Advanced Analytics & AI on Azure

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Technical Product Manager
Analytics & AI
Global business value derived from **AI in 2022** will reach $3.9T.

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
- Lead Scoring
- Sales Insights
  - Dynamic Pricing

Sales
- Intelligent chatbots
  - Virtual Assistants
  - Waiting line optimization
- Financial Forecasting
- Cash Flow Forecasting
- Risk Management

Service
- Predictive Maintenance
- Demand Forecasting
- Quality Assurance

Finance
- Employee Insights
  - HR Insights
  - Resource Planning

Operations

Workforce
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

## Familiar Data Science tools
To simplify model development

## Popular frameworks
To build advanced deep learning solutions

## Productive services
To empower data science and development teams

## Powerful infrastructure
To accelerate deep learning

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**Vision**

**Speech**

**Language**

**Search**

**PyCharm**

**Jupyter**

**Visual Studio Code**

**Command line**

**Pytorch**

**TensorFlow**

**Scikit-Learn**

**Onnx**

**Azure Databricks**

**Azure Machine Learning**

**Machine Learning VMs**

**CPU**

**GPU**

**FPGA**

---

*From the Intelligent Cloud to the Intelligent Edge*
Sophisticated pre-trained models

Infuse apps with powerful, pre-trained AI models

Customize easily and tailor to your needs
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

Azure Databricks

Individual data scientists
Desktop solutions adequate
Need cloud for sporadic compute needs

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 environment
- 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

- Train and deploy
- Track models in production
- Capture model telemetry
- Retrain models
- Deploy
## Machine Learning on Azure

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

### Domain Specific Pretrained Models
To reduce time to market

<table>
<thead>
<tr>
<th>Vision</th>
<th>Speech</th>
<th>Language</th>
<th>Search</th>
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<tbody>
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</tbody>
</table>

### Familiar Data Science tools
To simplify model development

<table>
<thead>
<tr>
<th>PyCharm</th>
<th>Jupyter</th>
<th>Visual Studio Code</th>
<th>Command line</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### Popular Frameworks
To build machine learning and deep learning solutions

<table>
<thead>
<tr>
<th>ONNX</th>
<th>Pytorch</th>
<th>TensorFlow</th>
<th>Scikit-Learn</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>

### Productive Services
To empower data science and development teams

<table>
<thead>
<tr>
<th>Azure Databricks</th>
<th>Azure Machine Learning</th>
<th>Machine Learning VMs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

### Powerful Infrastructure
To accelerate deep learning

<table>
<thead>
<tr>
<th>CPU</th>
<th>GPU</th>
<th>FPGA</th>
</tr>
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<tbody>
<tr>
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</tbody>
</table>

*From the Intelligent Cloud to the Intelligent Edge*
Understanding the Data Science Process on Azure
Recommended architecture to build e2e ML solutions

Ingest
- Batch data
  - Azure Data Factory
- Streaming data
  - Azure Event Hubs

Store
- Batch data
  - Azure Data Lake Storage
- Streaming data
  - Azure Data Lake Storage

Prep and train
- Azure Databricks
- Azure Machine Learning service

Serve
- Model Serving
  - Azure Kubernetes service
- Operational Databases
  - Cosmos DB, SQL DB
- Ad-hoc Analysis
  - Power BI
- Operational Databases
  - Azure SQL data warehouse
  - Azure analysis services
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

Ingest

Azure Data Factory

Store

Azure Blob Storage

Understand and transform

Azure Databricks

Leverage best-in-class analytics capabilities

Connect to data from any source

Leverage scale without limits
Train and evaluate machine learning models

- Easily scale up or scale out
- Autoscale on serverless infrastructure
- Leverage commodity hardware
- Determine the best algorithm
- Tune hyperparameters to optimize models
- Rapidly prototype in agile environments
- Collaborate in interactive workspaces
- Access a library of battle-tested models
- Automate job execution

Automated ML capabilities

Machine learning

Infrastructure

Scale out clusters

Tools

Azure Databricks

Azure ML service

Azure ML service

Azure Databricks

Automated ML

Simplify model development

Scale compute resources to meet your needs

Quickly determine the right model for your data
• Identify and promote your best models
• Capture model telemetry
• Retrain models with APIs

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

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
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

User input
- Text
- Speech
- Image

Channels
- SMS
- Twitter
- Instagram
- Facebook
- Reddit
- LinkedIn

Bot intelligence
- Bing search
- QnA Maker
- Translator
- Dispatch
- Language understanding

