Microsoft

Advanced Analytics & AI on Azure

Nishant Thacker
Technical Product Manager
Analytics & AI

Advanced Analytics & AI represents a growing opportunity

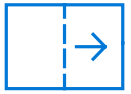
Global business value derived from **AI in 2022** will reach

"Forecast: The Business Value of Artificial Intelligence, Worldwide, 2017-2025", Gartner, April 2018.

Adopting Advanced Analytics and AI in your company

Where do you see **your company today?**

Where do you see your **top competitors today?**



Where do you see **your company in the future?**

Analytics Capabilities

← BASIC — ADVANCED →

Helping you innovate across your business

Marketing

Product Recommendation

Customer Insights

Churn Analytics

Sales

Lead Scoring

Sales Insights

Dynamic Pricing

Service

Intelligent chatbots

Virtual Assistants

Waiting line optimization

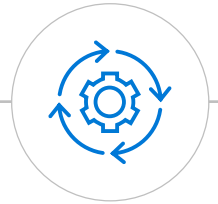
Finance

Financial Forecasting

Cash Flow Forecasting

Risk Management

Operations

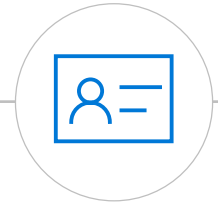


Predictive Maintenance

Demand Forecasting

Quality Assurance

Workforce



Employee Insights

HR Insights

Resource Planning

Leading to transformational changes

Product recommendation

The average size of a single cart has decreased

Provide personalized digital content to shoppers

Increase cart size

ASOS delivers 15.4 million personalized experiences with 33 orders per second

Predictive maintenance

Unplanned downtime results in cost overruns

Predict when maintenance should be performed

Minimize downtime

Hybrid solution predicts onboard water usage, saving $200k/ship/year

Demand forecasting

Solar energy production is inconsistent

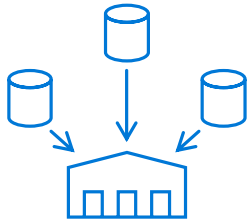
Align energy supply with the optimal markets

Maximize revenue

Distributed power generation increases revenue by over €100 million

How companies are transforming

Serving business users and end users with **intelligent** and **dynamic** applications

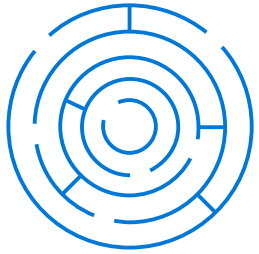


Build a unified and usable data pipeline

Train ML and DL models to derive insights

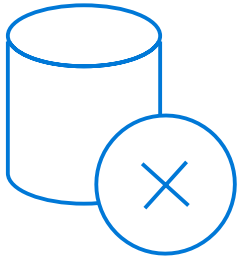
Operationalize models and distribute insights at scale

But there's a lot to consider



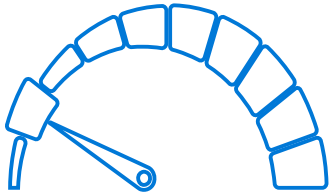
Complexity of solutions

Many options in the marketplace



Data silos

Incongruent data types



Difficult to scale effectively

Performance constraints

Microsoft has a comprehensive solution for Data & AI

Azure Data + AI Solution Areas

Data

Data Modernization on-premises

Data modernization to Azure

Globally distributed data

Cloud Scale Analytics

+

AI

AI apps & agents

Knowledge mining

Machine learning

Azure Data + AI Solution Areas

Data

Data Modernization on-premises

Data modernization to Azure

Globally distributed data

Cloud Scale Analytics

+

AI

AI apps & agents

Knowledge mining

Machine learning

Overview of Microsoft's Data Science & Machine Learning Portfolio

Machine Learning on Azure

Domain specific pretrained models
To reduce time to market


Vision


Speech


Language


Search

Familiar Data Science tools
To simplify model development


PyCharm


Jupyter


Visual Studio Code


Command line

Popular frameworks
To build advanced deep learning solutions


Pytorch


TensorFlow

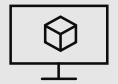

Scikit-Learn


Onnx

Productive services
To empower data science and development teams


Azure Databricks


Azure Machine Learning


Machine Learning VMs

Powerful infrastructure
To accelerate deep learning


CPU


GPU


FPGA


From the Intelligent Cloud to the Intelligent Edge


Sophisticated pretrained models

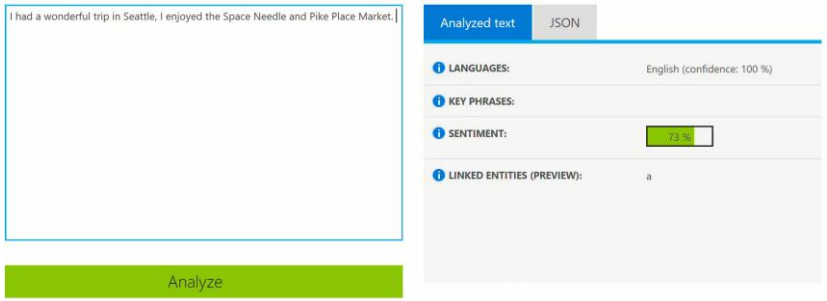
Infuse apps with powerful, pre-trained AI models

Customize easily and tailor to your needs

Vision

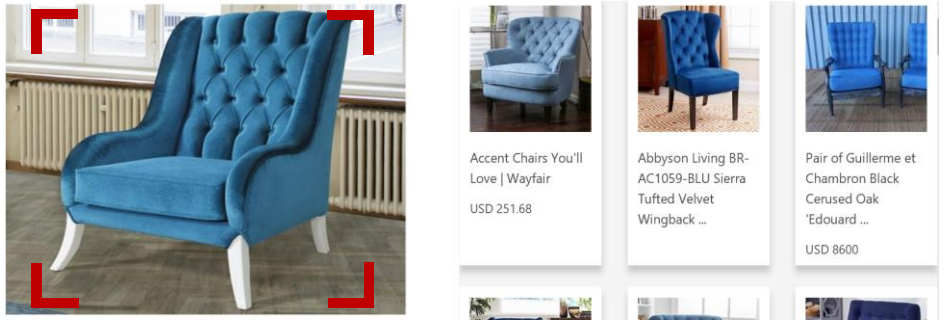
Computer Vision | Video Indexer | Face | Content Moderator

Language



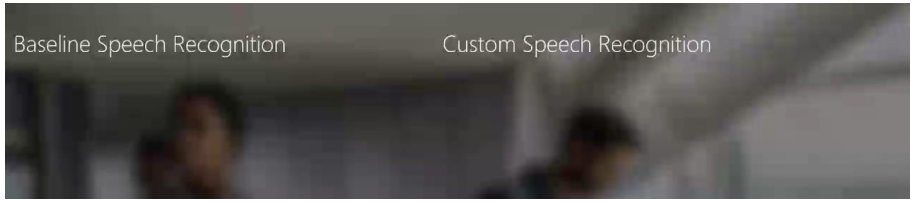
Text Analytics | Spell Check | Language Understanding | Text Translation | QnA Maker

Bing Search



Big Web Search | Video Search | Image Search | Visual Search | Entity Search | News Search | Autosuggest

Speech



Speech to Text | Text to Speech | Speech Translation | Speaker Recognition

Productive services

Empower data science and development teams

Integrated data science & data engineering teams

Desktop solutions not adequate

Need a unified big data & machine learning solution

Individual data scientists

Desktop solutions adequate

Need cloud for sporadic compute needs

Azure Databricks + Azure Machine Learning service

Machine Learning VMs

Azure Databricks

Fast, easy, and collaborative Apache Spark™-based analytics platform

Increase productivity

Build on a secure, trusted cloud

Scale without limits

Built with your needs in mind

- Optimized Apache Spark environmnet
- Collaborative workspace
- Integration with Azure data services
- Autoscale and autoterminate
- Optimized for distributed processing
- Support for multiple languages and libraries

Seamlessly integrated with the Azure Portfolio

Azure Machine Learning service

Bring AI to everyone with an end-to-end, scalable, trusted platform

Boost your data science productivity

Increase your rate of experimentation

Deploy and manage your models everywhere

Built with your needs in mind

- Automated machine learning
- Managed compute
- DevOps for machine learning
- Simple deployment
- Tool agnostic Python SDK
- Support for open source frameworks

