



Zero to Machine Learning in 4 hours





Diverse experience with data platforms from Mainframe to Big Data technologies.

Inventor on a dozen patents with applications of AI, Voice Recognition and Blockchain in Healthcare & IoT.

Worked in a variety of vertical industries including: Healthcare, Financial Services, Manufacturing and Utilities.

Bill Richard
Sr. Azure Data Architect





MASTER OF SCIENCE IN COMPUTER
INFORMATION SYSTEMS - DATABASE
MANAGEMENT & BUSINESS INTELLIGENCE



CONSULTANT – APPLICATION & DATABASE
DEVELOPMENT/SUPPORT



BACHELOR OF SCIENCE IN BIOMEDICAL
ENGINEERING TECHNOLOGY



ORACLE DATABASE ADMINISTRATOR &
HADOOP DATA ENGINEER



BIG DATA ARCHITECT & CLOUD EXPERT



Why Spyglass MTG?



Value Proposition

PROXIMITY

- Headquarters: Lincoln, RI
- 100+ Consultants
- Reduced travel with majority local consulting model

EXPERTISE

- New name, not new company
- 24+ years serving the US Northeast
- 20+ years average experience for consultants
- 6 Active Microsoft Gold and Silver Competencies

FOCUS

- Solely focused on Microsoft Technologies
- Microsoft Gold Partner for over 15 yrs
- Innovation and R&D help us attract the best and brightest

Cloud, Collaboration and Analytics



Microsoft Technology Group

Apps and Infrastructure for Azure

Data Platform Modernization

Modern Workplace
Microsoft Office365

Cloud Solution Provider

Managed Services

Session Objective



Agenda

- ML & AI
- Analytics Opportunities on Azure
- Real-World Use-Cases
- Simplify your ML & AI Approach
- Identify your Data Architecture (PaaS & IaaS)
- SQL Server Machine Learning Services Overview
- Application Overview
- Create Resources on Azure
- Configure SQL ML Services
- Install pre-trained ML models
- Restore SQL Backup from GIT
- Create predictive stored procedure
- Operationalize with Power BI
- Advance your Analytics Goals
- Review

The world is changing

Data

Cloud

AI

Benefits of modernizing data estate

Companies that embrace data estate modernization with cloud, data, and AI

Nearly double

operating margin

\$40k

more revenue per employee

50%+

higher average net income on revenue

\$100M

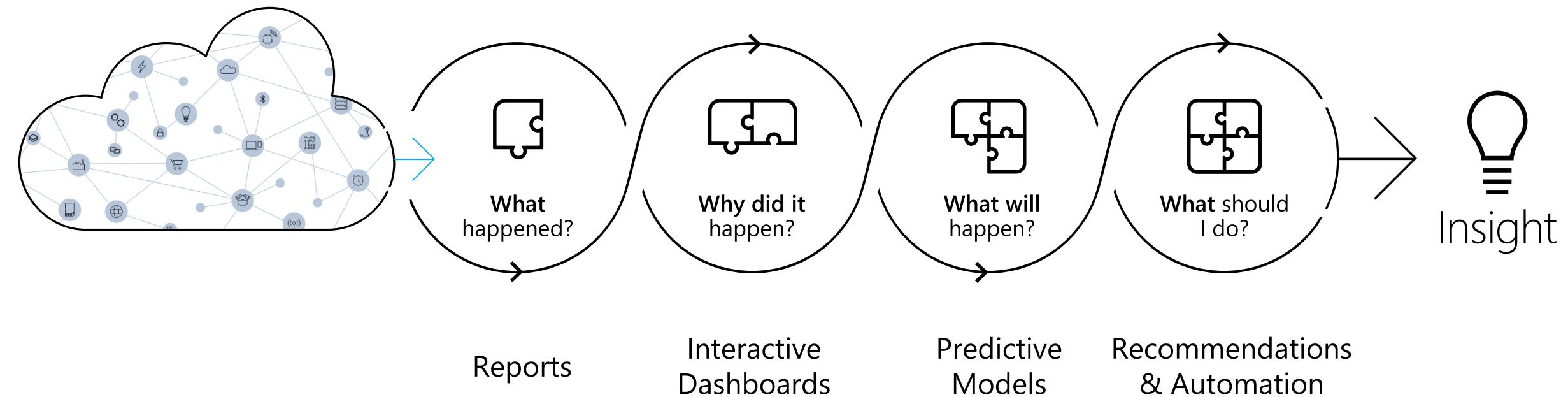
Additional average operating income for the most digitally transformed enterprises

Advanced Analytics & AI represents a growing opportunity

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



Insight is a journey



What is Machine Learning?

Machine learning identifies patterns in data using mathematical algorithms to make predictions.

Machine learning allows computers to use existing data to forecast future behaviors, outcomes, and trends.



What is AI?

AI is when a machine mimics the cognitive functions associated with human minds.

Cognitive functions:

- Perceiving
- Calculating
- Organizing
- Reasoning
- Problem solving

Machine learning and deep learning represent some of the techniques and tools used in the construction of an AI solution.



Current state of AI?

AI is NOT Artificial Intelligence... think Augmented intelligence (AI).

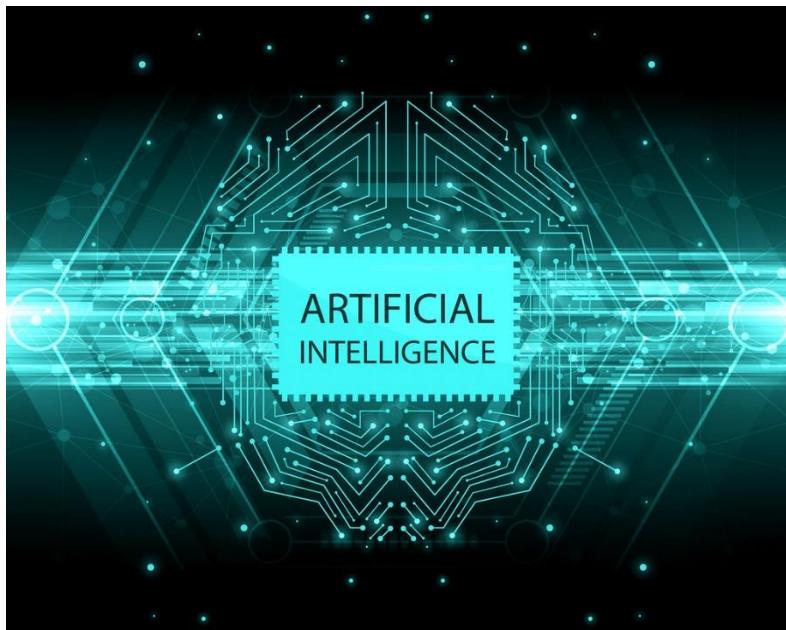
A complement—not a replacement—to human **intelligence**. It's about helping humans become faster and smarter at the tasks they're performing.



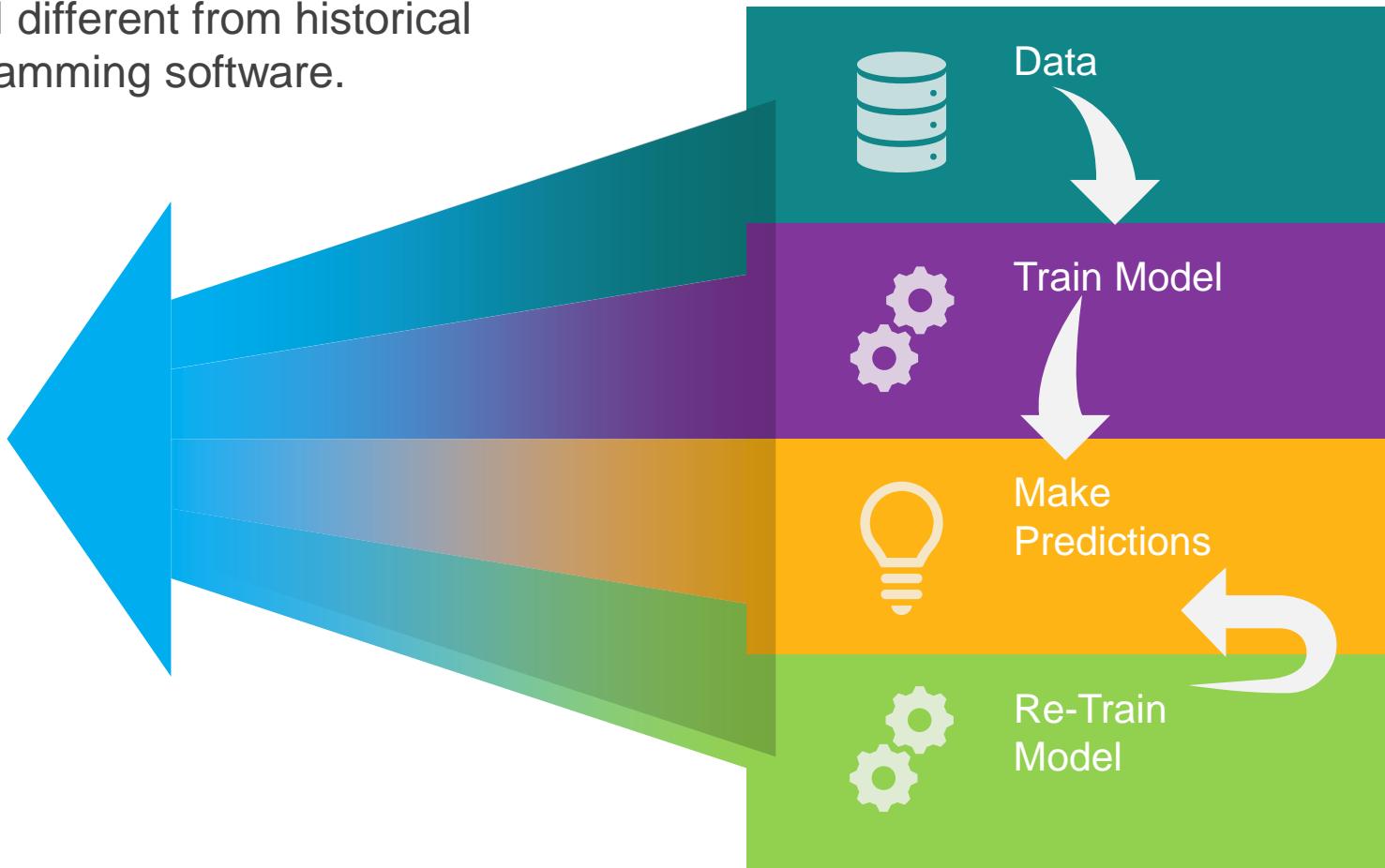
What is different about AI?

AI LEARNS AND THINKS

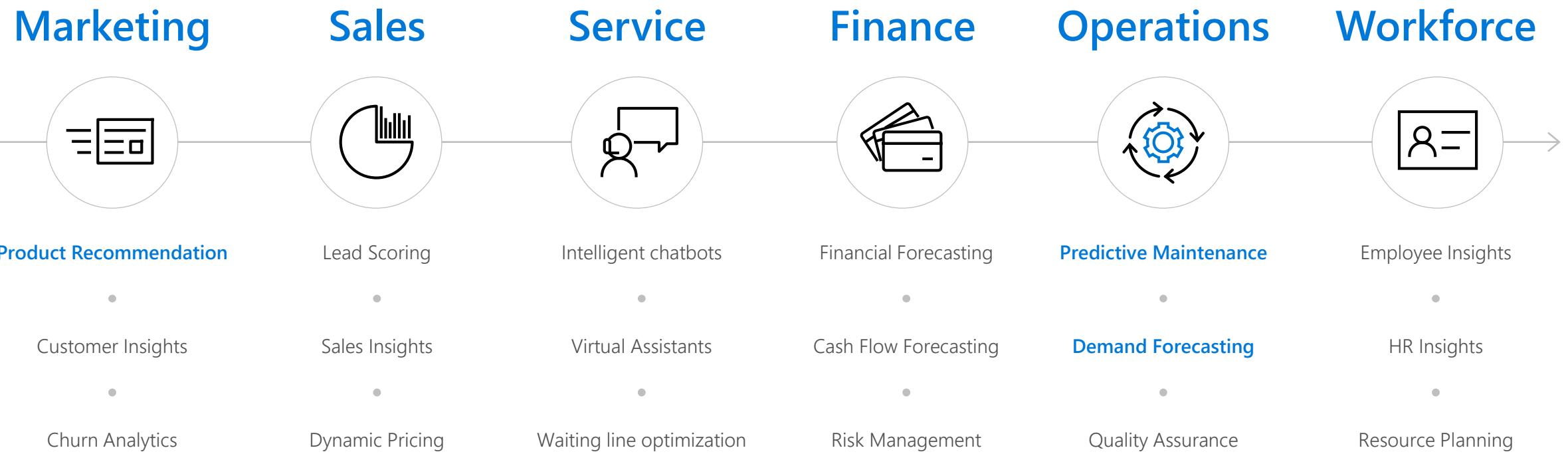
It is the learning component that makes AI different from historical approaches to building machines or programming software.