Business process
- LOB apps
- Microsoft Azure
- Dynamics365
- On-premises
- IFTTT
- Enterprise stores

Azure Tools
Security | Logging | Auditing | Integration
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

- 95% Of customer interactions powered by AI bots by 2025

**Intelligent apps**
Leverage AI to create the future of business applications

- 75% Applications to include AI by the end of this year

**Business processes**
Transform critical business processes with AI

- 85% 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

**Human connection**
Providing equal access to information and opportunity

- How RIT is helping the hearing-impaired
Data Science is for every industry
# Financial services use cases

<table>
<thead>
<tr>
<th>Effective customer engagement</th>
<th>Decision services management</th>
<th>Risk and revenue management</th>
<th>Risk and compliance management</th>
<th>Recommendation engine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer profiles&lt;br&gt;Credit history&lt;br&gt;Transactional data&lt;br&gt;LTV&lt;br&gt;Loyalty</td>
<td>Customer segmentation&lt;br&gt;CRM data&lt;br&gt;Credit data&lt;br&gt;Market data</td>
<td>Transaction data&lt;br&gt;Demographics&lt;br&gt;Purchasing history&lt;br&gt;Trends</td>
<td>CRM&lt;br&gt;Credit&lt;br&gt;Risk&lt;br&gt;Merchant records&lt;br&gt;Products and services</td>
<td>Clickstream data&lt;br&gt;Products&lt;br&gt;Services&lt;br&gt;Customer service data</td>
</tr>
</tbody>
</table>

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

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

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

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

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

## Faster innovation for a better customer experience

## Improved consumer outcomes and increased revenue

## Enhanced customer experience with machine learning

## Transform growth with predictive analytics

## Improved customer engagement with machine learning
# Health and life sciences use cases

<table>
<thead>
<tr>
<th>DNA sequences</th>
<th>Real world analytics</th>
<th>Image deep learning</th>
<th>Sensor data</th>
<th>Social data listening</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAST-Q, BAM, SAM, VCF, Expression</td>
<td>HL7/CCD, 837, Pharmacy, Registry, EMR</td>
<td>MRI, X-RAY, CT, Ultrasound</td>
<td>Readings, Time series, Event data</td>
<td>Social media, Adverse events, Unstructured</td>
</tr>
</tbody>
</table>

- **Genomics and precision medicine**
  - Single cell sequencing
  - Biomarker, genetic, variant and population analytics
  - ADAM and HAIL on Databricks

- **Clinical and claims data**
  - Claims data warehouse
  - Readmission predictions
  - Efficacy and comparative analytics
  - Prescription adherence
  - Market access analysis

- **GPU image processing**
  - Graphic intensive workloads
  - Deep learning using Tensor Flow
  - Pattern recognition

- **IoT device analytics**
  - Aggregation of streaming events
  - Predictive maintenance
  - Anomaly detection

- **Social analytics**
  - Real-time patient feedback via topic modelling
  - Analytics across publication data

- **Faster innovation for drug development**
  - Improved outcomes and increased revenue
  - Diagnostics leveraging machine learning
  - Predictive analytics transforms quality of care
  - Improved patient communications and feedback

- **Real world analytics**
  - DNA sequences
  - Biomarker, genetic, variant and population analytics
  - ADAM and HAIL on Databricks

- **Image deep learning**
  - MRI
  - X-RAY
  - CT
  - Ultrasound

- **Sensor data**
  - Readings
  - Time series
  - Event data

- **Social data listening**
  - Social media
  - Adverse events
  - Unstructured

- **DNA sequences**
  - FAST-Q
  - BAM
  - SAM
  - VCF
  - Expression
## Media and entertainment use cases

<table>
<thead>
<tr>
<th>Personalized recommendations</th>
<th>Effective customer retention</th>
<th>Information optimization</th>
<th>Inventory allocation</th>
<th>Consumer engagement analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer profiles</td>
<td>Customer profiles</td>
<td>Consumption logs</td>
<td>Transactions</td>
<td>Content metadata</td>
</tr>
<tr>
<td>Viewing history</td>
<td>Online activity</td>
<td>Clickstream and devices</td>
<td>Subscriptions</td>
<td>Ratings</td>
</tr>
<tr>
<td>Online activity</td>
<td>Content distribution</td>
<td>Marketing campaign</td>
<td>Demographics</td>
<td>Comments</td>
</tr>
<tr>
<td>Content sources</td>
<td>Services data</td>
<td>responses</td>
<td>Credit data</td>
<td>Social media activity</td>
</tr>
<tr>
<td>Channels</td>
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</tbody>
</table>