Seamlessly integrated with the Azure Portfolio

Powerful infrastructure

Accelerate deep learning

CPUs

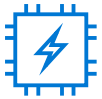
General purpose machine learning

D, F, L, M, H Series

GPUs

Deep learning

N Series



FPGAs

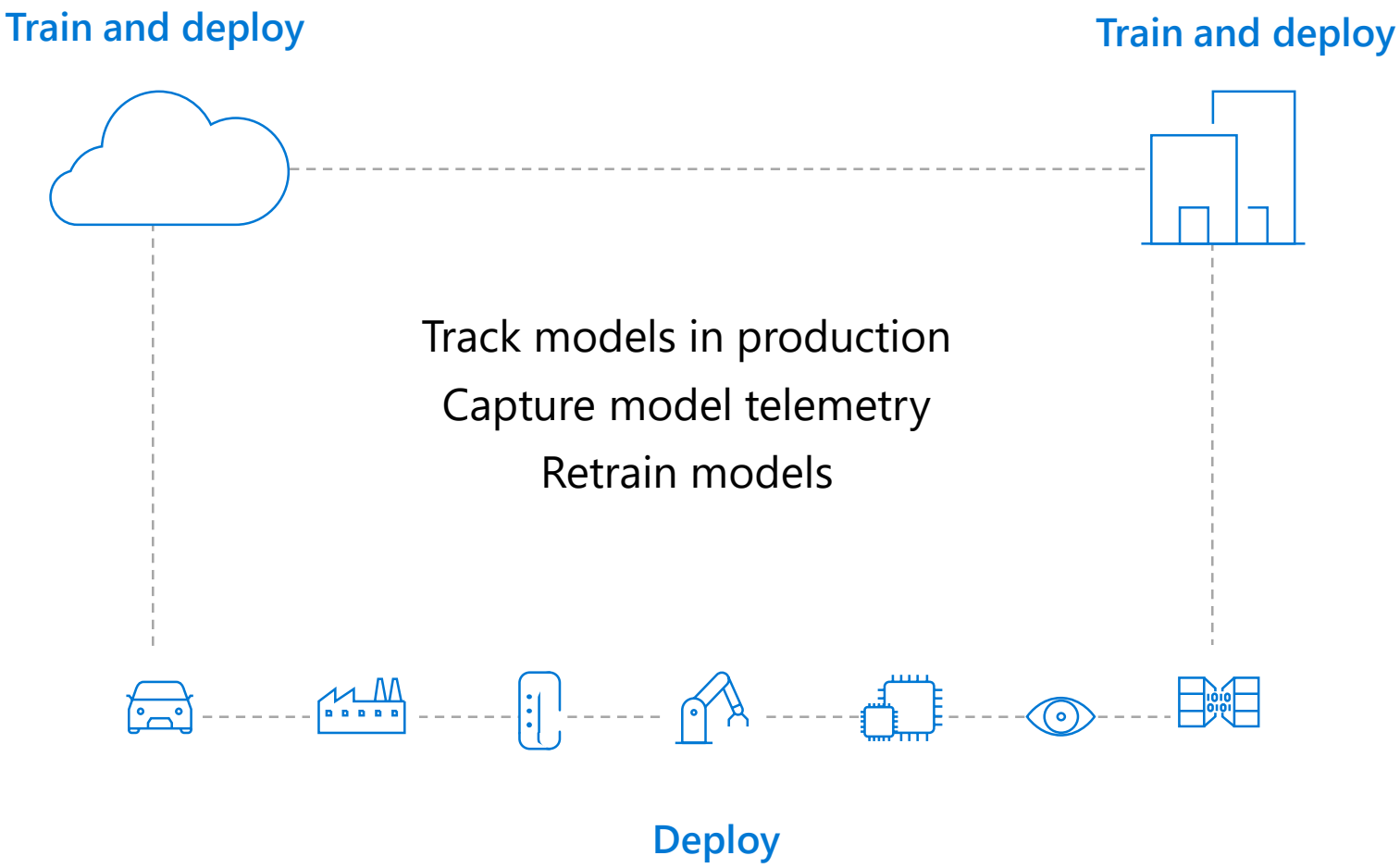
Specialized hardware accelerated deep learning

Project Brainwave

Optimized for flexibility ← → **Optimized for performance**

Flexible deployment

From the Intelligent Cloud to the Intelligent Edge



Machine Learning on Azure

Quickly and easily build, train, deploy and manage your models

Domain Specific Pretrained Models
To reduce time to market


Vision


Speech


Language


Search

Familiar Data Science tools
To simplify model development


PyCharm


Jupyter


Visual Studio Code


Command line

Popular Frameworks
To build machine learning and deep learning solutions


ONNX


Pytorch


TensorFlow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Productive Services
To empower data science and development teams


