterprises and application developers to build predictive applications.
Mar-15	Alchemy API	IBM	ND	ND	ND	Provides natural language processing services through a SaaS API for various businesses and computing applications in the United States and internationally.
Jan-15	Revolution Analytics	Microsoft	ND	ND	ND	Provides big data predictive analysis software solutions for analytics-driven business, big data, data science, and industrial applications.
Jan-15	Equivio	Microsoft	ND	ND	ND	Provides software solutions for the management of data redundancy in content-centric business processes.

Machine Learning M&A 2014 – 2017 YTD (Cont.)

Date Announced	Target Name	Acquirer Name	Enterprise Value ($M)	EV / LTM Revenue	LTM Revenue	Target Business Description
Jan-15	Wit.ai	Facebook	ND	ND	ND	Provides natural language solutions. The Company enables developers to add a natural language interface to their applications or devices.
Nov-14	EraTera Technologies	Searce	ND	ND	ND	Engages in mining semantic information from text and speech data and building intelligent applications to solve contemporary technical challenges.
Oct-14	Dark Blue Labs	Google	ND	ND	ND	Develops algorithm-based artificial intelligence deep learning and data processing software to enable natural language computer learning and other AI systems for businesses.
Oct-14	Vision Factory	Google	ND	ND	ND	Develops algorithm-based artificial intelligence deep learning and data processing software to enable object recognition, mobile embedded AI software and text recognition for businesses.
Jul-14	Madbits	Twitter	ND	ND	ND	Develops a visual artificial intelligence software that understands, organizes, and extracts relevant information from raw media.
Jun-14	Radoop	RapidMiner	ND	ND	ND	Provides big data analytics solutions.
May-14	Cognea	IBM	ND	ND	ND	Designs and develops artificial intelligence technology platform for creating interactive virtual agents to chat.
May-14	MeshLabs Software	Pegasystems	$1	ND	ND	Develops software solutions for text mining and analytics.
May-14	Convertro	AOL	ND	ND	ND	Provides multi-touch attribution modeling technology for brands and agencies.
Apr-14	Novauris Technologies	Apple	ND	ND	ND	Develops server-based and embedded speech recognition systems to OEMs.
Jan-14	DeepMind Technologies	Google	ND	ND	ND	Develops artificial intelligence systems. The Company's products include a computer system which is capable of understanding and playing a computer game by looking at it on a screen.

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with Global Reach**

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- High transaction volume fuels deep market knowledge and extensive worldwide technology contacts

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- Headquartered in Boston with offices in Silicon Valley, New York, London, and Minneapolis

Tech M&A Banking Top 2016 Dealmakers

451 Research®

	TECHNOLOGY	
	Firm	**# Trans.**
1.	Morgan Stanley	45
2.	William Blair & Co	30
3.	J.P. Morgan Securities Inc.	29
4.	Goldman Sachs	27
5	Evercore Partners	23
6.	**AGC Partners**	**22**
7.	Houlihan Lokey	22
8.	Raymond James	22
9.	GCA Altium	20
10.	BOA Merrill Lynch	17
11.	Jefferies	17
12.	Qatalyst Partners	16
13.	Arma Partners	15
14.	Petsky Prunier	15
15.	Pacific Crest Securities	13
16.	Pagemill Duff & Phelps	13
17.	Robert W. Baird & Co.	12
18.	JEGI	12
19.	Signal Hill	12
20.	Credit Suisse Securities	11

SOFTWARE

BI / Analytics	Vertical SaaS
CRM	Automotive
ECM	Building / Engineering
ERP	Education
FinTech / Payments	Healthcare
HCIT / Life Sciences	Legal
HCM	Non-Profit
IT Services	Public Sector
Marketing / Sales Automation	Real Estate
Supply Chain	Retail
Technical Software	Travel & Expense

Fred Joseph   **Jon Guido**   **Ben Howe**   **Dennis Rourke**   **Hugh Hoffman**