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Helping you innovate across your business



DEMAND FORECASTING

Demand forecasting is the ability to accurately predict demand for products and services based on customer preferences. It helps customers optimize resources, supply chain and employees by predicting demand.



Save time and money by optimizing resources and decision making, with highly accurate, continuously improving forecasting models



Maximize sales and avoid overstocks, ensuring that the right items are stocked in the right quantities and at the right location



Know your business better and improve results by unleashing the power of predictive analytics to help answer business questions

PERSONALIZATION

Personalization means leveraging data and analytics to deliver individualized experience for a current or prospective customer. It means using data to truly understand the customer and serve them in the best way possible.



Increase customer engagement with relevant, contextual and personalized engagement for inbound marketing



Increase customer conversion, lifetime value, and retention through timely, targeted, and tailored digital experiences



Reduce costs associated with new customer acquisition and capture an estimated \$56b in increased employee productivity

PREDICTIVE MAINTENANCE

Predictive maintenance aims to prevent asset failure, detect quality issues and improve operational processes. The outcomes of which are to optimize resources, increase revenue and improve efficiency.



Save time and money with advance warning signs and equipment maintenance needs, and preemptively repair equipment



Drive differentiated business models using cost saved from operational efficiencies to invest in additional value adds offerings



Increase customer engagement with improved responsiveness to customer requirements

Common AI applications

Sales and marketing: Customize the sales process, personalize communications to prospects and clients, match sales staff to buyers and offer personalized pricing.

Service: Offer virtual customer assistance and triage, predict maintenance and upcoming repair needs, connect service staff to customers and discover process gaps.

Supply chain: Discover and correct data errors, discover risks in the supply chain, elevate insights from Internet of Things (IoT) devices in the field and plan logistics.

Banking and financial services: Help customers access their bank balances using chatbots.

Healthcare: Follow up with patients post-discharge using virtual nursing assistants.

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
discover fashion online

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



CARNIVAL
MARITIME

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

Demand forecasting



Solar energy production is inconsistent



Align energy supply with the optimal markets

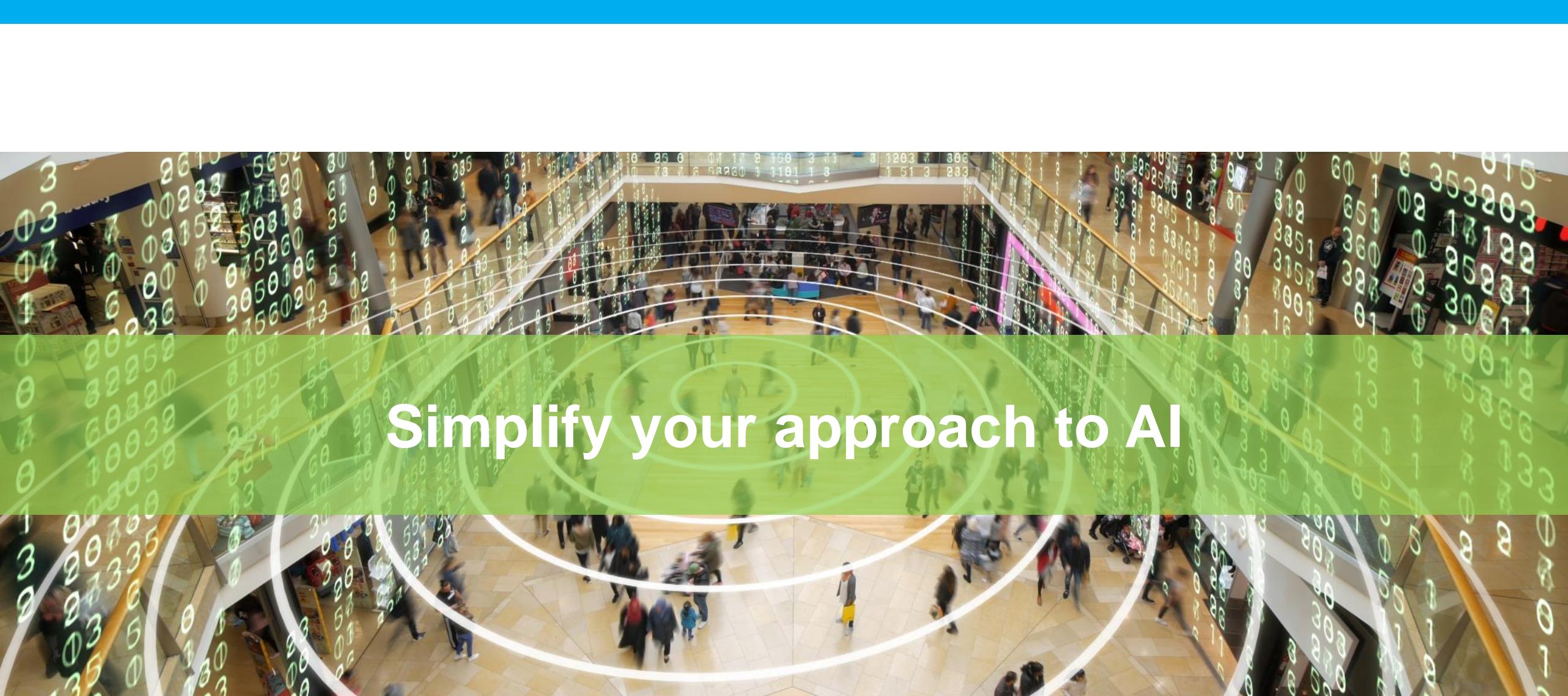


Maximize revenue



renewablesAI
DATA SCIENCE & ASSET MANAGEMENT

Distributed power generation increases revenue by over €100 million



Simplify your approach to AI

AI Myths

AI IS UNATTAINABLE

AI does not require a team of PhD Data Scientists.

AI does not require a large investment in infrastructure.

AI does not require the application of something unique that's never been proven.

AI skillsets are not out of reach.



AI REQUIRES A DATA SCIENCE PRACTICE

There are tools that simplify AI and facilitate a Citizen Data Scientist:

- Developer AI
- Azure ML Services
- Power BI ML
- Automated Machine Learning



AI SHOULD ALWAYS BE CORRECT

The largest barrier to adoption is the perception that AI should always be correct.

AI mimics the cognitive functions associated with human minds, it is NOT ALWAYS CORRECT!!!

Leverage AI for human cognitive augmentation.

Think decision support.

Simplify your AI Strategy

TAKE A STEP BACK

Understand that ML & AI initiatives can be complex and don't always work out.

What are your strengths and weaknesses?

Define your current maturity level first.

Build a strategy that focuses on small quick applications.

Think simple.



TAKE THE PATH OF LEAST RESISTANCE

Don't build a full fledged Data science organization from the start.

Don't jump into a skillset your organization does not have.

Remain agile: What tools/skills will allow you to produce value quickly?

Think simple.



CHOOSE ONE OR TWO USE-CASES

Apply and leverage industry proven use-cases first.

From your list of industry proven use-cases choose two.

Of those use-cases are there pre-trained models or API's available?

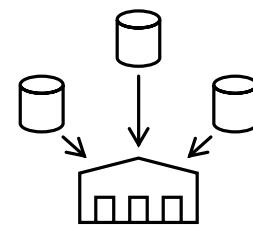
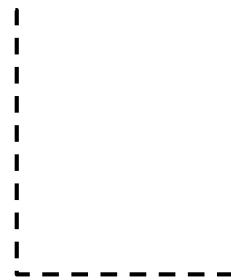
Think simple.



How companies are transforming



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



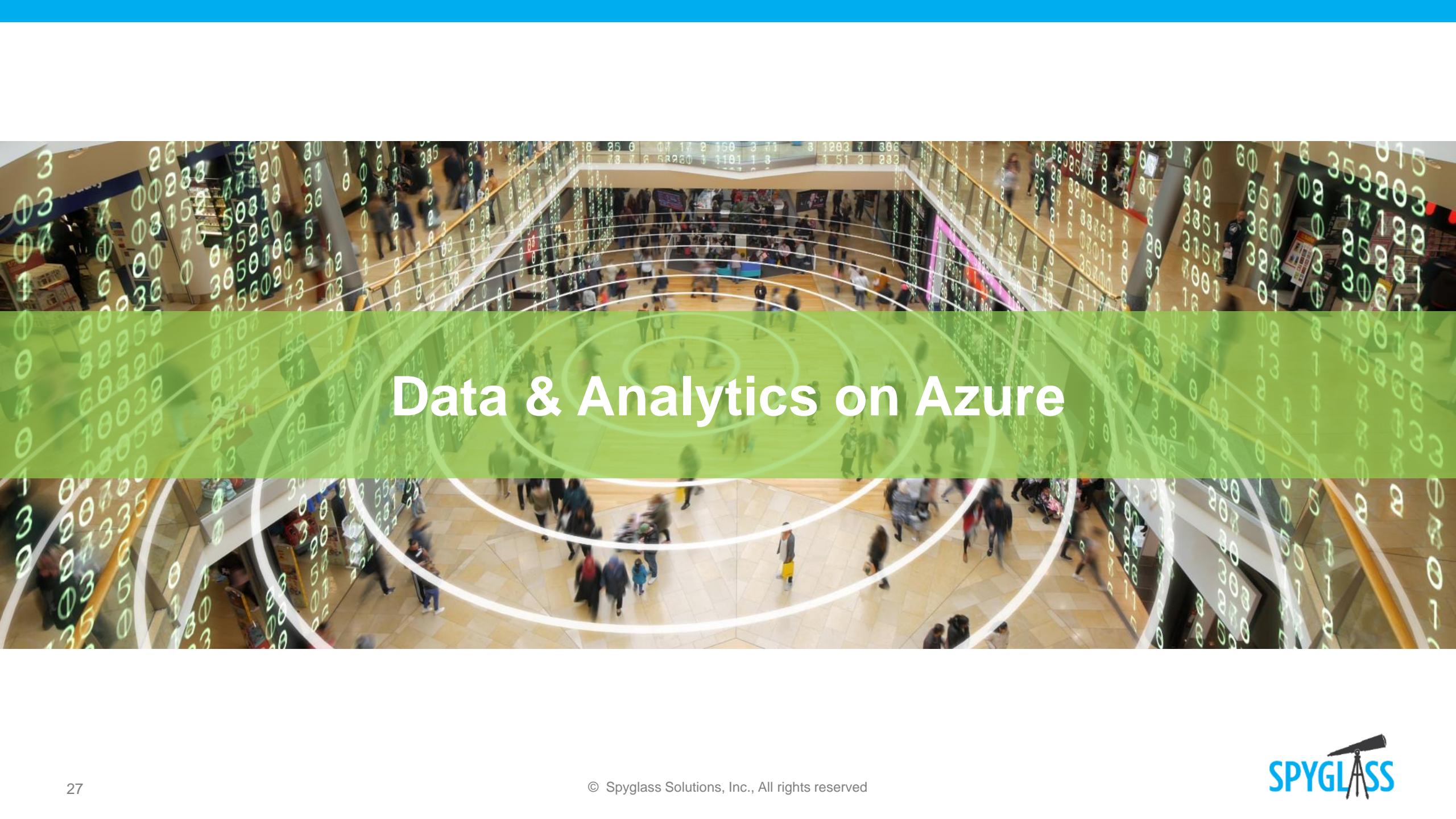
Build a unified and usable data pipeline



Train ML and DL models to derive insights



Operationalize models and distribute insights at scale



Data & Analytics on Azure

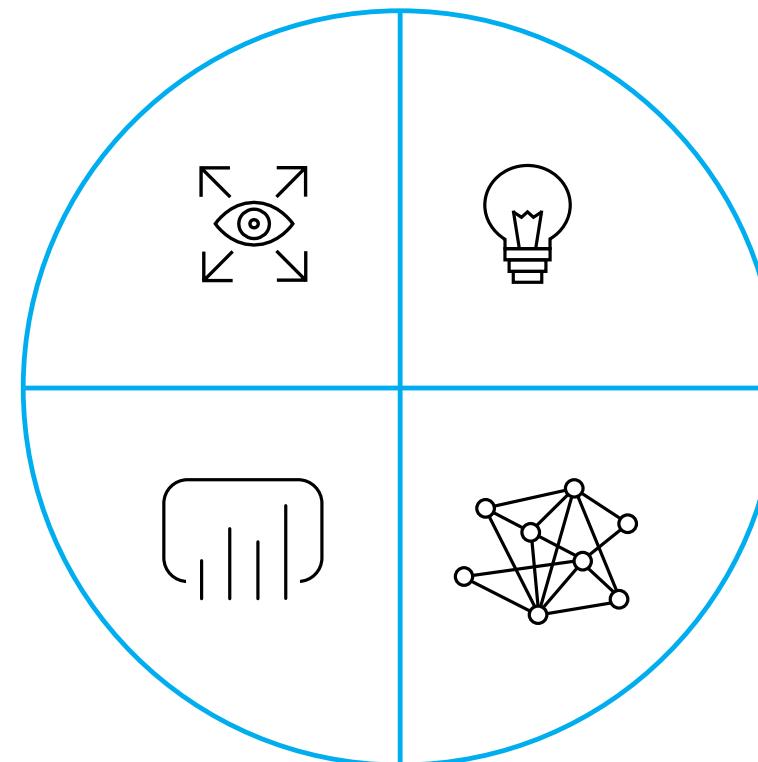
Opportunities to Improve with Business Analytics