Azure Databricks


Azure Machine Learning


Machine Learning VMs

Powerful Infrastructure
To accelerate deep learning


CPU

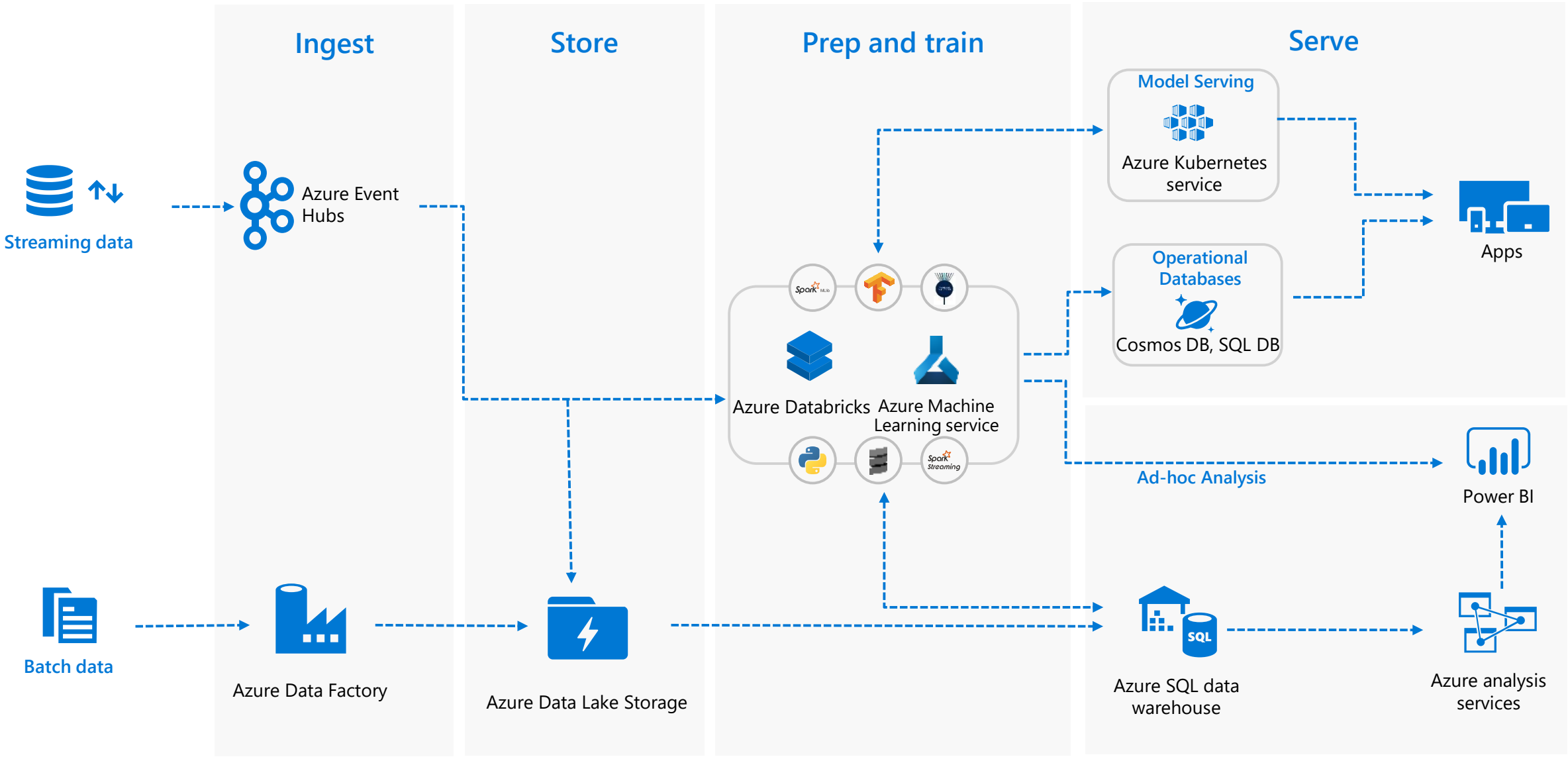

GPU


FPGA

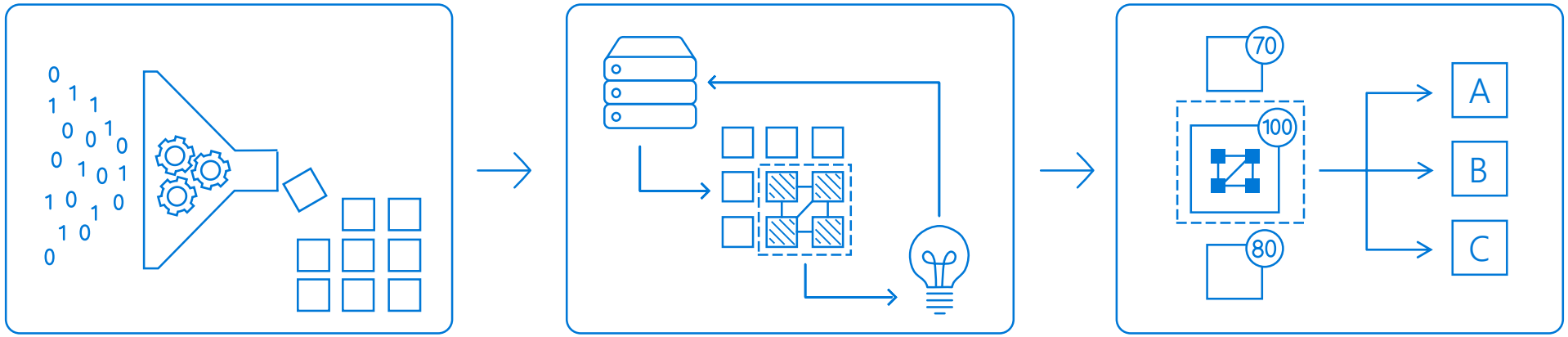

From the Intelligent Cloud to the Intelligent Edge


Understanding the Data Science Process on Azure

Recommended architecture to build e2e ML solutions



PREP & TRAIN

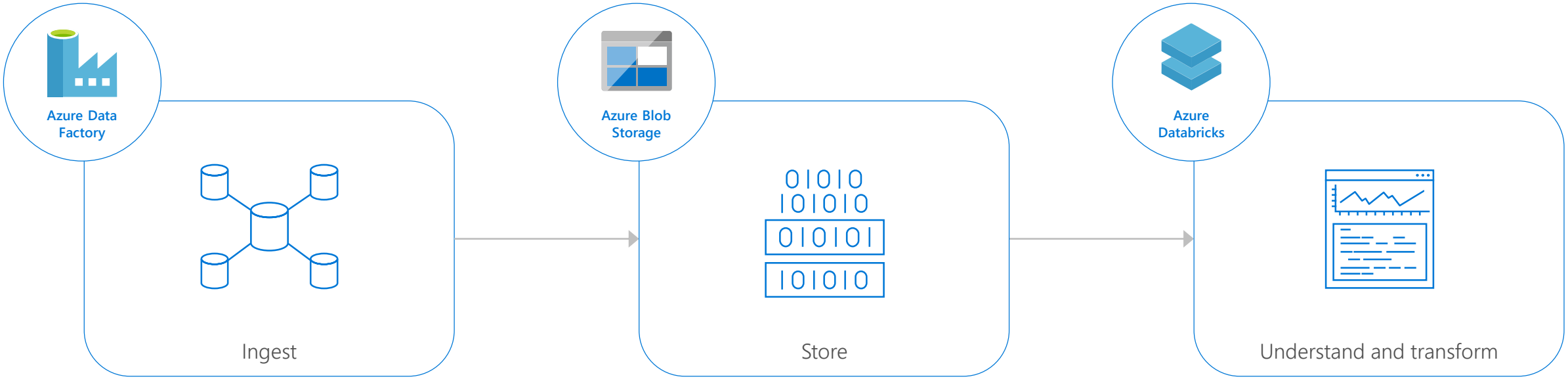


Collect and prepare data

Train and evaluate model

Operationalize and manage

Collect and prepare all of your data at scale



Connect to data from any source

- Integrate with all of your data sources
- Create hybrid pipelines
- Orchestrate in a code-free environment

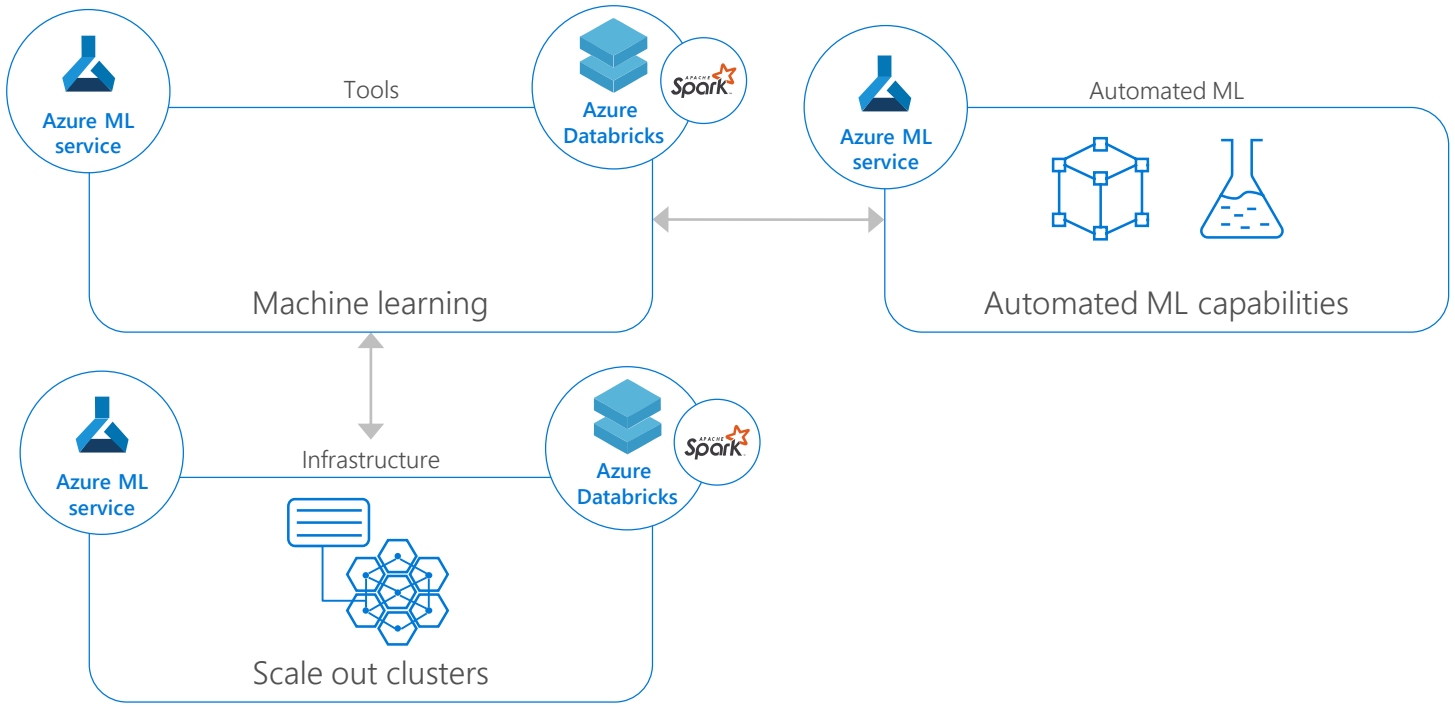
Leverage best-in-class analytics capabilities

- Leverage open source technologies
- Collaborate within teams
- Use ML on batch streams

Scale without limits

- Build in the language of your choice
- Leverage scale out topology
- Scale compute and storage separately

Train and evaluate machine learning models



Simplify model development

- Collaborate in interactive workspaces
- Access a library of battle-tested models
- Automate job execution

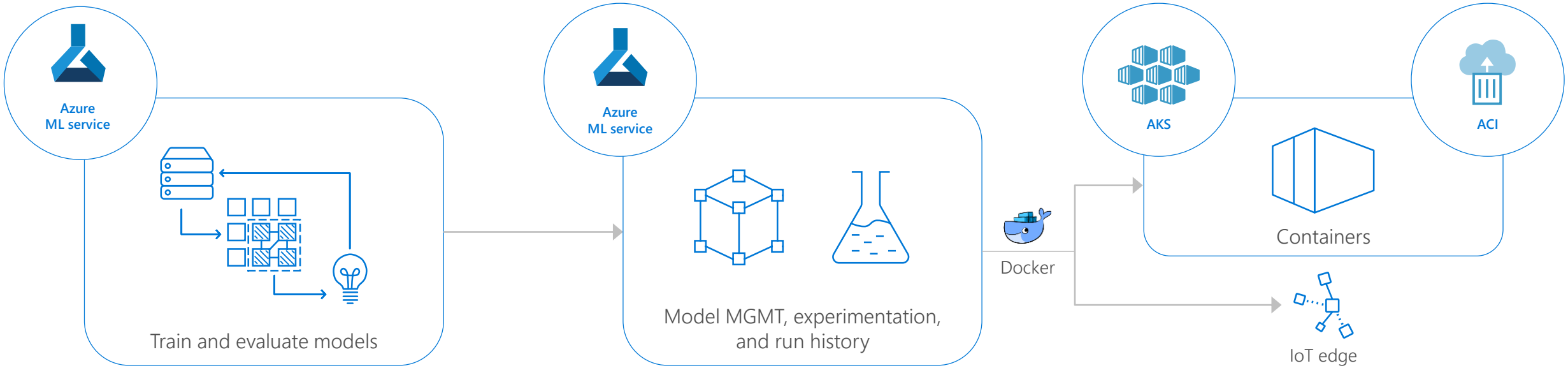
Scale compute resources to meet your needs

- Easily scale up or scale out
- Autoscale on serverless infrastructure
- Leverage commodity hardware

Quickly determine the right model for your data

- Determine the best algorithm
- Tune hyperparameters to optimize models
- Rapidly prototype in agile environments

Operationalize and manage models with ease



Bring models to life quickly

- Build and deploy models in minutes
- Iterate quickly on serverless infrastructure
- Easily change environments