### Content personalization
- Personalized viewing and engagement experience
- Click-path optimization
- Next best content analysis
- Improved real time ad targeting

### Customer churn prevention
- Quality of service and operational efficiency
- Market basket analysis
- Customer behavior analysis
- Click-through analysis

### Recommendation engine
- Ad effectiveness
- Content monetization
- Fraud detection
- Information-as-a-service
- High value user engagement

### Predictive analytics
- Predict audience interests
- Network performance and optimization
- Pricing predictions
- Nielsen ratings and projections
- Mobile spatial analytics

### Inventory allocation
- Transactions
- Subscriptions
- Demographics
- Credit data

### Consumer engagement analysis
- Content metadata
- Ratings
- Comments
- Social media activity

### Faster innovation for customer experience
- Improved consumer outcomes and increased revenue
- Enhanced user experience with machine learning
- Predictive analytics transforms growth
- Improved consumer engagement with machine learning

### Sentiment analysis
- Demand-elasticity
- Social network analysis
- Promotion events
- Time-series analysis
- Multi-channel marketing attribution
### Retail use cases

<table>
<thead>
<tr>
<th>Recommendation engine</th>
<th>Effective customer engagement</th>
<th>Inventory optimization</th>
<th>Inventory allocation</th>
<th>Consumer engagement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customer profiles</td>
<td>Shopping history</td>
<td>Demand plans</td>
<td>Demographics</td>
<td>Historical sales data</td>
</tr>
<tr>
<td>Shopping history</td>
<td>Online activity</td>
<td>Forecasts</td>
<td>Buyer perception</td>
<td>Price scheduling</td>
</tr>
<tr>
<td>Online activity</td>
<td>Floor plans</td>
<td>Sales history</td>
<td>Consumer perception</td>
<td>Segment level price changes</td>
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<tr>
<td>Social network analysis</td>
<td>App data</td>
<td>Trends</td>
<td>Market/competitive analysis</td>
<td></td>
</tr>
<tr>
<td>Customer 360/consumer personalization</td>
<td>Path to purchase</td>
<td>Local events/weather patterns</td>
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</tr>
<tr>
<td>Right product, promotion, at right time</td>
<td>In-store experience</td>
<td>Economic modelling</td>
<td>Economic modelling</td>
<td></td>
</tr>
<tr>
<td>Multi-channel promotion</td>
<td>Workforce and manpower optimization</td>
<td>Optimization for foot traffic, Online interactions</td>
<td>Optimization for foot traffic, Online interactions</td>
<td></td>
</tr>
</tbody>
</table>

**Next best and personalized offers**

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

**Store design and ergonomics**

- Path to purchase
- In-store experience
- Workforce and manpower optimization

**Data-driven stock, inventory, ordering**

- Predict inventory positions and distribution
- Fraud detection
- Market basket analysis

**Assortment optimization**

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

**Predictive analytics transforms growth**

- Improved consumer outcomes and increased revenue
- Omni-channel shopping experience with machine learning
- Improved consumer engagement with machine learning

**Real-time pricing optimization**

- Faster innovation for customer experience
- Improved consumer outcomes and increased revenue
- Omni-channel shopping experience with machine learning
- Predictive analytics transforms growth
- Improved consumer engagement with machine learning
## Advertising and marketing tech use cases

<table>
<thead>
<tr>
<th>Effective customer engagement</th>
<th>Recommendation engine</th>
<th>Risk and fraud analysis</th>
<th>Campaign reporting analytics</th>
<th>Brand promotion and customer experience</th>
</tr>
</thead>
<tbody>
<tr>
<td>Faster innovation for customer growth</td>
<td>Improved outcomes and increased revenue</td>
<td>Risk management with machine learning</td>
<td>Predictive analytics transforms growth</td>
<td>Improved customer engagement with machine learning</td>
</tr>
<tr>
<td>Customer profiles</td>
<td>Customer segmentation</td>
<td>Transaction data</td>
<td>CRM</td>
<td>Social media</td>
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<td>Online history</td>
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<td>Demographics</td>
<td>Merchant records</td>
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<td>Transaction data</td>
<td>Credit data</td>
<td>Purchasing history</td>
<td>Products</td>
<td>Customer service data</td>
</tr>
<tr>
<td>Loyalty</td>
<td>Market data</td>
<td>Trends</td>
<td>Services</td>
<td></td>
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</tbody>
</table>