DW + Big Data

Cloud Data Warehouse
Data Lake Strategy
Support Advanced Analytics
End of extended support for SQL Server
Enhanced features and performance

Business Intelligence

Business Led Self-Service BI
Modern Dashboarding Integration
Real-Time Dashboards
Citizen Data Scientist
Operational ML & AI



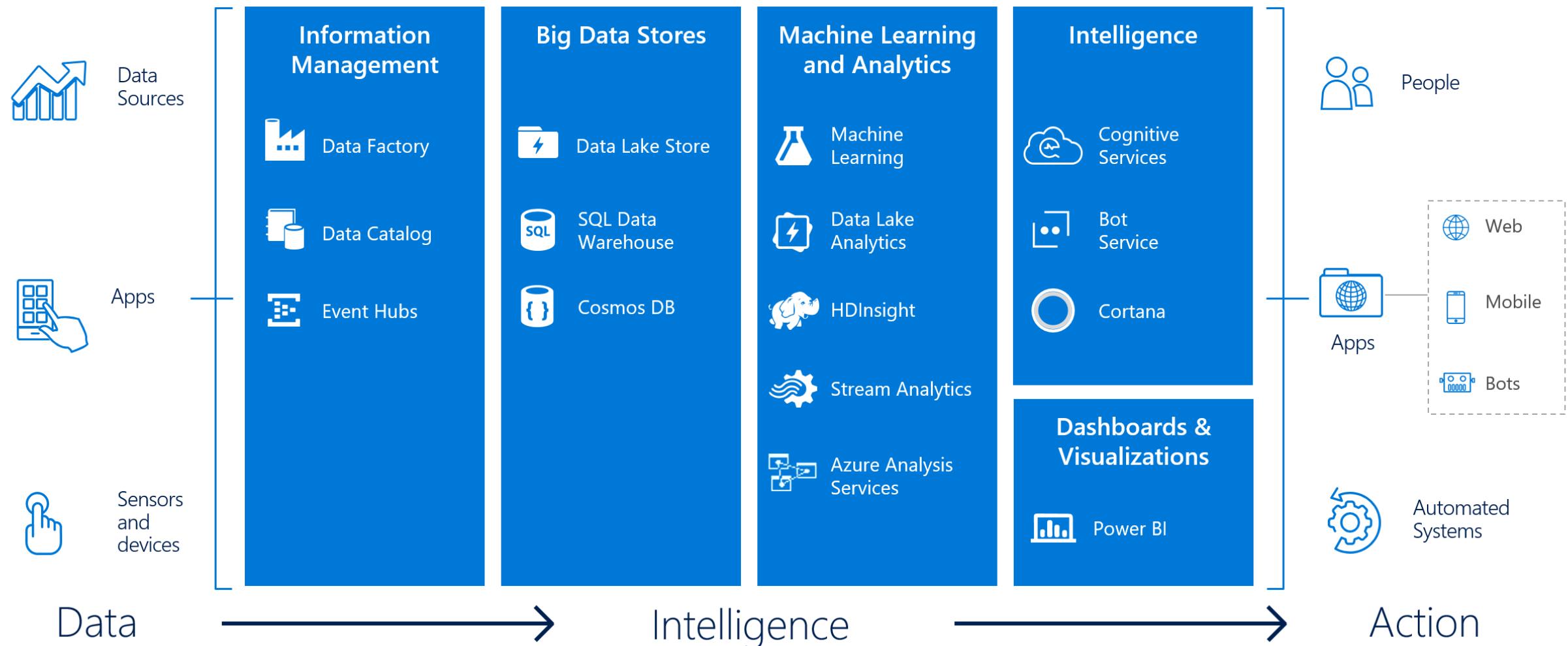
Advanced Analytics

Demand Forecasting
Cross Sell and Up Sell
Opportunity Scoring
Product Recommendations
Lead Generation
Customer Insight

Artificial Intelligence Services

Sentiment Analysis
Anomaly Detection
Personalization
Document Processing

Analytics on Azure



Machine Learning & AI 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



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

Azure Value Proposition – PaaS and IaaS



On Premises

Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking

IaaS

Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking

PaaS

Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking

SaaS

Applications
Data
Runtime
Middleware
O/S
Virtualization
Servers
Storage
Networking

You Own

Azure Owns

Azure PaaS Services – Azure SQL Database

- General-purpose relational database as a managed service
- Based on the latest stable version of the Microsoft SQL Server database engine
- Advanced Security on Cloud
 - Encryption, Audit, Data Discovery, Threat Detection
- Extensive Monitoring Capabilities
- Deployment Options 99.99% SLA
 - Single Database
 - a single fully-managed isolated database as a service
 - Elastic Pool
 - a collection of Single databases with a shared set of resources such as CPU or memory
 - Managed Instance
 - A fully-managed instance of the Microsoft SQL Server database engine
- Azure Hybrid Benefit with VCore Model
- SQL Machine Learning Services is currently in PREVIEW



Azure PaaS Services – Azure Managed SQL Server

- Managed instance of SQL Server
 - Near 100% compatibility with the latest SQL Server on-premises
 - Enterprise Edition
 - Lift and shift to cloud
- Preserves all PaaS capabilities
 - automatic patching
 - version updates
 - automated backups
 - high-availability
 - reduces management overhead and TCO
 - security and compliance
- SLA of 99.99%
- SQL Machine Learning Services is NOT supported at this time



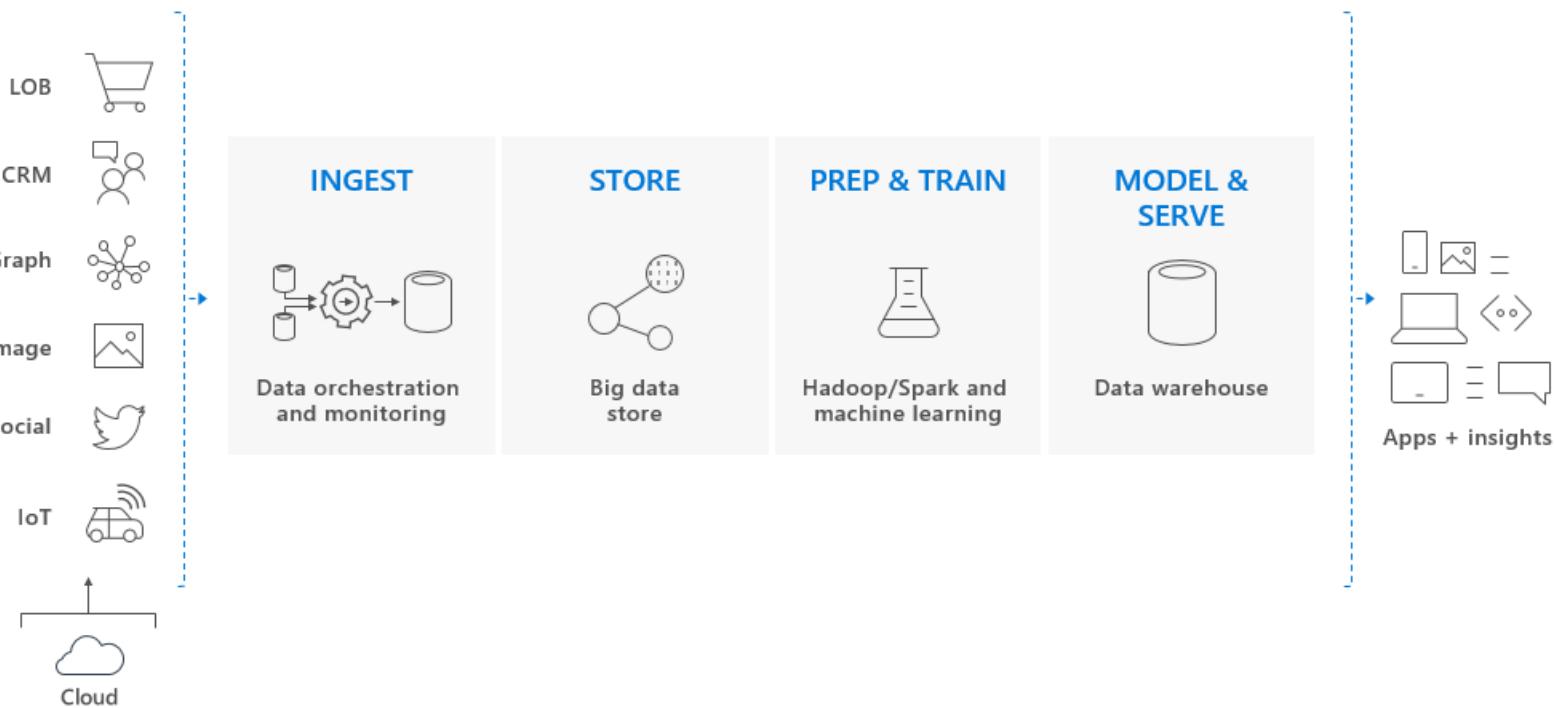
Azure IaaS Services – Azure VM SQL Server

- Full versions of SQL Server in the Cloud
- Enhanced Cloud Capabilities
 - Automated Patching
 - Automated Backups
 - High Availability
 - Scale Up with ease
- ‘Pay as you go’ vs. ‘Bring your own license’
- Customer has complete control over database and OS
- SQL Machine Learning Services is fully supported



Azure PaaS Services – Azure SQL Data Warehouse

- Cloud-based Enterprise Data Warehouse (EDW)
- Massively Parallel Processing for analytics at massive scale
- Key component of end-to-end big data solution



A young boy with blonde hair, wearing a blue superhero costume with a white star on the chest and a red cape, stands on a large, light-colored rock. He is looking towards the horizon with his arms raised in a triumphant pose. The background features a vast, sandy beach leading to a calm sea under a clear, blue sky.

SQL Server Machine Learning Services

SQL Server Machine Learning Services

- Ability to run Python and R scripts with relational data
- In-database execution without moving data outside SQL Server
- Remote & T-SQL stored procedures execution approach
 - Prepare and clean data
 - Feature engineering
 - Train, evaluate, and deploy machine learning models



Problems you can solve:

Classification/Categorization	Automatically divide customer feedback into positive and negative categories
Regression/Predict continuous values	Predict the price of houses based on size and location
Anomaly Detection	Detect fraudulent banking transactions
Recommendations	Suggest products that online shoppers may want to buy, based on their previous purchases

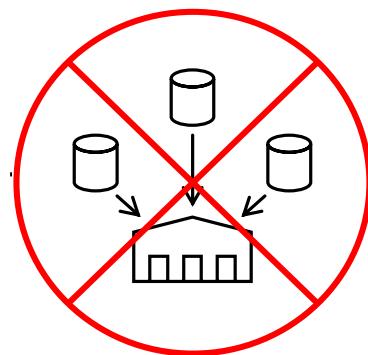
Pre-Trained Models

- Sentiment Analysis
 - Scores natural language text and creates a column that contains probabilities that the sentiments in the text are positive
- Image Processing
 - Featurizes an image using a pre-trained deep neural network model.
- Built by Microsoft and ready-to-use
- Use cases:
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 - Call Centers
 - Reviews
 - Government Outlook
 - Political Outlook
 - File Processing
 - Contract Processing from PDF
 - PHI Identification from Images
 - Visual Search Engine