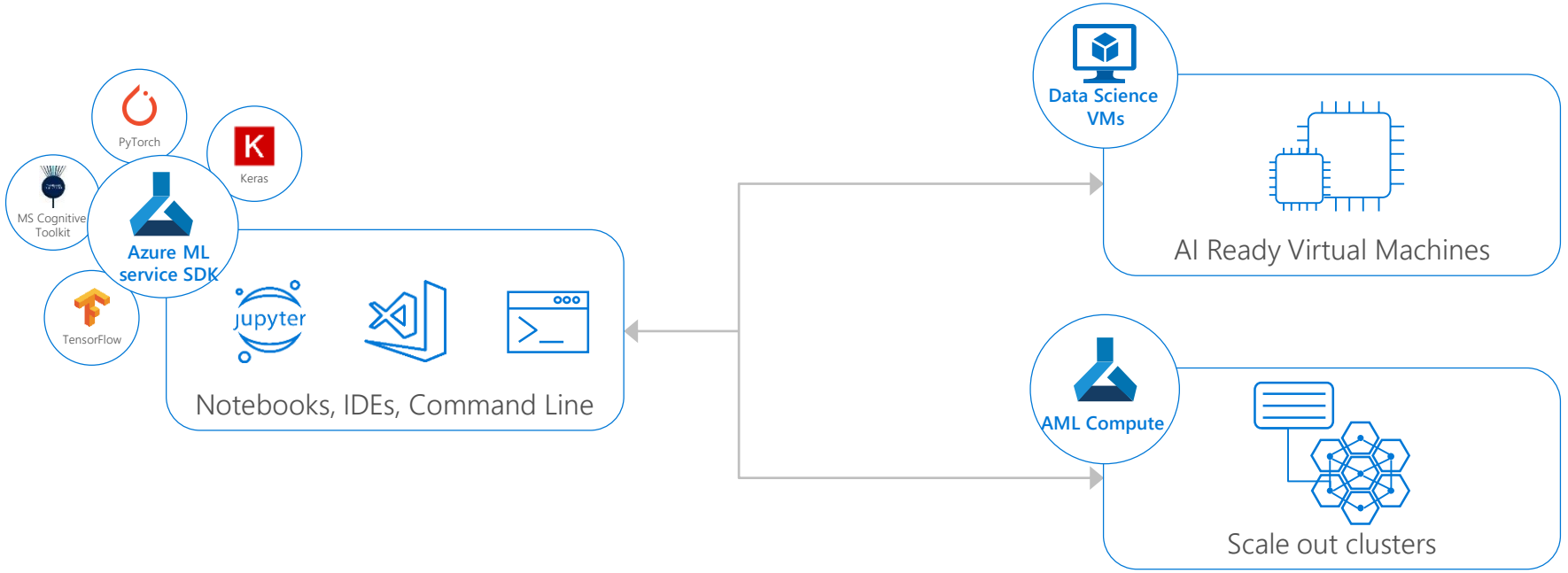
Proactively manage model performance

- Identify and promote your best models
- Capture model telemetry
- Retrain models with APIs

Deploy models closer to your data

- Deploy models anywhere
- Scale out to containers
- Infuse intelligence into the IoT edge

Build and deploy deep learning models



Streamline AI development efforts

- Leverage popular deep learning toolkits
- Develop your language of choice

Scale compute resources in any environment

- Choose VMs for your modeling needs
- Process video using GPU-based VMs

Quickly evaluate and identify the right model

- Run experiments in parallel
- Provision resources automatically

Azure Databricks for deep learning model

Ready-to-use clusters with Azure Databricks Runtime for ML

Tools

Use HorovodEstimator via a native runtime to enable build deep learning models with a few lines of code

Load images natively in Spark DataFrames to automatically decode them for manipulation at scale with distributed DNN training on Spark

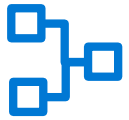
Simultaneously collaborate within notebooks environments to streamline model development

Frameworks

Full Python and Scala support for transfer learning on images

Seamlessly use TensorFlow, Microsoft Cognitive Toolkit, Caffe2, Keras, and more

Use built-in hyperparameter tuning via Spark MLLib to quickly optimize the model



Infrastructure

Leverage powerful GPU-enabled VMs pre-configured for deep neural network training

Automatically store metadata in Azure Database with geo-replication for fault tolerance

Improve performance 10x-100x over traditional Spark deployments with an optimized environment

Machine Learning Product Investments

Machine Learning Investments

Enhance existing capabilities

Azure Databricks Remote support for other IDEs outside of native notebooks

MLFlow for better DevOps with Azure Databricks and other ML pipelines

Azure Machine Learning Python SDK support for popular IDEs & notebooks, including Azure Databricks

Azure Machine Learning managed compute capabilities

Introduce new models for FPGA scoring

Introduce new capabilities

Robust ONNX support - runtime engine in AML, model operationalization in SQL Server

Automated machine learning

Deploy and manage models to IoT edge

Extend Machine Learning services to SQL DB

Continue simplify machine learning

Leverage deep learning services and frameworks

AZURE ML SERVICE

Bring AI to the edge

Increase your rate of experimentation

Deploy and manage your models everywhere

AZURE DATABRICKS

Accelerate processing with the fastest Apache Spark engine

Integrate natively with Azure services

Access enterprise-grade Azure security

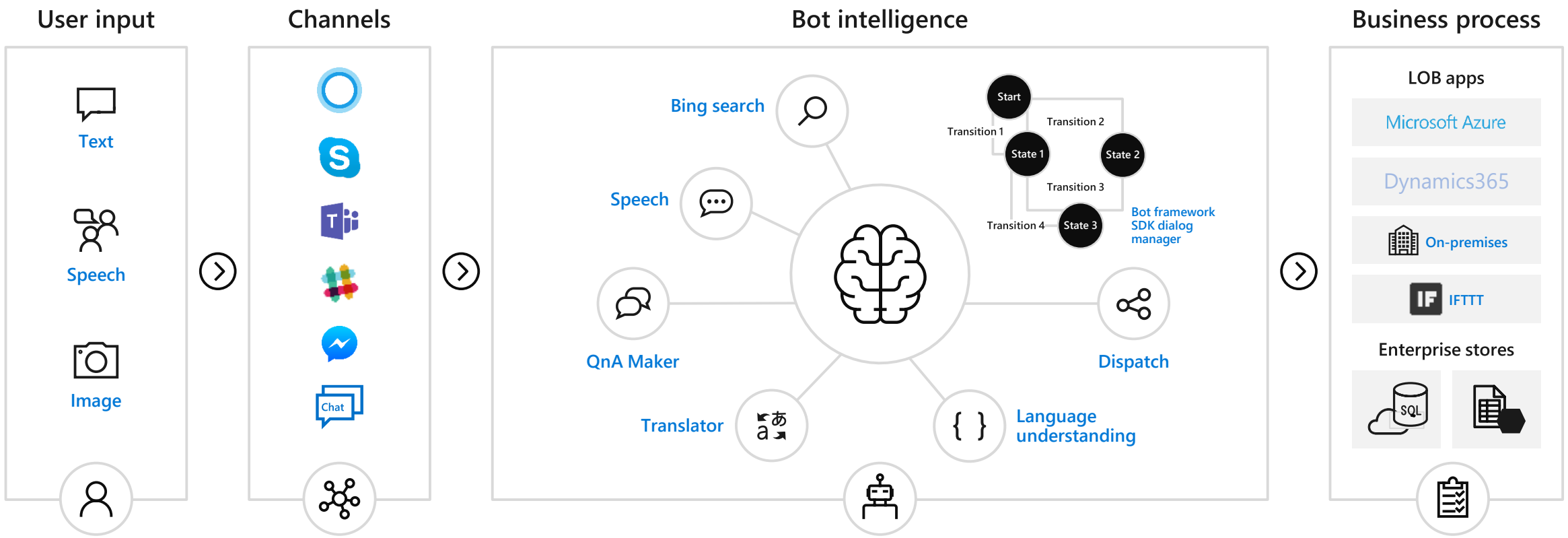
Leverage your favorite deep learning frameworks

TensorFlow | MS Cognitive Toolkit | PyTorch | Scikit-Learn | ONNX | Caffe2 | MXNet | Chainer

Get started quickly with Developer AI

Conversational AI

Azure bot service + cognitive services



Azure Tools | Security | Logging | Auditing | Integration

Microsoft

Leverage out-of-the-box AI tools and services

Cognitive services

Use pre-built AI services
to solve business problems

Map complex
information and data

Allow your apps to
process natural language

Azure search

Get up and
running quickly

Reduce complexity with
a fully-managed service

Use artificial intelligence
to extract insights

Bot services

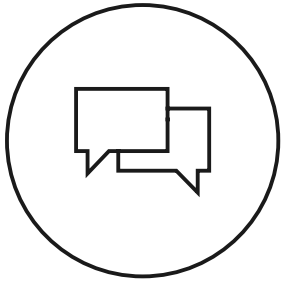
Speed development with a purpose-built
environment for bot creation