**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

**Next best and personalized offers**
- Right product, promotion, at right time
- Real time ad bidding platform
- Personalized ad targeting
- Ad performance reporting

**Risk and fraud management**
- Real-time anomaly detection
- Fraud prevention
- Customer spend and risk analysis
- Data relationship maps

**Sales and campaign optimization**
- Optimizing return on ad spend and ad placement
- Multi-channel promotion
- Ideal customer traits
- Optimized ad placement

**Sentiment analysis**
- Opinion mining/social media analysis
- Deeper customer insights
- Customer loyalty programs
- Shopping cart analysis
## Oil, gas, and energy use case studies

<table>
<thead>
<tr>
<th>Use Case</th>
<th>Data Sources</th>
<th>Technology</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upstream optimization, maximize well life</td>
<td>Field data, Asset data, Demographics, Production data</td>
<td>Digital oil field/oil production, Industrial IoT</td>
<td>Faster innovation for revenue growth</td>
</tr>
<tr>
<td>Grid operations, asset inventory optimization</td>
<td>Sensor stream data, UAVs images, Inventory data, Production data</td>
<td>Industrial IoT</td>
<td>Improved outcomes and increased revenue</td>
</tr>
<tr>
<td>Supply-chain optimization</td>
<td>Transaction data, Demographics, Purchasing history, Trends</td>
<td>Supply-chain optimization</td>
<td>Optimizing supply-chain with machine learning</td>
</tr>
<tr>
<td>Risk optimization</td>
<td>Sensor stream data, Transport, Retail data, Grid production data</td>
<td>Safety and security</td>
<td>Predictive analytics transforms safety and security</td>
</tr>
<tr>
<td>Recommendations engine</td>
<td>Clickstream data, Products, Services, Market data, Competitive data, Demographics</td>
<td>Sales and marketing analytics</td>
<td>Improved customer engagement with machine learning</td>
</tr>
</tbody>
</table>

### Description
- **Digital oil field/oil production**
  - Production optimization
  - Integrate exploration and seismic data
  - Minimize lease operating expenses
  - Decline curve analysis
- **Industrial IoT**
  - Pipeline monitoring
  - Preventive maintenance
  - Smart grids and microgrids
  - Grid operations, field service
  - Asset performance as a service
- **Supply-chain optimization**
  - Trade monitoring, optimization
  - Retail mobile applications
  - Vendor management - construction, transportation, truck and delivery optimization
- **Safety and security**
  - Real-time anomaly detection
  - Predictive analytics
  - Industrial safety
  - Environment health and safety
- **Sales and marketing analytics**
  - Fast marketing and multi-channel engagement
  - Develop new products and monitor acceptance of rates
  - Predictive energy trading
  - Deep customer insights
<table>
<thead>
<tr>
<th>Security use cases</th>
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</thead>
<tbody>
<tr>
<td><strong>Security controls to leverage all data</strong></td>
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<tr>
<td>Firewall/network logs</td>
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<tr>
<td>Apps</td>
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<tr>
<td>Data access layers</td>
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<tr>
<td><strong>Intrusion detection and predictive analytics</strong></td>
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<tr>
<td>Prevention of DDoS attacks</td>
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<tr>
<td>Threat classifications</td>
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<tr>
<td>Data loss/anomaly detection in streaming</td>
</tr>
<tr>
<td>Cybermetrics and changing use patterns</td>
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<tr>
<td><strong>Security intelligence</strong></td>
</tr>
<tr>
<td>Prevent complex threats with machine learning</td>
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<tr>
<td>Faster innovation for threat prevention</td>
</tr>
<tr>
<td><strong>Risk and fraud analysis</strong></td>
</tr>
<tr>
<td>Risk management with machine learning</td>
</tr>
<tr>
<td><strong>Compliance management</strong></td>
</tr>
<tr>
<td>Transform security with improved visibility</td>
</tr>
<tr>
<td><strong>Identity and access management for analytics</strong></td>
</tr>
<tr>
<td>Limit malicious insiders to transform growth</td>
</tr>
</tbody>
</table>