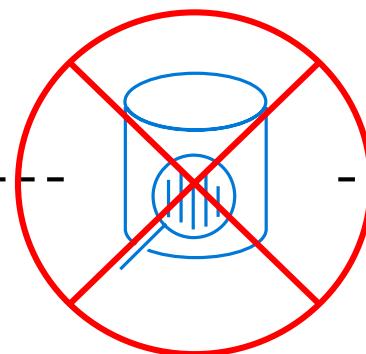
How companies are transforming



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

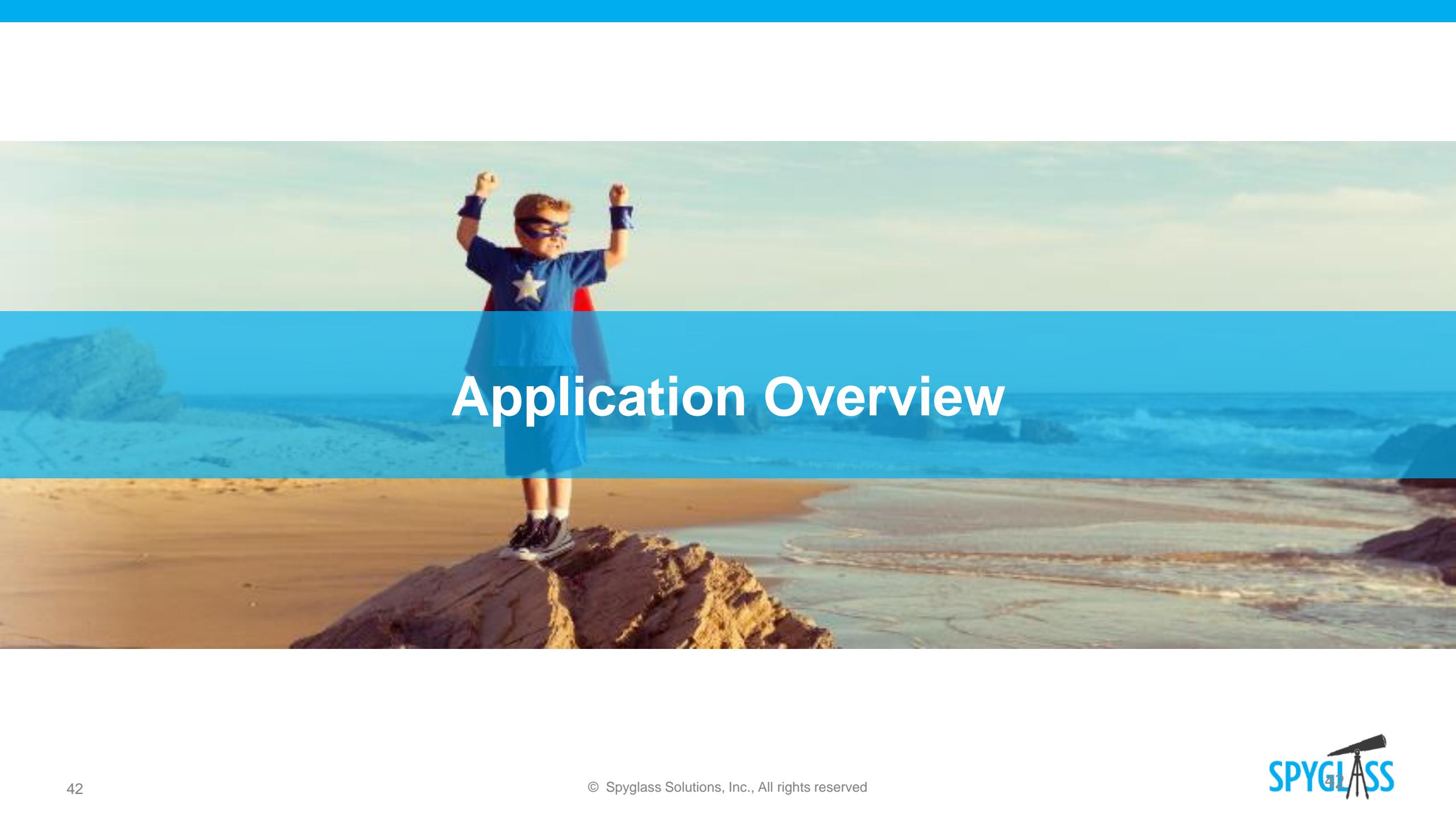


Operationalize models and distribute insights at scale

SQL Server Machine Learning Services: Things to Look For



- Where does your data live?
 - On Premises/Cloud?
- Is your skillset Python or R?
- What version of SQL Server are you running?
 - <SQL 2016 no support
 - SQL 2016 R Only
 - > SQL 2016 R and Python
- Review SQL features
 - Migrate to Azure for Analytics?
 - Upgrade SQL Version
- Review source database performance
 - Dedicated analytics environment?
 - In-memory OLTP?
- Authentication
- Do you require 3rd Party Packages?
- Can you leverage pre-trained models?
- Building your own models

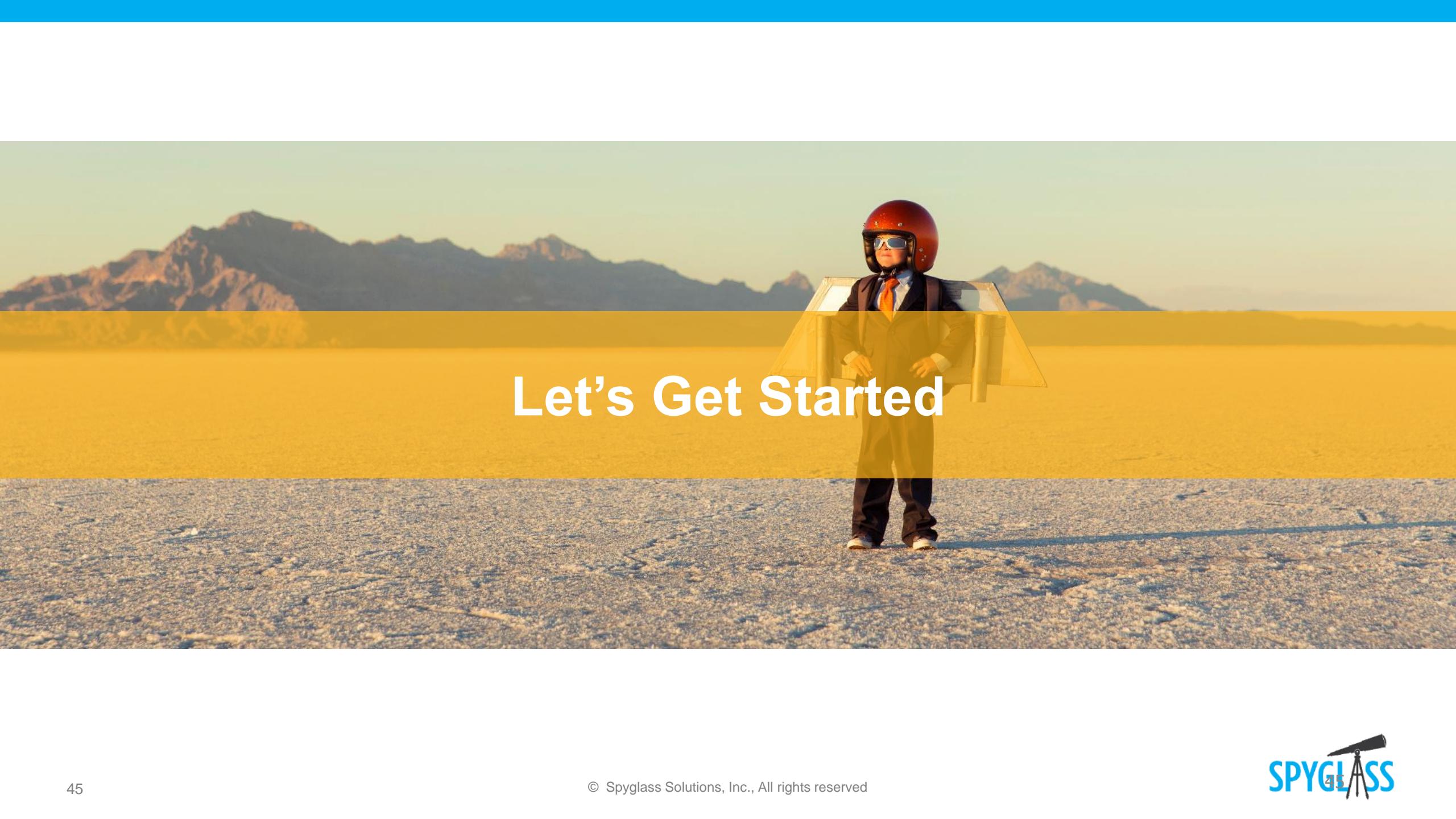


Application Overview



Demo





Let's Get Started

Creating Azure Resources

- Everything in Azure is a resource
- Resources are created in a Subscription
- Tenant can have one or more subscriptions
- Access to resources is controlled by Roles Based Access Control
- When creating be careful on which data center you are using





Download Resources

- Download demo database:

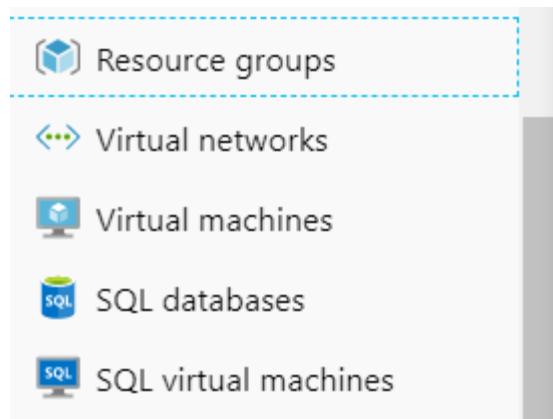
<https://spyglassdemodefault.blob.core.windows.net/files/RServicesMLDemo.zip?st=2019-11-11T14%3A44%3A25Z&se=2020-11-12T14%3A44%3A00Z&sp=rl&sv=2018-03-28&sr=b&sig=F09VCibAYjFzNrPoM06scp3dIAqVm6JTbDYesJAcJm4%3D>

- Samples and basic instructions:

<https://github.com/wrichard-spyglass/Demystifying-Machine-Learning-and-AI-Workshop>

Creating Azure Resources

- Login And click All Services
- Check Star if NOT Already on Faves:
 - Resource Groups
 - Virtual Networks
 - Virtual Machines
 - SQL Databases
 - SQL Virtual Machines



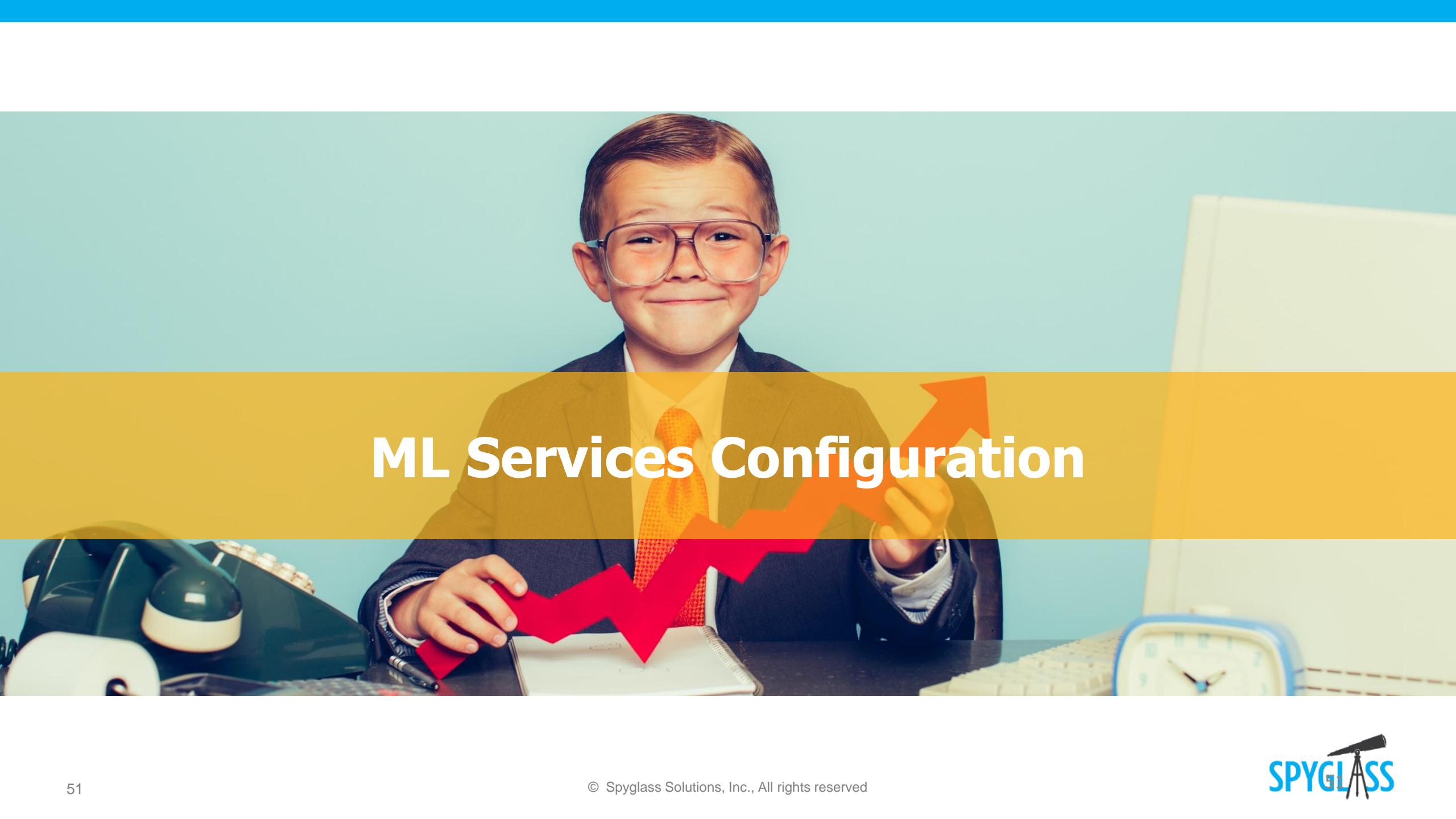


Demo



Objective: Create Resources

- Resource Group
 - "MTCDemoEUS_rg" – East US
- Virtual Network
 - "MTCDemoEUS_vn" – East US
- SQL Virtual Machine
 - Select Resource Group
 - Name MTCDemoSQLML
 - EAST US
 - Size = DS13_v2
 - SQL Server 2017 Developer on Windows Server 2016
 - New VNET – MTCDemoEastUS_vn
 - SQL Connectivity = Private
 - Enable SQL Authentication
 - General Storage
 - Disable backup
 - Disable R Services(Advanced Analytics) **Don't cheat
- Add client IP to Network Security Group inbound
- Connect to VM
 - Download RDP File
 - If on Mac go to:
<https://docs.microsoft.com/en-us/windows-server/remote/remote-desktop-services/clients/remote-desktop-mac>
 - Connect to VM with admin credentials

A young boy with glasses and a suit is holding a red arrow pointing upwards. He is sitting at a desk with a computer keyboard and a telephone. The background is yellow.