Infuse intelligence into your bot using
cognitive services

Integrate across multiple
channels to reach more customers

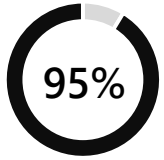
Create a seamless developer experience across desktop, cloud, or at the edge using Visual Studio AI Tools

Enterprise scenarios for AI

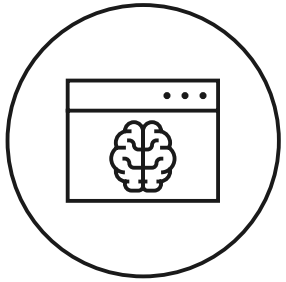


Conversational agents

Transform your engagements with customers and employees

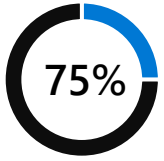


Of customer interactions powered by AI bots by 2025

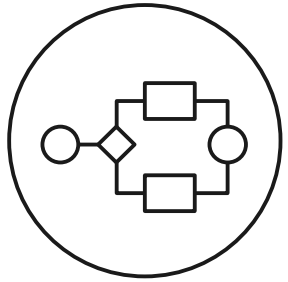


Intelligent apps

Leverage AI to create the future of business applications

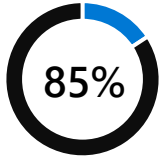


Applications to include AI by the end of this year



Business processes

Transform critical business processes with AI



Of enterprises using AI by 2020

AI-enabled devices

Custom AI

Drones

Smart kiosks

Enterprise AI

Smart factory

Smart kitchen

Smart bath

Developer AI

Voice-activated speakers

Smart cameras

Microsoft AI for accessibility

Empowering people with tools that amplify human capability

Employment

Facilitating development of professional skills

How Microsoft is helping the visually-impaired

Modern life

Delivering personalized experiences to improve independence

How Helpicto is helping non-verbal children

Helpicto™

Human connection

Providing equal access to information and opportunity

How RIT is helping the hearing-impaired

R·I·T

Data Science is for every industry

Financial services use cases

Effective customer engagement

Customer profiles
Credit history
Transactional data
LTV
Loyalty

Customer analytics

Customer 360 degree evaluation
Customer segmentation
Reduced customer churn
Underwriting, servicing and delinquency handling
Insights for new products

Faster innovation for a better customer experience

Decision services management

Customer segmentation
CRM data
Credit data
Market data

Financial modeling

Commercial/retail banking, securities, trading and investment models
Decision science, simulations and forecasting
Investment recommendations

Improved consumer outcomes and increased revenue

Risk and revenue management

Transaction data
Demographics
Purchasing history
Trends

Risk, fraud, threat detection

Real-time anomaly detection
Card monitoring and fraud detection
Security threat identification
Risk aggregation

Enhanced customer experience with machine learning

Risk and compliance management

CRM
Credit
Risk
Merchant records
Products and services

Credit analytics

Enterprise DataHub
Regulatory and compliance analysis
Credit risk management
Automated credit analytics

Transform growth with predictive analytics

Recommendation engine

Clickstream data
Products
Services
Customer service data

Marketing analytics

Recommendation engine
Predictive analytics and targeted advertising
Fast marketing and multi-channel engagement
Customer sentiment analysis

Improved customer engagement with machine learning

Health and life sciences use cases

DNA sequences

FAST-Q
BAM
SAM
VCF
Expression

Genomics and precision medicine

Single cell sequencing

Biomarker, genetic, variant and population analytics

ADAM and HAIL on Databricks

Faster innovation for drug development

Real world analytics

HL7/CCD
837
Pharmacy
Registry
EMR

Clinical and claims data

Claims data warehouse

Readmission predictions

Efficacy and comparative analytics

Prescription adherence

Market access analysis

Improved outcomes and increased revenue

Image deep learning

MRI
X-RAY
CT
Ultrasound

GPU image processing

Graphic intensive workloads

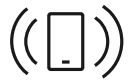
Deep learning using Tensor Flow

Pattern recognition

Diagnostics leveraging machine learning

Sensor data

Readings
Time series
Event data



IoT device analytics

Aggregation of streaming events

Predictive maintenance

Anomaly detection

Predictive analytics transforms quality of care

Social data listening

Social media
Adverse events
Unstructured

Social analytics

Real-time patient feedback via topic modelling

Analytics across publication data

Improved patient communications and feedback

Media and entertainment use cases

Personalized recommendations	Effective customer retention	Information optimization	Inventory allocation	Consumer engagement analysis
Customer profiles	Customer profiles	Consumption logs	Transactions	Content metadata
Viewing history	Online activity	Clickstream and devices	Subscriptions	Ratings
Online activity	Content distribution	Marketing campaign responses	Demographics	Comments
Content sources	Services data		Credit data	Social media activity
Channels				
				
Content personalization	**Customer churn prevention**	**Recommendation engine**	**Predictive analytics**	**Sentiment analysis**
Personalized viewing and engagement experience	Quality of service and operational efficiency	Ad effectiveness	Predict audience interests	Demand-elasticity
Click-path optimization	Market basket analysis	Content monetization	Network performance and optimization	Social network analysis
Next best content analysis	Customer behavior analysis	Fraud detection	Pricing predictions	Promotion events time-series analysis
Improved real time ad targeting	Click-through analysis	Information-as-a-service	Nielsen ratings and projections	Multi-channel marketing attribution
		High value user engagement	Mobile spatial analytics	
Faster innovation for customer experience	**Improved consumer outcomes and increased revenue**	**Enhance user experience with machine learning**	**Predictive analytics transforms growth**	**Improved consumer engagement with machine learning**

Retail use cases

Recommendation engine

Customer profiles
Shopping history
Online activity
Social network analysis

Next best and personalized offers

Customer 360/consumer personalization
Right product, promotion, at right time
Multi-channel promotion

Faster innovation for customer experience

Effective customer engagement

Shopping history
Online activity
Floor plans
App data

Store design and ergonomics

Path to purchase
In-store experience
Workforce and manpower optimization

Improved consumer outcomes and increased revenue

Inventory optimization

Demand plans
Forecasts
Sales history
Trends
Local events/weather patterns

Data-driven stock, inventory, ordering

Predict inventory positions and distribution
Fraud detection
Market basket analysis

Omni-channel shopping experience with machine learning

Inventory allocation

Demographics
Buyer perception
Consumer research
Market/competitive analysis

Assortment optimization

Economic modelling
Optimization for foot traffic, Online interactions
Flat and declining categories

Predictive analytics transforms growth

Consumer engagement

Historical sales data
Price scheduling
Segment level price changes

Real-time pricing optimization

Demand-elasticity
Personal pricing schemes
Promotion events
Multi-channel engagement

Improved consumer engagement with machine learning

Advertising and marketing tech use cases

Effective customer engagement

Customer profiles
Online history
Transaction data
Loyalty

Customer value analytics

Customer 360, segmentation aggregation and attribution
Audience modelling/index report
Reduce customer churn
Insights for new products
Historical bid opportunity as a service

Faster innovation for customer growth

Recommendation engine

Customer segmentation
CRM data
Credit data
Market data

Next best and personalized offers

Right product, promotion, at right time
Real time ad bidding platform
Personalized ad targeting
Ad performance reporting

Improved outcomes and increased revenue

Risk and fraud analysis

Transaction data
Demographics
Purchasing history
Trends

Risk and fraud management

Real-time anomaly detection
Fraud prevention
Customer spend and risk analysis
Data relationship maps

Risk management with machine learning

Campaign reporting analytics

CRM
Merchant records
Products
Services
Marketing data

Sales and campaign optimization

Optimizing return on ad spend and ad placement
Multi-channel promotion
Ideal customer traits
Optimized ad placement

Predictive analytics transforms growth

Brand promotion and customer experience

Social media
Online history
Customer service data

Sentiment analysis

Opinion mining/social media analysis
Deeper customer insights
Customer loyalty programs
Shopping cart analysis

Improved customer engagement with machine learning

Oil, gas, and energy use cases

Upstream optimization, maximize well life

Field data
Asset data
Demographics
Production data

Digital oil field/ oil production

Production optimization
Integrate exploration and seismic data
Minimize lease operating expenses
Decline curve analysis

Faster innovation for revenue growth

Grid operations, asset inventory optimization

Sensor stream data
UAVs images
Inventory data
Production data

Industrial IoT

Pipeline monitoring
Preventive maintenance
Smart grids and microgrids
Grid operations, field service
Asset performance as a service

Improved outcomes and increased revenue

Supply-chain optimization

Transaction data
Demographics
Purchasing history
Trends

Supply-chain optimization

Trade monitoring, optimization
Retail mobile applications
Vendor management - construction, transportation, truck and delivery optimization

Optimizing supply-chain with machine learning

Risk optimization

Sensor stream data
Transport
Retail data
Grid production data
Refinery tuning parameters

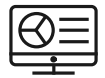
Safety and security

Real-time anomaly detection
Predictive analytics
Industrial safety
Environment health and safety

Predictive analytics transforms safety and security

Recommendations engine

Clickstream data
Products
Services
Market data
Competitive data
Demographics



Sales and marketing analytics

Fast marketing and multi-channel engagement
Develop new products and monitor acceptance of rates
Predictive energy trading
Deep customer insights