| **Prevention of DDoS attacks**                                                    |
| **Risk and fraud analysis**                                                       |
| e-Tailing                                                                         |
| Inventory monitoring                                                              |
| Social media monitoring                                                           |
| Phishing scams                                                                    |
| Piracy protection                                                                  |
| **Security compliance reporting**                                                 |
| Ad-hoc/historic incident reports                                                  |
| SOC/NOC dashboards                                                                |
| Deep OS auditing                                                                  |
| Data loss detection in IoT                                                        |
| User behavior analytics                                                            |
| **Fine-grained data analytics security**                                           |
| Role-based access controls                                                        |
| Auditing and governance                                                            |
| File integrity monitoring                                                          |
| Row level and column level access permissions                                     |
| **Actionable threat intelligence**                                                |
| Security intelligence                                                              |
| Prevent complex threats with machine learning                                     |
| Faster innovation for threat prevention                                            |
| **Fraud detection and prevention**                                                |
| Fraud detection and prevention                                                     |
| Ad-hoc/historic incident reports                                                  |
| SOC/NOC dashboards                                                                |
| Deep OS auditing                                                                  |
| Data loss detection in IoT                                                        |
| User behavior analytics                                                            |
| **Identity and access management for analytics**                                  |
| Limit malicious insiders to transform growth                                       |
Our unique differentiators
Microsoft AI breakthroughs

**Vision**
- 96%
- RESNET vision test
- 152 layers

**Speech**
- 5.1%
- Switchboard speech recognition test

**Language**
- 69.9%
- MT research system
- 88.5%
- SQuAD reading comprehension test

**Timeline**
- **2016**
  - First to achieve
  - Object recognition
  - Human parity
- **2017**
  - First to achieve
  - Speech recognition
  - Human parity
- **March 2018**
  - First to achieve
  - Machine translation
  - Human parity
- **January 2018**
  - First to achieve
  - Machine reading comprehension
  - Human parity
Ongoing Momentum

Vision

1M devs
Using Azure Cognitive Services

Speech

300K devs
Creating digital agents with Azure Bot Service

60 languages
Supported by Powerpoint Translator live feature

Language

35T Docs
Processed by machine reading
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

<table>
<thead>
<tr>
<th>Data integration</th>
<th>System integration</th>
<th>BI and analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informatica™</td>
<td>capaxglobal</td>
<td>Tableau</td>
</tr>
<tr>
<td>talend</td>
<td>KOHERA</td>
<td>Qlik</td>
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<tr>
<td>DATOMETRY</td>
<td>Cognizant</td>
<td>MicroStrategy</td>
</tr>
<tr>
<td>ATTUNITY</td>
<td>Capgemini</td>
<td>alteryx</td>
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</tbody>
</table>
Thank you
Appendix
ONNX is the new open ecosystem for AI models

Create

Frameworks

- Azure Machine Learning services
- Ubuntu VM
- Windows Server 2019 VM

Services

- Azure Custom Vision Service

Deploy

- Windows devices
- Other devices (iOS, etc.)
To empower data science and development teams

Productive Services

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?**

<table>
<thead>
<tr>
<th>Customer use case</th>
<th>Data Prep</th>
<th>Build &amp; Train</th>
<th>Manage and Deploy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Big Data/Apache Spark</td>
<td>Azure Databricks</td>
<td>Azure Databricks + Azure ML service</td>
<td>Azure ML service</td>
</tr>
<tr>
<td></td>
<td>(Apache Spark Dataframes, Datasets, Delta,</td>
<td>(Spark MLlib and OSS frameworks + Automated ML,</td>
<td>(containerize, deploy, inference and</td>
</tr>
<tr>
<td></td>
<td>Pandas, NumPy etc.)</td>
<td>Model Registry)</td>
<td>monitor)</td>
</tr>
<tr>
<td>Data Science</td>
<td>Pandas, NumPy etc.</td>
<td>Azure ML service</td>
<td>Azure ML service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(OSS frameworks, Hyperdrive, Pipelines, Automated</td>
<td>(containerize, deploy, inference and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ML, Model Registry)</td>
<td>monitor)</td>
</tr>
</tbody>
</table>
DevOps loop for data science

**Prepare**
- Prepare Data

**Experiment**
- Build model (your favorite IDE)
- Train & Test Model
- Register and Manage Model

**Deploy**
- Build Image
- Deploy Service
- Monitor Model
DevOps loop for data science

Prepare

Data

Prepare

Train & Test Model

Register and Manage Model

Build Image

Build model (your favorite IDE)

Deploy Service

Monitor Model
Model management in Azure Machine Learning

1. **Register model**
2. **Create scoring files and dependencies**
3. **Create and register image**
4. **Deploy image**
5. **Monitor**
6. **Create/retrain model**
Experimentation

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

Use leaderboards, side by side run comparison and model selection

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

Conduct a hyperparameter search on traditional ML or DNN