Doug Hurst   **Greg Roth**   **Elena Marcus**   **Trevor Martin**   **Charlie Schopp**

SECURITY

Cybersecurity	Security Orchestration
Advanced Threat Defense	Security Services
CASB	Threat Intelligence
Endpoint	User Behavior Analytics
Identity Access Management	Vulnerability
Network	IOT / SCADA

Maria Lewis Kussmaul   **Ben Howe**   **Joe Dews**   **Russ Workman**   **Eric Davis**

DIGITAL MEDIA & INTERNET

AdTech	Internet
Consumer	Mobile
E-Commerce	Social
Food Tech	Virtual Reality / Augmented
Gaming	Reality

Jon Guido   **Elena Marcus**   **Gee Leung**   **Linda Gridley**   **Charlie Schopp**

INFRASTRUCTURE

Big Data	Energy & Industrial Tech
Cloud Computing	Internet of Things
Communications Infrastructure	Mobility Solutions
Data Center	Semiconductors
	Storage

Scott Card   **Markus Salolainen**   **Joe Dews**   **Rob Buxton**   **Fred Joseph**

Client	Investor	Check Size / Enterprise Value	Process and Outcome
certify travel & expense made easy	K1	ND / ND	• AGC advised Certify, a leading enterprise SaaS company, on a majority investment from K1 Investment Management, a leading technology-focused PE fund • In a targeted approach, AGC reached out to a select group of the top PE technology investors in a highly competitive process • The invested capital provides liquidity for the founders and angel investors, enables a large acquisition for Certify, and allows for the significant operational expertise of K1 to help Certify continue to scale
ZAPPROVED	Vista Equity Partners	ND / ND	• Zapproved engaged AGC Partners to complete a large minority/majority PE financing • In less than 30 days, AGC had engaged the leading global PE tech investors in a highly competitive auction which resulted in Vista Equity taking a controlling position in the company • The investment provided liquidity for angel investors, added cash to the balance sheet, and resulted in a strong strategic relationship for Zapproved to benefit from Vista's expertise in building enterprise SaaS companies
Building Engines	WAVECREST GROWTH PARTNERS	$27M / ND	• AGC helped Building Engines, a leading real estate software provider, raise $27M • After bringing in multiple term sheets, with both minority and majority options, AGC assisted Building Engines in choosing the right partner with which to move forward • The capital was a mix of primary and secondary for liquidity to shareholders and fuel strategic growth
Buildium Property Managed.	Sumeru EQUITY PARTNERS	$65M / ND	• AGC kicked off a highly competitive growth equity process that ultimately brought in 8 term sheets from prospective investors • Buildium moved forward with Sumeru and closed a $65M capital raise • The capital was a mix of primary and secondary to provide liquidity to shareholders and K1, and to fuel future strategic growth
litmus	SPECTRUM EQUITY	$49M / ND	• AGC advised Litmus on a $49M capital raise that valued the company at 6x revenues • AGC leveraged inbound interest to drive an intense 60-day process, soliciting multiple preemptive term sheets from top PE and strategic buyers, representing a valuation that was over 2x the original offer • The invested capital was a mix of primary and secondary to provide liquidity to the existing shareholders and to drive strategic growth initiatives
erecruit	NORTH BRIDGE growth equity	$25M / ND	• AGC closed a $25M investment led by North Bridge Growth Equity • The transaction included primary and secondary capital to provide liquidity to shareholders and to finance erecruit's first growth equity round
planet fitness	TSG CONSUMER PARTNERS	$375M / $535M	• AGC advised Planet Fitness on a $375M capital raise led by TSG Consumer Partners at a $535M value • AGC conducted a frenzied auction in the middle of August and signed the definitive agreement roughly 60 days after signing the engagement letter • Planet Fitness went public on the NYSE in August 2015 opening at an implied equity value of $1.6B, 4.3x the pre-money equity valuation at the close of the AGC transaction
MANDIANT	KPCB	$70M / $145M	• AGC advised Mandiant on a $70M capital raise at a $145M valuation and 5.1x revenue multiple • The proceeds were used to repurchase shares from investors and to fuel strategic growth initiatives • Mandiant leveraged KPCB's knowledge and expertise following the investment and grew rapidly before being acquired by FireEye in 2014 for $1B, 6x the pre-money equity value of the AGC growth equity transaction