Improved customer engagement with machine learning

Security use cases

Security controls to leverage all data

Firewall/network logs
Apps
Data access layers

Intrusion detection and predictive analytics

Prevention of DDoS attacks
Threat classifications
Data loss/anomaly detection in streaming
Cybermetrics and changing use patterns

Prevent complex threats with machine learning

Actionable threat intelligence

Firewall/network logs
Network flows
Authentications

Security intelligence

Real-time data correlation
Anomaly detection
Security context, enrichment
Offence scoring, prioritization
Security orchestration

Faster innovation for threat prevention

Risk and fraud analysis

Firewall/network logs
Web/app logs
Social media content

Fraud detection and prevention

e-Tailing
Inventory monitoring
Social media monitoring
Phishing scams
Piracy protection

Risk management with machine learning

Compliance management

Firewall/network logs
Web
Applications
Devices
OS

Security compliance reporting

Ad-hoc/historic incident reports
SOC/NOC dashboards
Deep OS auditing
Data loss detection in IoT
User behavior analytics

Transform security with improved visibility

Identity and access management for analytics

Files
Tables
Clusters
Reports
Dashboards
Notebooks

Fine-grained data analytics security

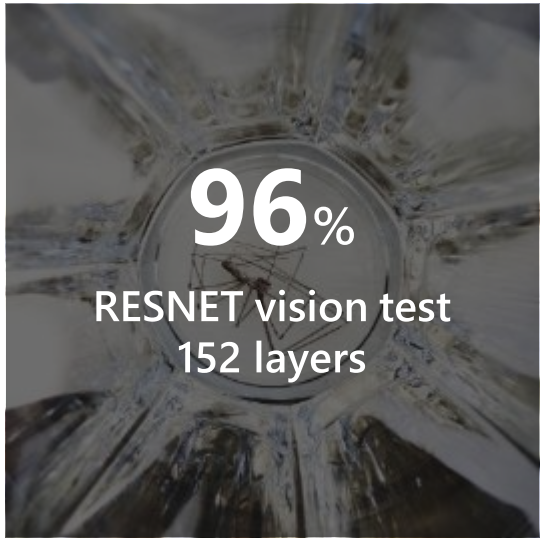
Role-based access controls
Auditing and governance
File integrity monitoring
Row level and column level access permissions

Limit malicious insiders to transform growth

Our unique differentiators

Microsoft AI breakthroughs

Vision

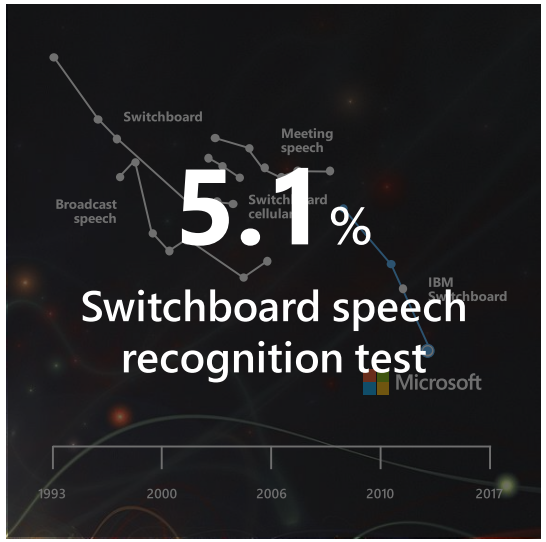


2016

First to achieve

Object recognition
Human parity

Speech



2017

First to achieve

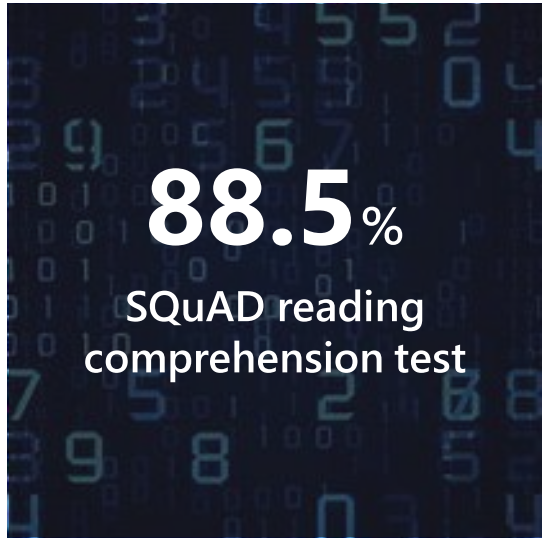
Speech recognition
Human parity

March 2018

First to achieve

Machine translation
Human parity

Language



January 2018

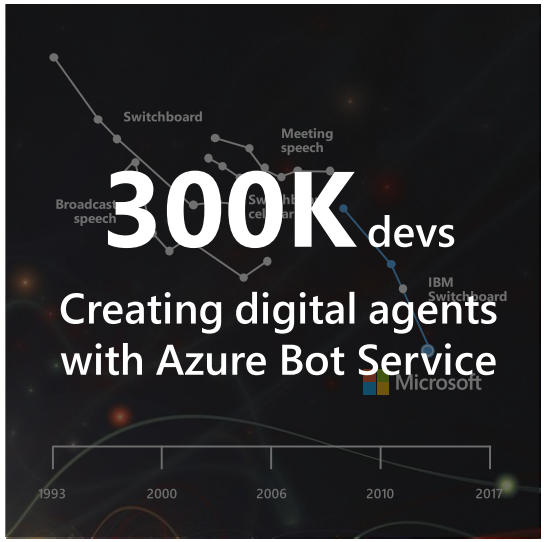
First to achieve

Machine reading comprehension
Human parity

Ongoing Momentum

Vision

Speech



Language

Our differentiated value proposition

Accelerate time to value with agile tools and services

Pretrained AI services

Powerful tools

Comprehensive platform

Innovate with AI everywhere – in the cloud, at edge and on-premises

Cloud

Edge

On-premises

Use any language, any development tool and any framework

python

PYTORCH

ONNX

TensorFlow

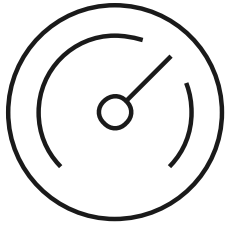
Spark

Benefit from industry-leading security, privacy, compliance, transparency, and AI ethics standards