ML Services Configuration

Configuration

The image shows two screenshots of the SQL Server 2017 Setup interface.

Left Screenshot: Installation Type

This screen allows you to choose the type of installation:

- Perform a new installation of SQL Server 2017
- Add features to an existing instance of SQL Server 2017

For the second option, a dropdown menu shows "MSSQLSERVER".

Installed instances:

Instance Name	Instance ID	Features	Edition	Version
MSSQLSERVER	MSSQL14.MSSQLS...	SQLEngine,SQLEn...	Developer	14.0.3192.2
<Shared Compone...		Conn, BC, SDK		14.0.1000.169
<Shared Compone...		DQC, IS, MDS		14.0.3192.2

Right Screenshot: Complete

Your SQL Server 2017 installation completed successfully with product updates.

Global Rules

Information about the Setup operation or possible next steps:

Feature	Status
Python	Succeeded

Details:

Install successful.

Product Update:
Product Update has successfully applied KB 4505225 <https://support.microsoft.com/?id=4505225>. These updates have set the patch level of the Setup operation to 14.0.3192.0.

Summary log file has been saved to the following location:
C:\Program Files\Microsoft SQL Server\140\Setup Bootstrap\Log\20190802_203117\Summary_spymlservicesvm_20190802_203117.txt

Buttons:

- Close

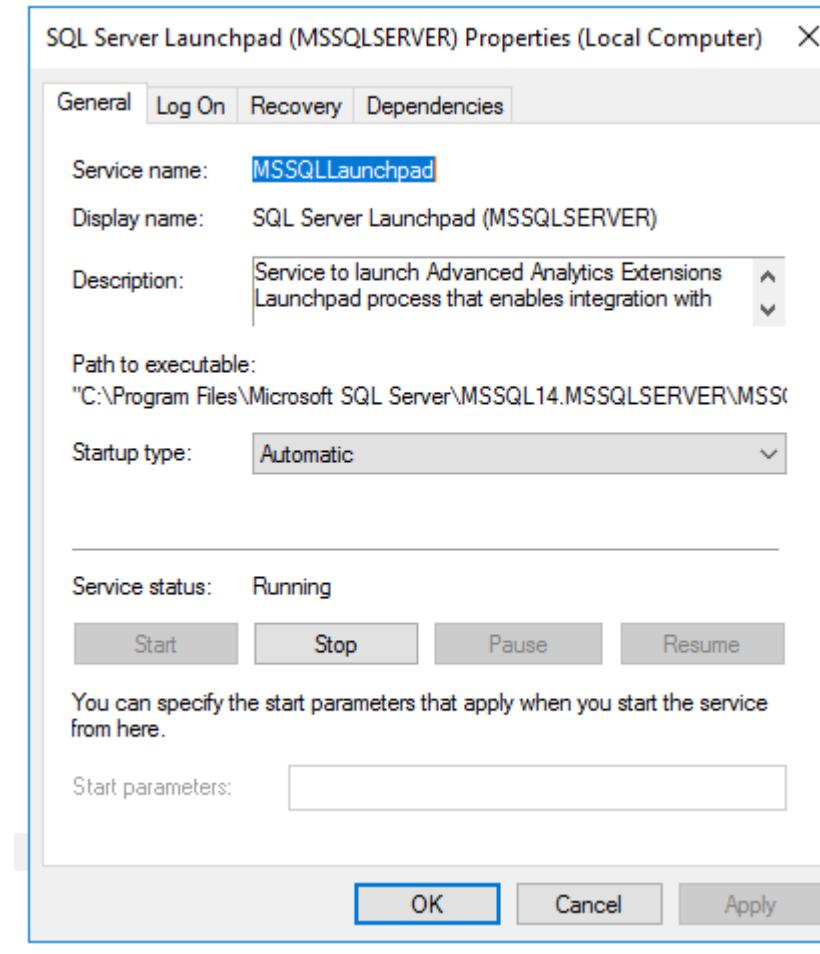


Demo



Objective: Install & Confirm SQL ML Services

- Find the SQL Installation Media
- Add Features to Existing Installation
- Install Python and R ML Services
- Update Environment Variables
- Configure Database
- Restart the Database Service
- Update Launchpad Service to Automatic





Pre-Trained Machine Learning

Sophisticated pretrained models

Infuse apps with powerful, pre-trained AI models

Customize easily and tailor to your needs



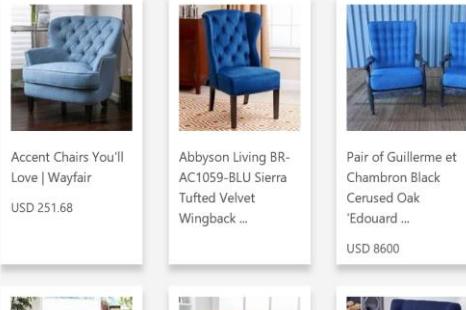
Vision



Computer Vision | Video Indexer | Face | Content Moderator



Bing
Search



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

A₊
Language



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

Analyzed text JSON

LANGUAGES: English (confidence: 100 %)

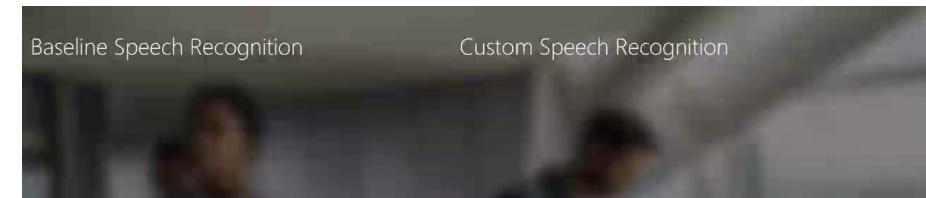
KEY PHRASES:

SENTIMENT: 73 %

LINKED ENTITIES (PREVIEW): a

...

Speech



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

Pre-Trained Models

- Sentiment Analysis
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- Image Processing
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- Built by Microsoft and ready-to-use
- Use cases:
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 - Political Outlook
 - File Processing
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 - PHI Identification from Images
 - Visual Search Engine



Demo



Pre-Trained Models

Pros

- Easy to Setup
- Easy to Use
- Easy to Manage
- Quickest application of ML available

Cons

- Not customized to your data
- Need to manually update model version



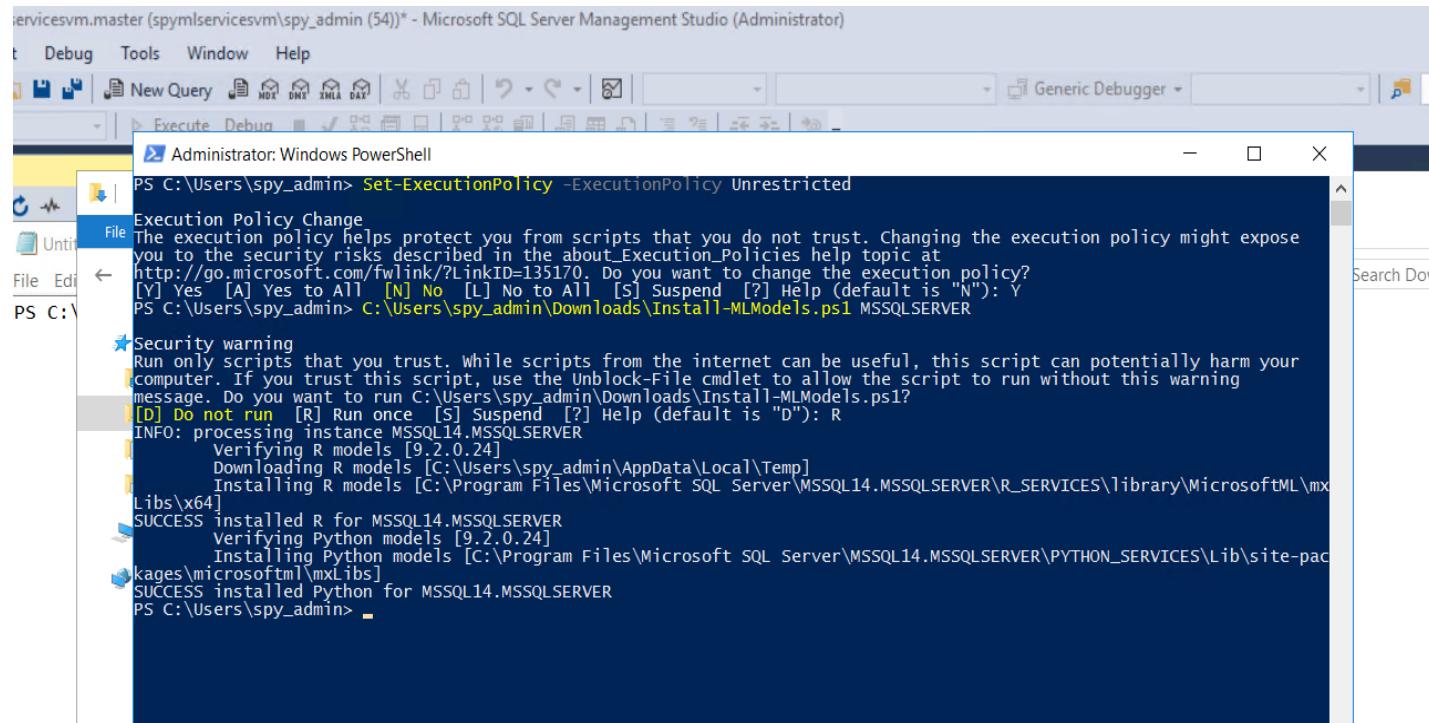
Custom Models

- Customize to your data
- Significantly more options to solve your business problem
- Support for most common open source packages like SCIKIT
- Requires a bit more Python or R skill
- Can be automatically retrained and published



Objective: Install Pre-Trained Models

- Download the file **Install-MLModels.ps1** from GIT or <https://aka.ms/mlm4sql>
- Open Powershell CMD
 - Set Execution Policy Unrestricted
 - Run Install-MLModels.ps1 from download directory