Source: 451 Research

Market-Defining M&A

Client	Buyer	EV / Revenue Multiple	Process and Outcome
SIMPLYGON	Microsoft	ND / ND	• AGC advised Simplygon, an AR / VR company, on its sale to Microsoft in January, 2017 • Within two weeks of launching a market test, AGC generated multiple in-person meetings including several top global technology strategic buyers • The highly competitive process generated multiple strategic bids • Upon receiving Microsoft's term sheet, AGC negotiated seller friendly terms and our client signed the term sheet within 24 hours
FMCG Direct	DELUXE	$200M / ND	• AGC advised FMCG Direct, a leading data-driven marketing services provider to financial services on its sale to Deluxe Corporation (NYSE: DLX) • The Company had inbound interest from multiple parties which AGC fielded, keeping the appropriate amount of tension to create a competitive bidding environment • AGC commenced outreach in less than two weeks of engagement resulting in over 40 NDAs signed and ~20 meetings with management • AGC leveraged the high level of interest it collected from the outreach to negotiate a more compelling offer and better terms for FMCG
L2	Gartner	ND / ND	• AGC advised L2, a provider of digital performance benchmarking to Fortune 500 brands, on its sale to Gartner • AGC ran a highly efficient, disciplined process, reaching out to a carefully selected group of top digital media buyers and receiving multiple term sheets • The Company's price expectations were very specific; AGC drove effective price valuation rationales to get buyers to meet those expectations and adopt a view of L2's data driven digital measurement capabilities as potentially transformative to their business
iSIGHT PARTNERS	FireEye	$275M / 7.4x	• AGC initially advised iSIGHT on their $30M capital raise from Bessemer in 2014, and subsequently advised the Company on their sale to FireEye (Nasdaq: FEYE) in January 2016 • In light of inbound interest, AGC was engaged to run a rapid, highly disciplined M&A process to test the market and simultaneously stoke existing interest from the buyer at the table • By positioning iSIGHT's superior technology, continued market traction, and viable growth strategy to the market, AGC was able to drive a competitive process that improved negotiating leverage resulting in optimal deal terms and a massive exit multiple
Cognilytics	CenturyLink	ND / ND	• AGC advised Cognilytics on a sale to CenturyLink • AGC reached out to a targeted group of potential acquirers; of that group, several parties conducted an evaluation of the business and held introductory meetings with the management team • Following receipt of an LOI, AGC pushed other prospective acquirers into a competitive process that resulted in a higher enterprise value and better terms with the ultimate acquirer, CenturyLink
PROLEXIC	Akamai	$400M / 8.5x	• AGC initially advised Prolexic on their $30M capital raise led by Trident Capital and Intel in 2013, and subsequently advised the Company on their $400M dollar sale to Akamai • Following a competitive financing round, Prolexic was approached by Akamai to be acquired • By driving an extremely competitive process and providing access to the right decision makers, AGC was able to achieve an 8.5x acquisition transaction multiple
SS&C	THE CARLYLE GROUP	$1B / 8.0x	• AGC advised SS&C on a $1 billion dollar sale to the Carlyle Group at an 8x revenue multiple • AGC set up an intense 2-day roadshow with the top 6 technology buyout firms: Carlyle, Summit, Thomas Lee, Tudor, Warburg Pincus, Welsh Carson • AGC created an auction environment and generated bids in 30 days • AGC drove a 80% premium to the pre-deal trading price