>90% of Fortune 500 companies use Microsoft Cloud

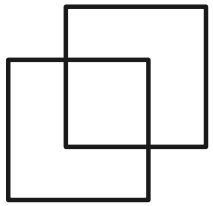
It’s all on Microsoft Azure

Microsoft Azure



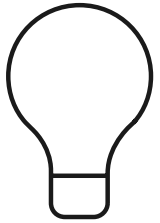
Productive

Accelerate time to market



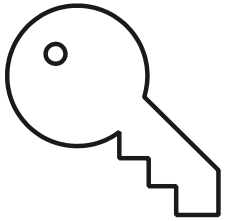
Hybrid

Optimize your infrastructure



Intelligent

Innovate at scale



Trusted

Develop with confidence

Companies using Azure for ML and AI

Rich partner network

Data integration

Informatica

talend

DATOMETRY

ATTUNITY

System integration

capax global

ARTIS CONSULTING

adatis

KOHERA

Pragmatic Works

ELASTACLOUD

Cognizant

avanade

HITACHI Inspire the Next

Capgemini

TATA CONSULTANCY SERVICES

altius

wipro

BLUEGRANITE

BI and analytics

tableau

Qlik

MicroStrategy

alteryx

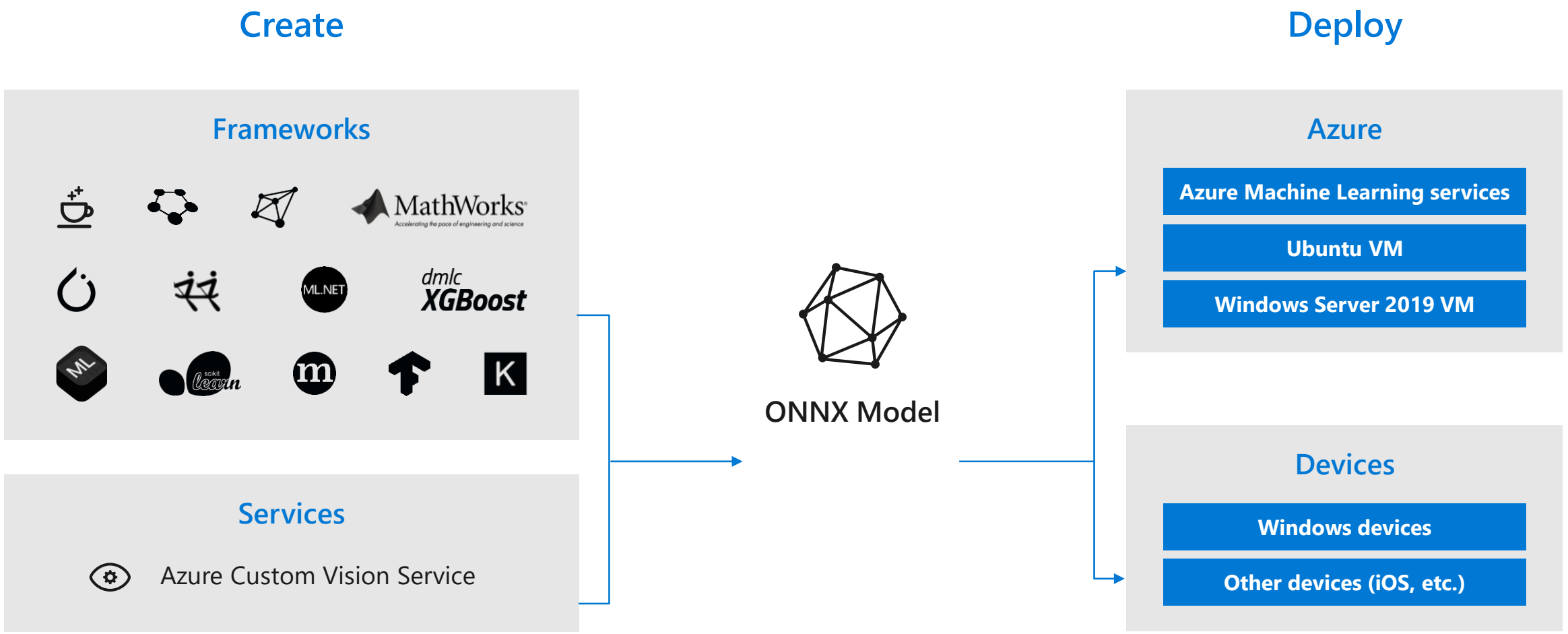
atscale

Thank you

Appendix

ONNX is the new open ecosystem for AI models

> Announcing ONNX Runtime open source



Productive Services

To empower data science and development teams

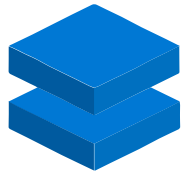
Azure Machine Learning

Python-based machine learning service

Develop models faster with automated machine learning

Use any Python environment and ML frameworks

Manage models across the cloud and the edge.



Azure Databricks

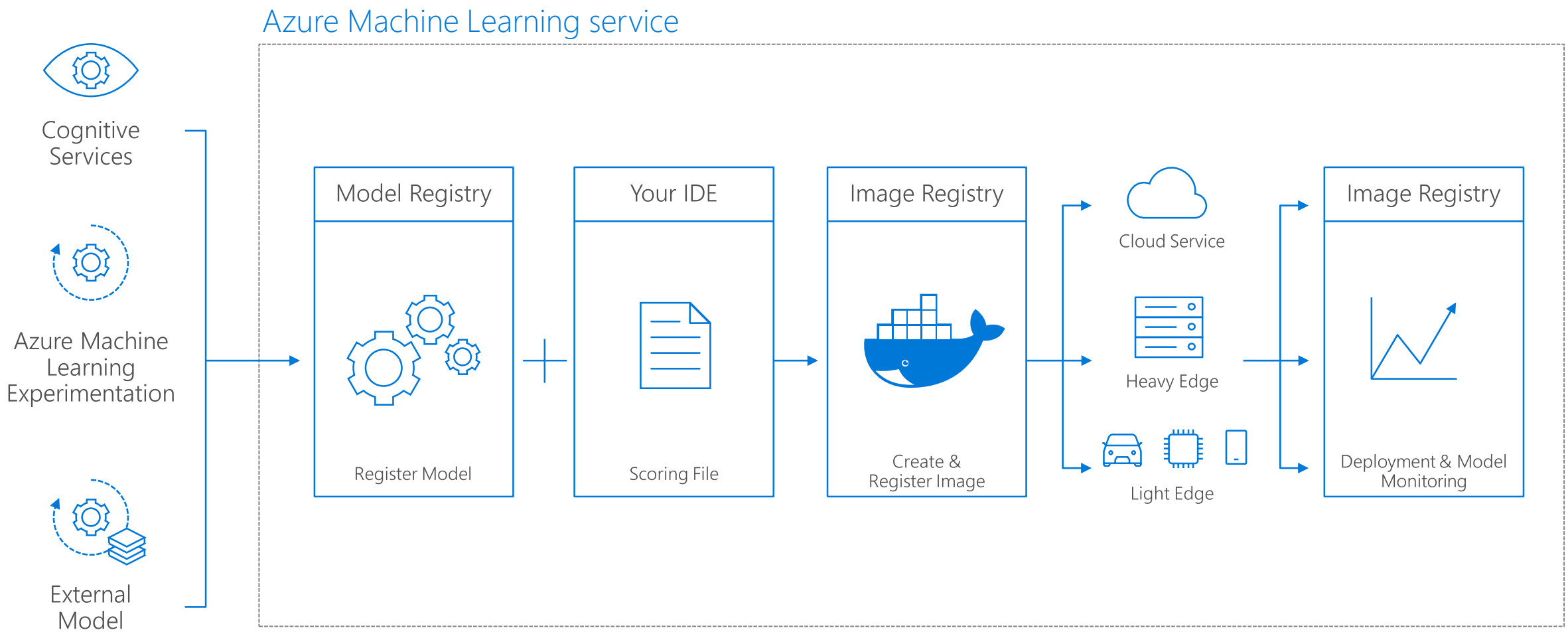
Apache Spark-based big-data service

Prepare data clean data at massive scale

Enable collaboration between data scientists and data engineers

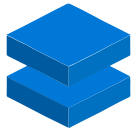
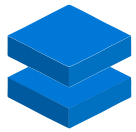
Access machine learning optimized clusters