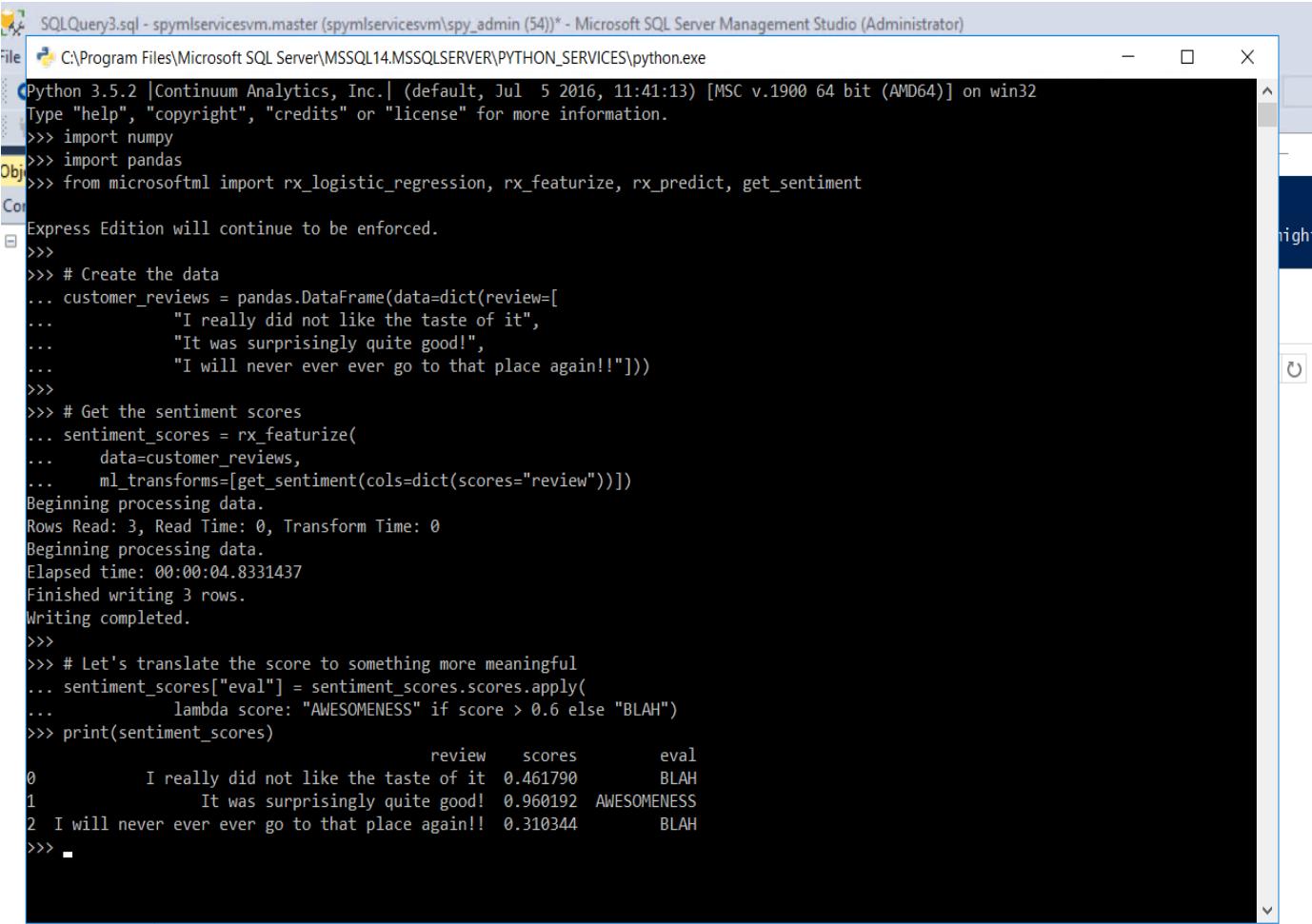
The screenshot shows a Microsoft SQL Server Management Studio (SSMS) interface with a PowerShell window open. The PowerShell window title is "Administrator: Windows PowerShell". The command PS C:\Users\spy_admin> Set-ExecutionPolicy -ExecutionPolicy Unrestricted is run, followed by PS C:\Users\spy_admin> C:\Users\spy_admin\Downloads\Install-MLModels.ps1 MSSQLSERVER. A security warning message appears, asking if the user wants to run the script. The user selects "[D] Do not run". The script then proceeds to install R and Python models. The output shows the progress of the installations, including verifying models and installing them into the MSSQLSERVER instance.

```
PS C:\Users\spy_admin> Set-ExecutionPolicy -ExecutionPolicy Unrestricted
Execution Policy Change
The execution policy helps protect you from scripts that you do not trust. Changing the execution policy might expose you to the security risks described in the about_Execution_Policies help topic at http://go.microsoft.com/fwlink/?LinkId=135170. Do you want to change the execution policy?
[Y] Yes [A] Yes to All [N] No [L] No to All [S] Suspend [?] Help (default is "N"): Y
PS C:\Users\spy_admin> C:\Users\spy_admin\Downloads\Install-MLModels.ps1 MSSQLSERVER

★ Security warning
Run only scripts that you trust. While scripts from the internet can be useful, this script can potentially harm your computer. If you trust this script, use the Unblock-File cmdlet to allow the script to run without this warning message. Do you want to run C:\Users\spy_admin\Downloads\Install-MLModels.ps1?
[D] Do not run [R] Run once [S] Suspend [?] Help (default is "D"): R
INFO: processing instance MSSQL14.MSSQLSERVER
    Verifying R models [9.2.0.24]
    Downloading R models [C:\Users\spy_admin\AppData\Local\Temp]
    Installing R models [C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\library\MicrosoftML\x64]
SUCCESS installed R for MSSQL14.MSSQLSERVER
    Verifying Python models [9.2.0.24]
    Installing Python models [C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES\Lib\site-packages\microsoftml\mxlibs]
SUCCESS installed Python for MSSQL14.MSSQLSERVER
PS C:\Users\spy_admin>
```

Objective: Validate Pre-Trained Models

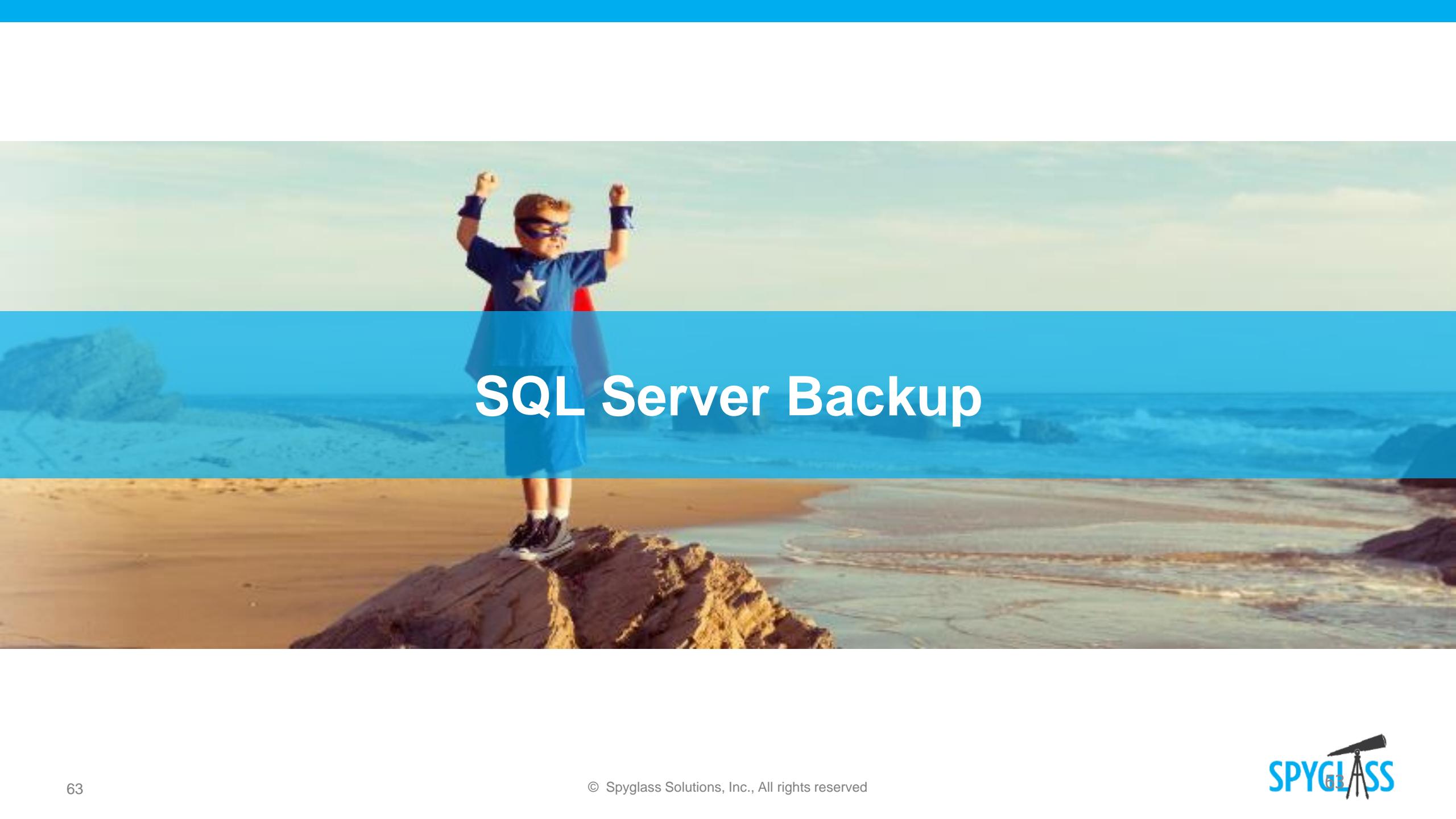
- R Verification
 - Start RDUI @ C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\R_SERVICES\bin\x64
- Python Verification
 - Python.exe at C:\Program Files\Microsoft SQL Server\MSSQL14.MSSQLSERVER\PYTHON_SERVICES



The screenshot shows a Microsoft SQL Server Management Studio window titled "SQLQuery3.sql - spymlservicesvm.master (spymlservicesvm\spy_admin (54))* - Microsoft SQL Server Management Studio (Administrator)". The session is running Python 3.5.2. The code imports numpy and pandas, and uses rx_logistic_regression, rx_featurize, rx_predict, and get_sentiment from microsoftml. It creates a DataFrame of customer reviews and processes them to get sentiment scores. The output shows three rows of reviews with their scores and corresponding eval values ("AWESOMENESS" or "BLAH").

```
Python 3.5.2 |Continuum Analytics, Inc.| (default, Jul  5 2016, 11:41:13) [MSC v.1900 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> import numpy
>>> import pandas
>>> from microsoftml import rx_logistic_regression, rx_featurize, rx_predict, get_sentiment
Express Edition will continue to be enforced.

>>>
>>> # Create the data
... customer_reviews = pandas.DataFrame(data=dict(review=[
...     "I really did not like the taste of it",
...     "It was surprisingly quite good!",
...     "I will never ever ever go to that place again!!"]))
...
>>> # Get the sentiment scores
... sentiment_scores = rx_featurize(
...     data=customer_reviews,
...     ml_transforms=[get_sentiment(cols=dict(scores="review"))])
Beginning processing data.
Rows Read: 3, Read Time: 0, Transform Time: 0
Beginning processing data.
Elapsed time: 00:00:04.8331437
Finished writing 3 rows.
Writing completed.
>>>
>>> # Let's translate the score to something more meaningful
... sentiment_scores["eval"] = sentiment_scores.scores.apply(
...     lambda score: "AWESOMENESS" if score > 0.6 else "BLAH")
>>> print(sentiment_scores)
      review      scores        eval
0 I really did not like the taste of it  0.461790    BLAH
1 It was surprisingly quite good!  0.960192  AWESOMENESS
2 I will never ever ever go to that place again!!  0.310344    BLAH
>>>
```

A young boy with blonde hair, wearing a blue superhero costume with a red cape and a white star on the chest, stands on a large, weathered wooden log. He is looking towards the horizon with his arms raised in a triumphant pose. The background features a vast, sandy beach leading to a calm ocean under a clear sky.

SQL Server Backup

SQL Server vs. Azure SQL Database

- Not all features of SQL are available in SQL Azure
 - Cannot restore database .bak to Azure SQL
 - Machine Learning Services is in Preview
 - R is the only available language in Preview
- Move existing SQL databases to SQL Azure with
 - Data Migration Assistant
 - Creating a “Data Tier Application” (bacpac)
 - “Deploy Database to SQL Azure”
 - 3rd party tools e.g. Redgate SQL Compare or Data Compare
- For Demo we will restore .bak to VM and deploy to SQL Azure if you feel adventurous