Source: 451 Research

Accenture	CableVision	Fiserv	Johnson Controls	QinetiQ	Telefonico
Activision		France Telecom	Juniper Networks		Tellie
Adobe	Capgemini	Fujitsu	Kronos	Quest Software	Teradata
Adobe	CBS	Gannett	L3	RackSpace	Thales
ADP	Check Point	GE Security	LG	Raytheon	Thomson Reuters
Affinion	Cisco	Gemalto	Liberty Media	ReachLocal	TIBCO
Akamai	Citrix Systems	Genband	LinkedIn	Redhat	Time Warner
Alcatel-Lucent	Comcast / NBC	General Dynamics	Lockheed Martin	Rediff.com	Trend Micro
Alibaba	commvault	Getty Images	McAfee	Rocket	Trustwave
Amazon	Compuware	Google	SGI	Sage	Twitter
Amdocs	Constant Contact	Groupon	Manhattan Associates	SAIC	Tyco
Ancestry.com	CSC	GSI Commerce	Manpower	Salesforce	Ultra Electronics
AOL	Deloitte	Harland Clarke	ManTech	Samsung	Unify
Apple	Descartes	Harris	Mercadolibre	SAP	United Online
ASG Software	Deutsche Telecom	Harte-Hanks	Micro Strategy	Schneider Electric	ValueClick
Assurant	Digital River	HCL	Microsoft	Scripps	Verizon
AT&T	Discover	Hitachi	Motorola	Seagate	Viacom
Avast	Discovery	Hitachi	NEC	Siemens	Virgin Media
Avaya	Disney	Honeywell	NetApp	SingTel	Visa
AVG	eBay	HP	Netscout	SK Telecom	Vivendi
BAE Systems	Electronic Arts	HTC	New / Asurion	Software AG	VMware
Baidu	EMC	Huawei	New York Times	Solarwinds	Web.com
Barracuda Networks	Equifax	IAC	News Corp.	Sony	Webroot
BestBuy	Equinix	IBM	Nokia	Sprint	Western Digital
Blue Coat	Ericsson	Informatica	Nokia Siemens Networks	SRA	Western Union
BMC software	Expedia	Infospace	Northrop Grumman	Staples	Wipro
Boeing	Experian	Infosys	NTT	Sunguard	WPP
Bosch Security	f5	Intel	Oracle	Symantec	Xerox
British Sky Broadcasting	Facebook	Intermec	Orbitz	Syntel	Yahoo!
Brocade	Fair Isaac Software	Internet Brands	Pegasystems	TATA	
BT	FICO	Iron Mountain	Pitney Bowes	Tech Mahindra	Zynga
CA	First Data	JDSU	Publicis	Tekelec	

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San Francisco
February, 2017

London
June, 2017

Boston
November, 2017

- Three annual technology conferences optimized for private companies and entrepreneurs

- Leveraging a robust and proprietary 1-on-1 meeting format to arrange 6,000+ meetings between private company CEOs and investors/buyers at events throughout the year

- High-caliber panel discussions featuring renowned tech industry experts on hot topics and trends

- Leading public and private emerging growth companies spanning all major tech sectors, including Cloud/SaaS, FinTech, HCIT, E-Commerce, Infrastructure, IoT, Security, Mobile and Social, regularly attend our conferences

- 2,000 professionals from all of the leading PE / VC firms and corporate venture funds and strategic buyers attended our conferences over the past 12 months

- San Francisco 2017 featured 450 technology companies and 3,500+ 1-on-1 meetings