Deploy Azure ML models at scale

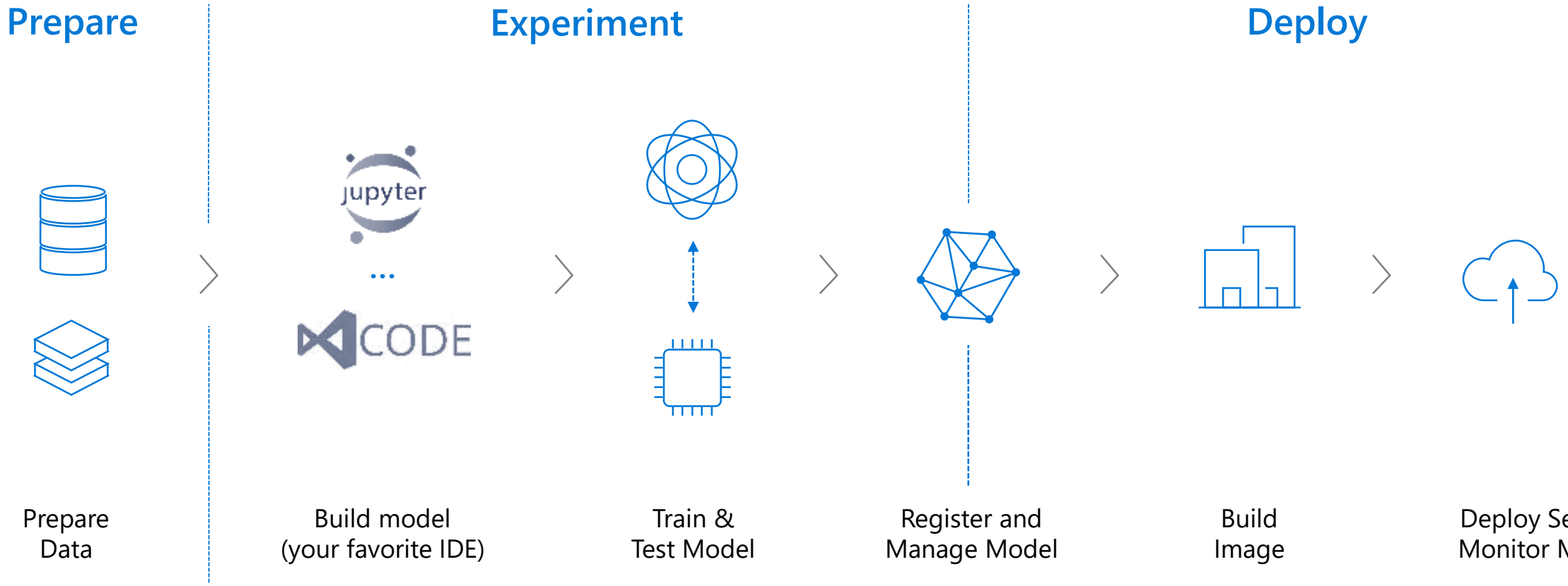


Productive Services

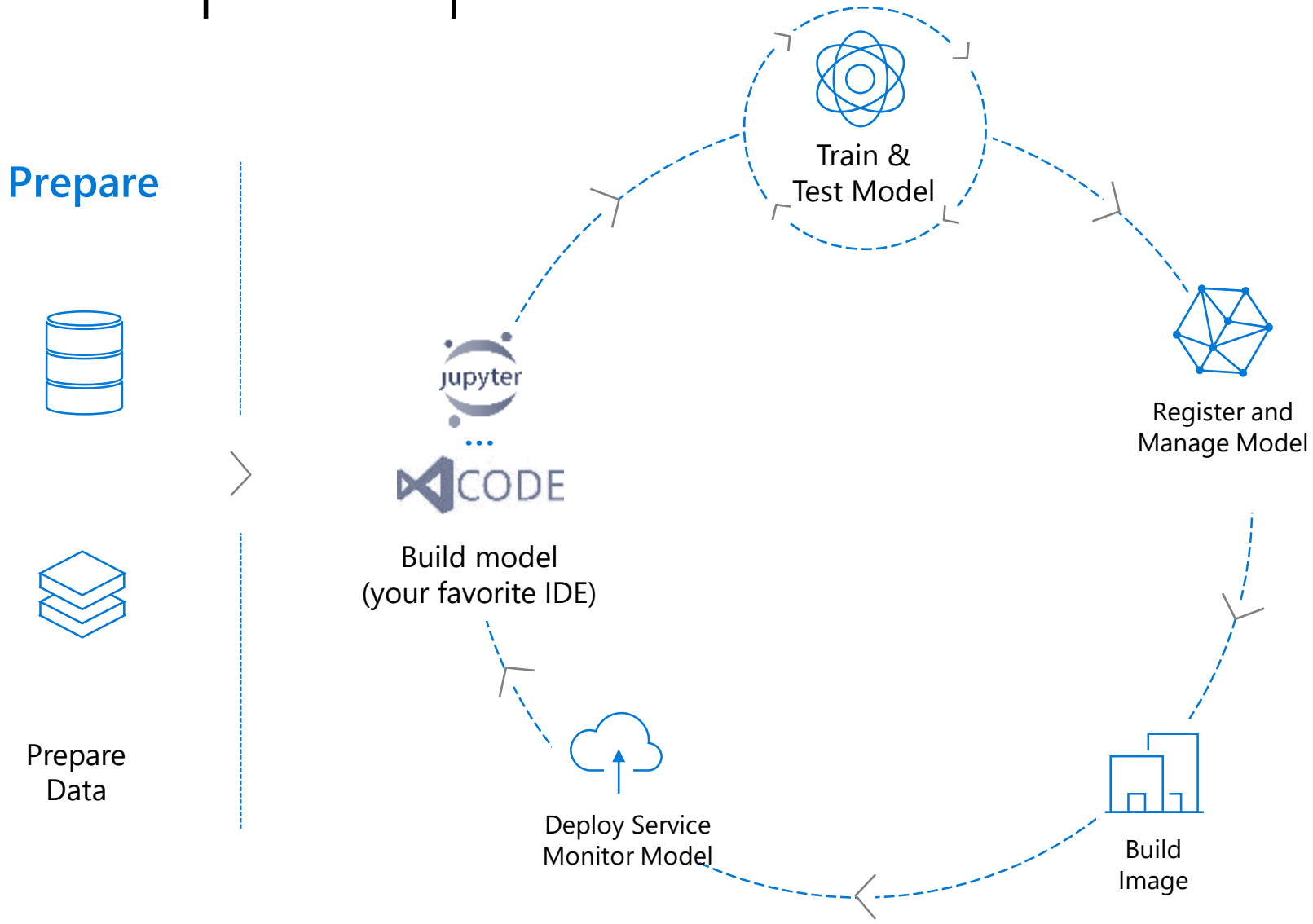
What to use when?

Customer use case	Data Prep	Build & Train	Manage and Deploy
Big Data/Apache Spark	 Azure Databricks (Apache Spark Dataframes, Datasets, Delta, Pandas, NumPy etc.)	 +  Azure Databricks + Azure ML service (Spark MLlib and OSS frameworks + Automated ML, Model Registry)	 Azure ML service (containerize, deploy, inference and monitor)
Data Science	Pandas, NumPy etc.	 Azure ML service (OSS frameworks, Hyperdrive, Pipelines, Automated ML, Model Registry)	 Azure ML service (containerize, deploy, inference and monitor)

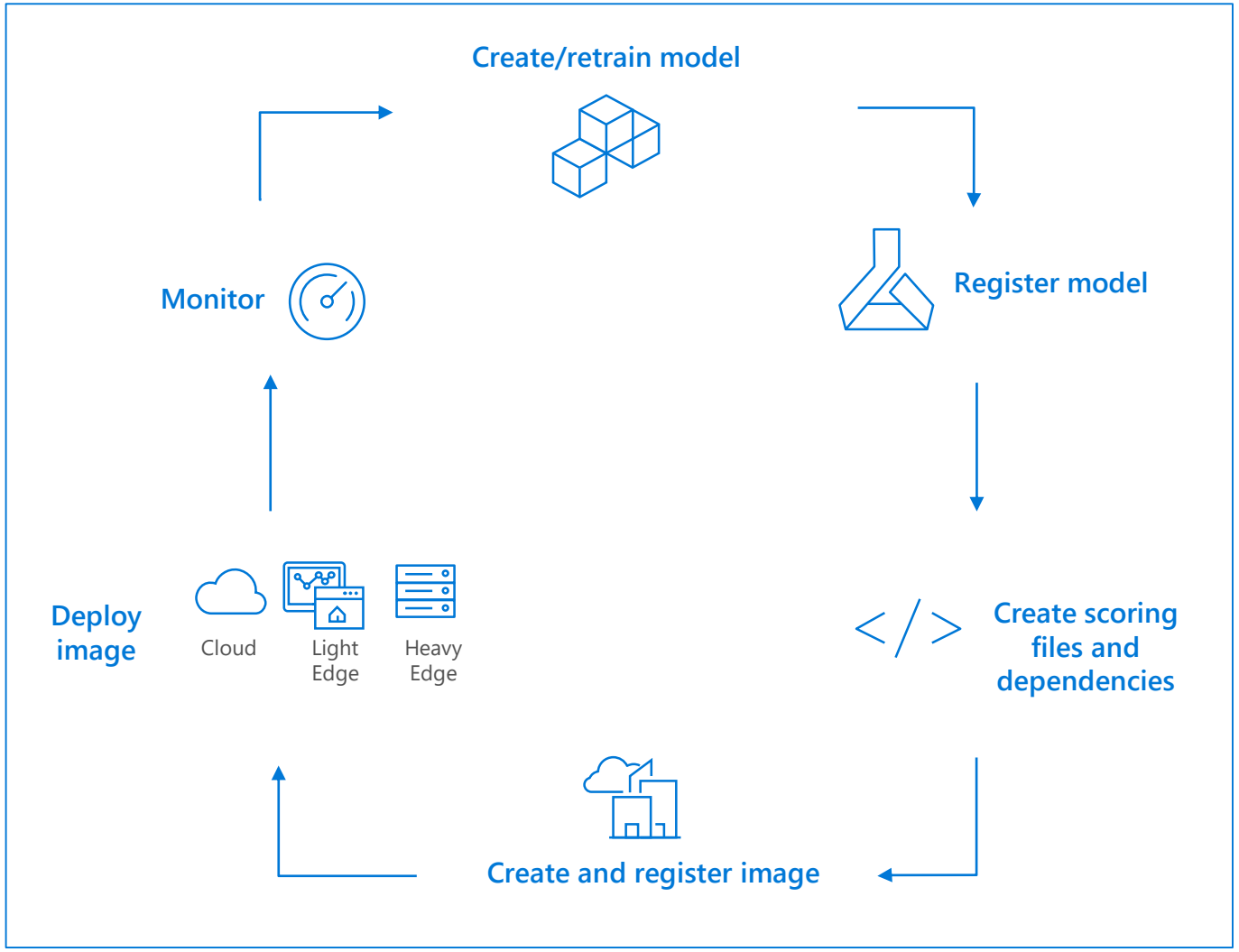
DevOps loop for data science



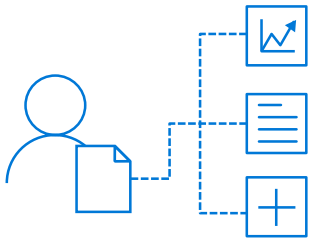
DevOps loop for data science



Model management in Azure Machine Learning

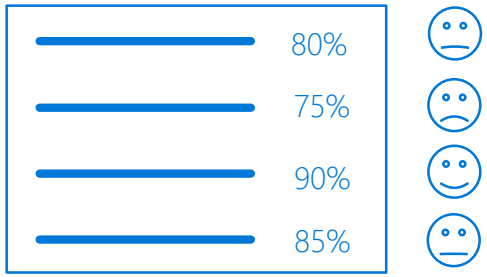


Experimentation

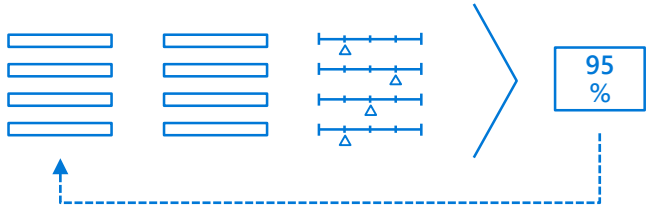


Leverage service-side capture of run metrics, output logs and models

Manage training jobs locally, scaled-up or scaled-out



Use leaderboards, side by side run comparison and model selection



Conduct a hyperparameter search on traditional ML or DNN