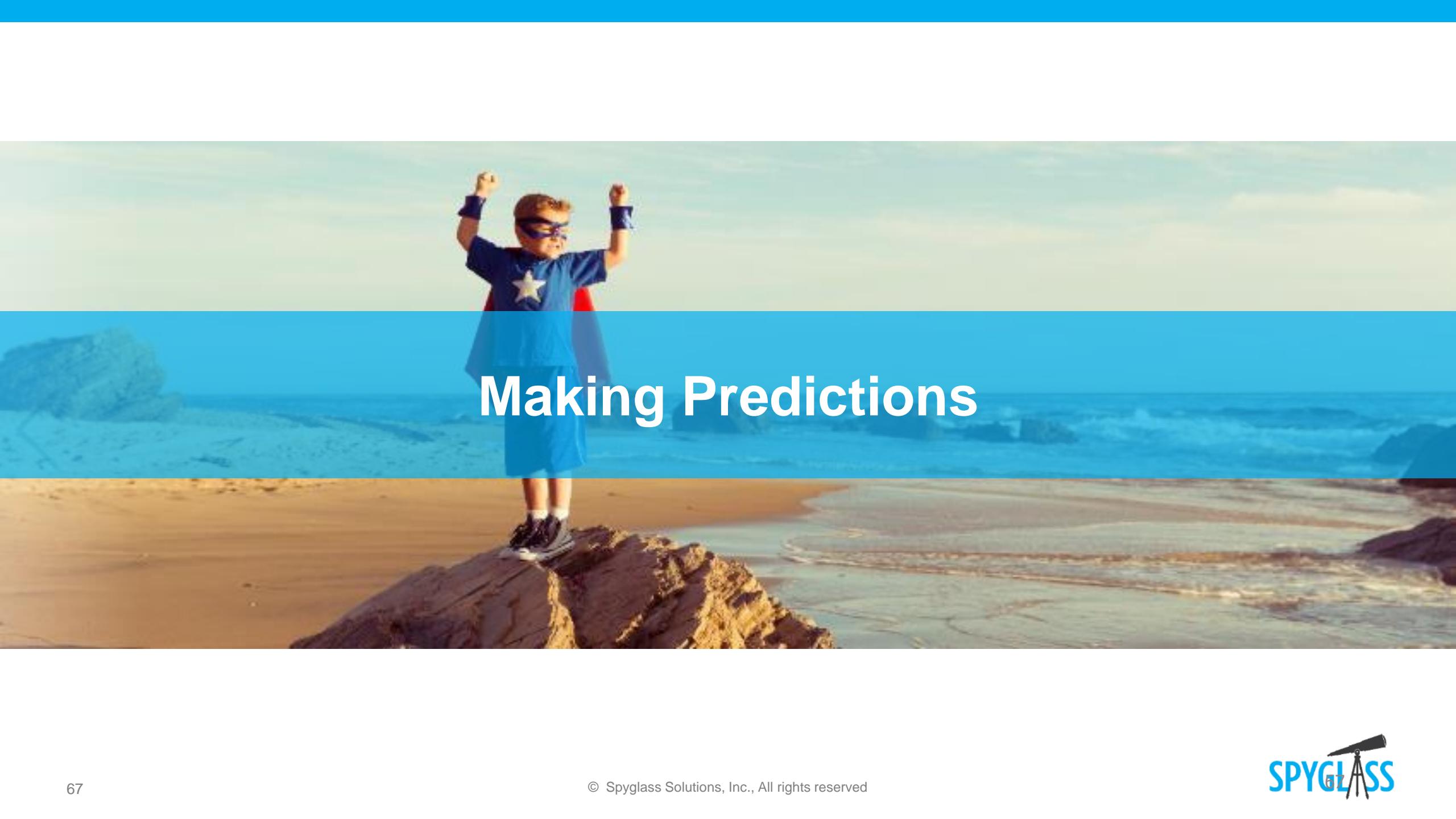


Demo



Objective: Restore database from Backup (Azure SQL Optional)

- Restore .bak to SQL Virtual Machine
 - SSMS
- Create Azure SQL Database
 - Select Standard
 - Vcore
 - Gen 5
- Deploy Database to Azure SQL
 - “Deploy Database to SQL Azure”
- SQL Server Management Studio 18
 - Connect to Database server and execute example procedure
 - Connect to SQL Azure and execute example procedure
- Review predictions and example procedure



Making Predictions

Machine Learning Services & T-SQL Procedures

- Python and R scripts work with relational data input via SQL
- T-SQL procedures execution
 - In-database execution
 - No need to move data
 - Prepare and clean data with SQL, Python or R
 - Perform feature engineering with SQL, Python or R
 - Train, evaluate, and deploy machine learning models
 - Triggers, Parameters, Consume on-demand, Direct Power BI Consumption
 - Security
 - Obscure code from end-users
 - Can provide predictions without access to underlying data
- Input data is identified by implicit variables
 - "@input_data_1 & @input_data_1_name"

SQL

```
DECLARE @speedmodel VARBINARY(max) = (
    SELECT model
    FROM dbo.stopping_distance_models
    WHERE model_name = 'latest model'
);

EXECUTE sp_execute_external_script @language = N'R'
    , @script = N'
current_model <- unserialize(as.raw(speedmodel));
new <- data.frame(NewCarData);
predicted.distance <- rxPredict(current_model, new);
str(predicted.distance);
OutputDataSet <- cbind(new, ceiling(predicted.distance));
'

    , @input_data_1 = N'SELECT speed FROM [dbo].[NewCarsSpeed]'
    , @input_data_1_name = N'NewCarData'
    , @params = N'@speedmodel varbinary(max)'
    , @speedmodel = @speedmodel
WITH RESULT SETS(
    new_speed INT
    , predicted_distance INT
));
```



Demo



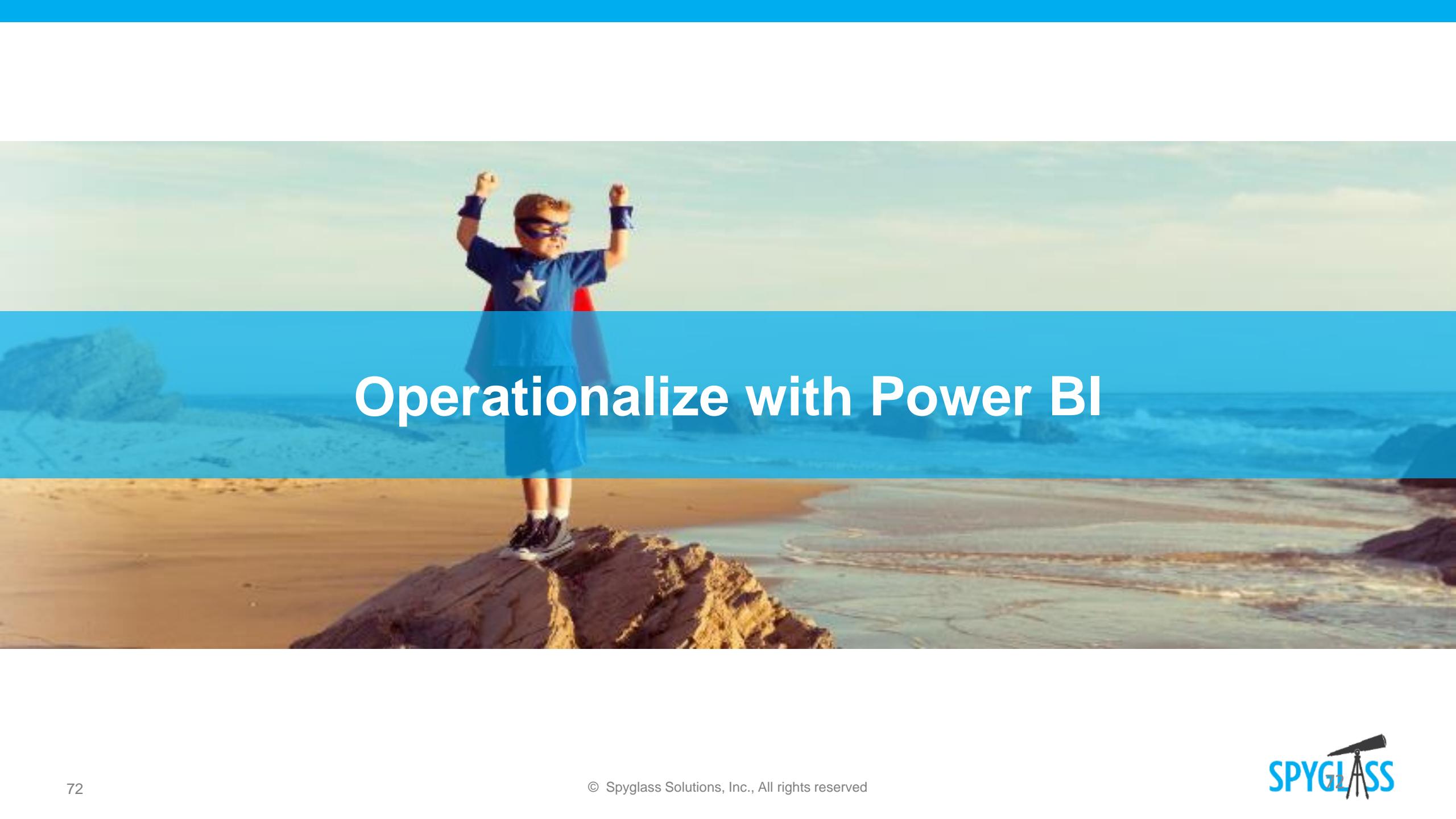
Objective: Create Stored Procedure & Testing the Prediction