- Boston 2016 featured 170 technology companies and 1,500+ 1-on-1s

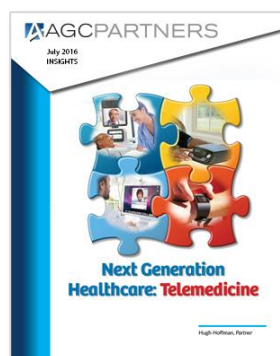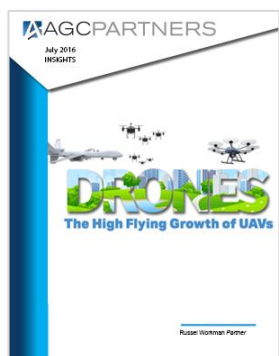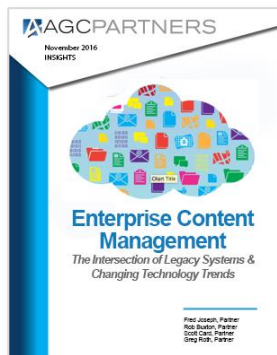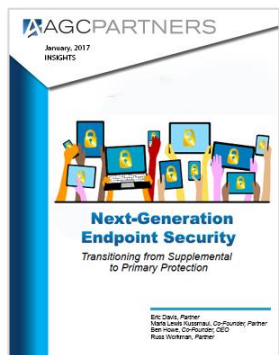- London 2017 featured 100 technology companies and 1,000+ 1-on-1s

- Our Partner authored "Insights" publications insure that we are ahead of important sector and financing trends

- We uncover new technologies that are beginning to emerge

- We uncover new companies in emerging landscapes

- We maintain dialog with the most active investors and strategic buyers

- We distribute to a proprietary list of over 10,000 industry participants

INFORMATION SECURITY & DEFENSE

SOFTWARE / TECH ENABLED SERVICES / ENERGY TECH

COMMUNICATIONS / SEMICONDUCTOR / IT INFRASTRUCTURE

DIGITAL MEDIA & INTERNET

HCIT

FIN TECH

Gary Gauba, President, Advanced Solutions Group, CenturyLink

Gary founded and successfully sold three companies—Softline, Systech, and Cognilytics—all with AGC Partners as his advisor

There is nobody I would rather have in my corner…

"AGC inherited a complex situation, boiled it down to a very consumable story and ran a highly efficient and effective process. Ultimately they found the best buyer in Providence Equity, and drove a premium valuation for Untangle. There is nobody I would rather have in my corner than Russ and AGC." – **Untangle sold to Providence Equity**

Provided invaluable counsel and execution support…

"Jon and his team were an incredible team of advisors and execution partners. At every step they provided invaluable counsel and execution support that changed what could have been a challenging process into an event that changed the lives of our senior officers and entire team. We were so delighted with the AGC Partners team that we increased their compensation above our initial agreement." – **FMCG sold to Deluxe Financial**

Leveraged multiple indications of interest into an excellent outcome…

"AGC leveraged multiple indications of interest into an excellent outcome for all of our stakeholders, and provided advice to the Board and management that effectively balanced the deal structure and pricing." – **M-Files raised a financing round from Partech Ventures**

We're thrilled with the outcome…

"We're thrilled with this outcome and greatly appreciate Maria's hard work over the years as well as that of her team in helping to guide us to this point." – **iSight Partners sold to FireEye**

24 x 7 commitment, creativity, and persistence…

"Their 24x7 commitment, creativity, and persistence drove continuous progress and kept communications flowing throughout the engagement." – **Cognilytics sold to CenturyLink**

Super smart, responsive, and insightful…

"It was a pleasure working with AGC. Their commitment to the process was palpable. They have a very strong team who were not only super smart and responsive but also insightful and very well versed on our industry." – **Litmus raised a financing round from Spectrum Equity**

Head and shoulders above the others…

"I've had the chance to work with many investment banks over the years. AGC stands head and shoulders above the others in three areas: they invested the time and energy to get to know our business at a really granular level; they were tirelessly persistent in working to achieve a great outcome; and the quality of both tactical and strategic advice that I received from Jon Guido was exceptional." – **Cartera Commerce sold to Ebates**

✓ Strong Relationships with the Leading Strategic and Financial Buyers and Growth Equity Investors

✓ Outstanding Sector Knowledge Enables AGC to Effectively Position our Clients in the Market

✓ One of the Largest Global Technology Banking Teams

✓ Engagements Led by Partners, Not Handed Down to Junior Bankers

✓ Premier Industry Investor Conferences

✓ AGC Drives Both Big and Small Deals to Premium Valuations