- Application Insights
 - Live Metrics
 - Dashboard
 - Application Map



Demo

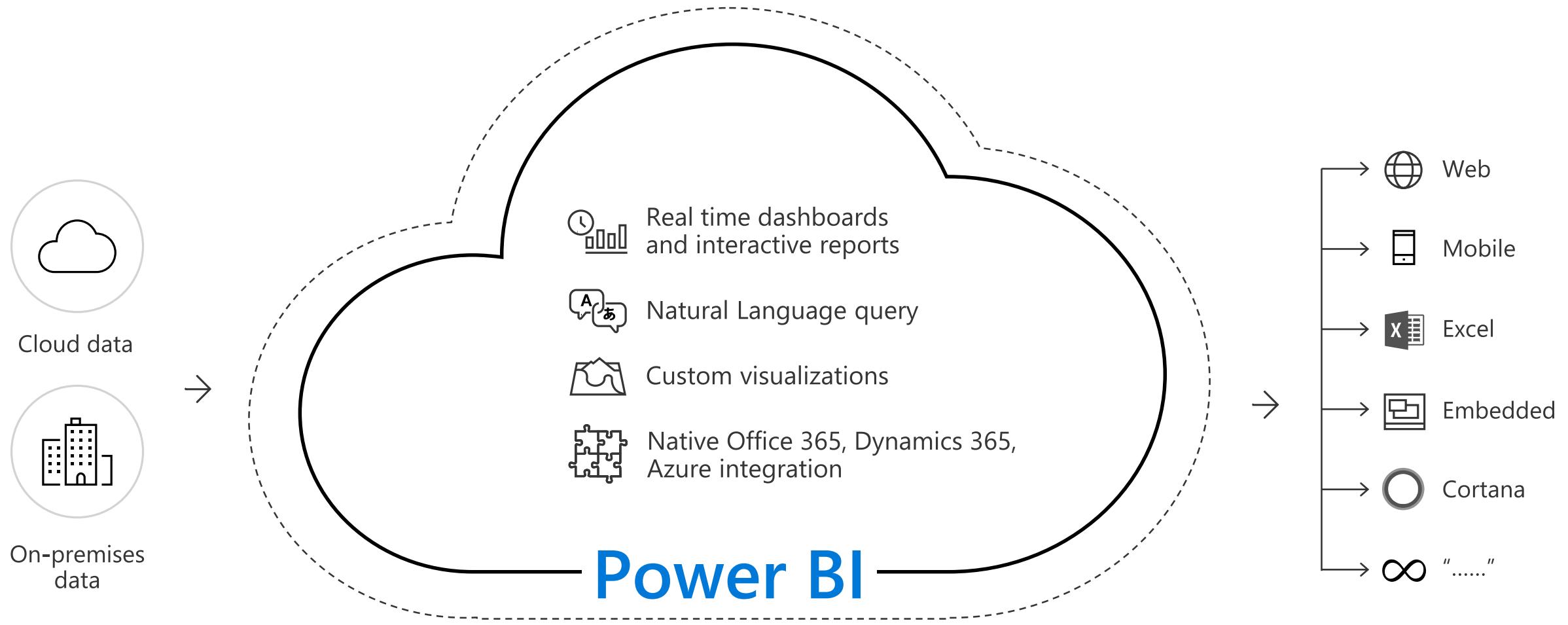




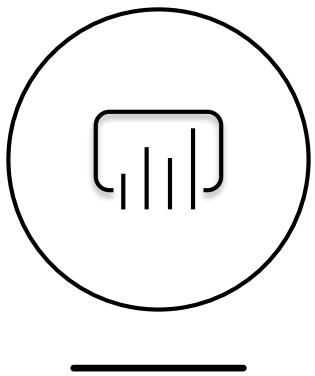
Operationalize with Power BI

Power BI: experience your data

Any data, any way, anywhere



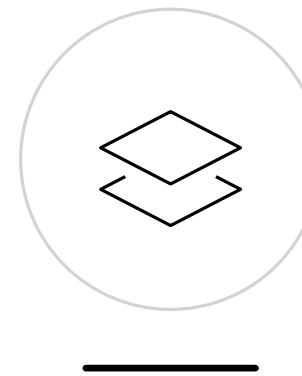
Power BI + Azure Data Services



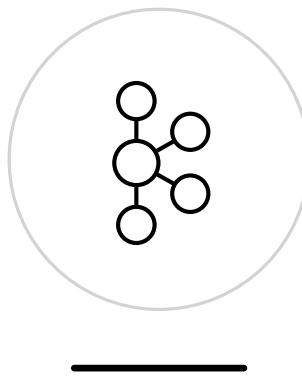
+



Power BI

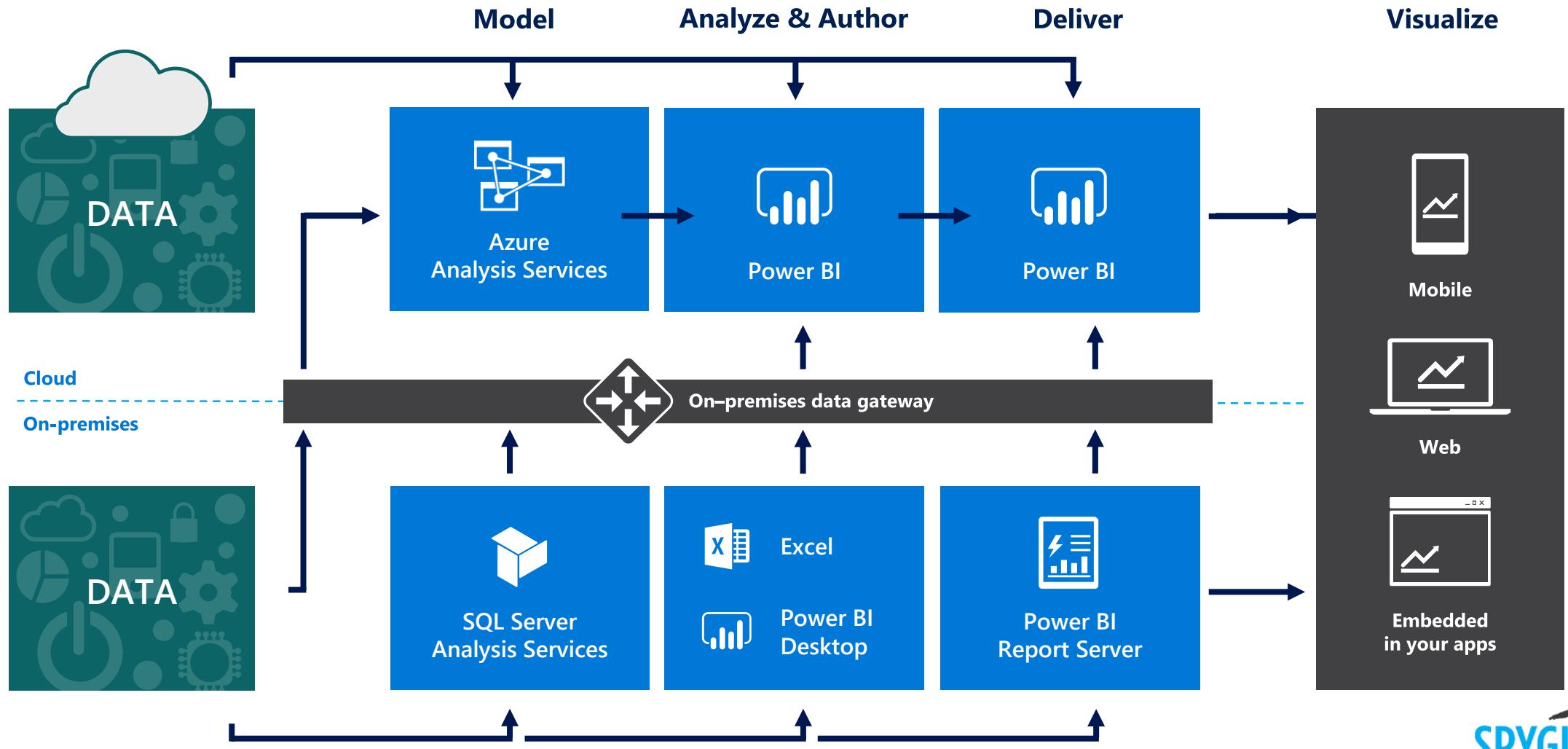


Advanced
analytics on
big data



Real-time
analytics

Modern business intelligence



Power BI Composite Models

Composite Models in Power BI allow you to mix import and direct query data sources

- **Import**

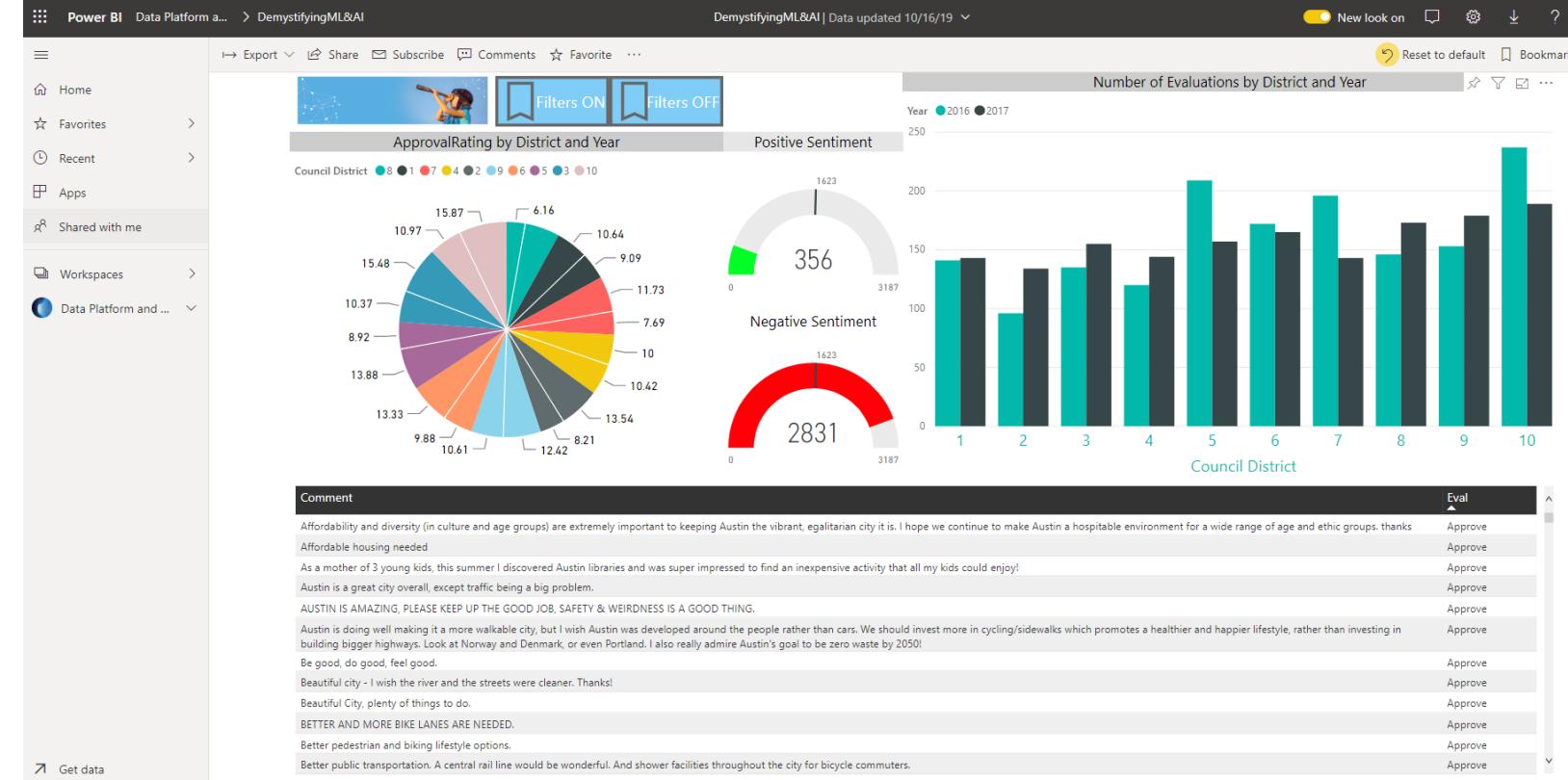
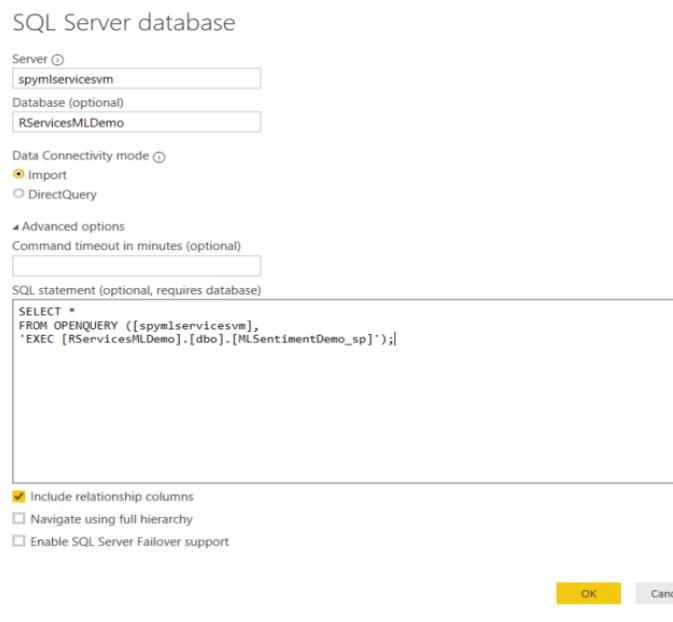
- Required for consuming Store Procedures
- Increases the data stored in the Power BI Service
- Updates require refresh of report (scheduled or manual)
- Improved visual response time

- **Direct Query**

- Ideal for real-time access to data
- Reduces data stored in the Power BI Service
- Pushes computation down to data source (if possible)
- Build visualizations on larger data sets
- Can increase visual response time
- 1 Million row limit (post aggregation)
- Data source RLS supported in some cases

Objective: Consume Prediction with Power BI

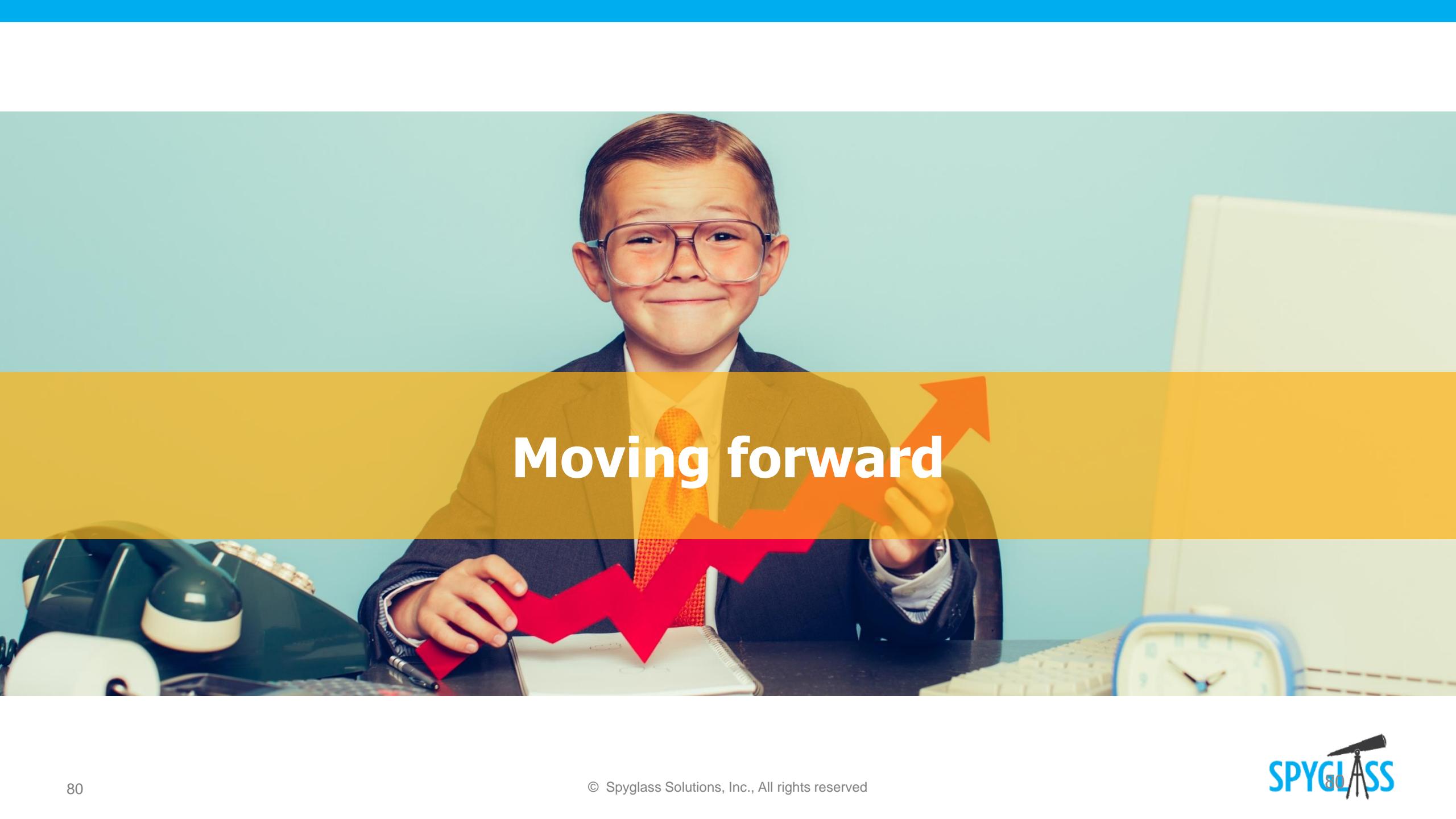
- Open Power BI Desktop





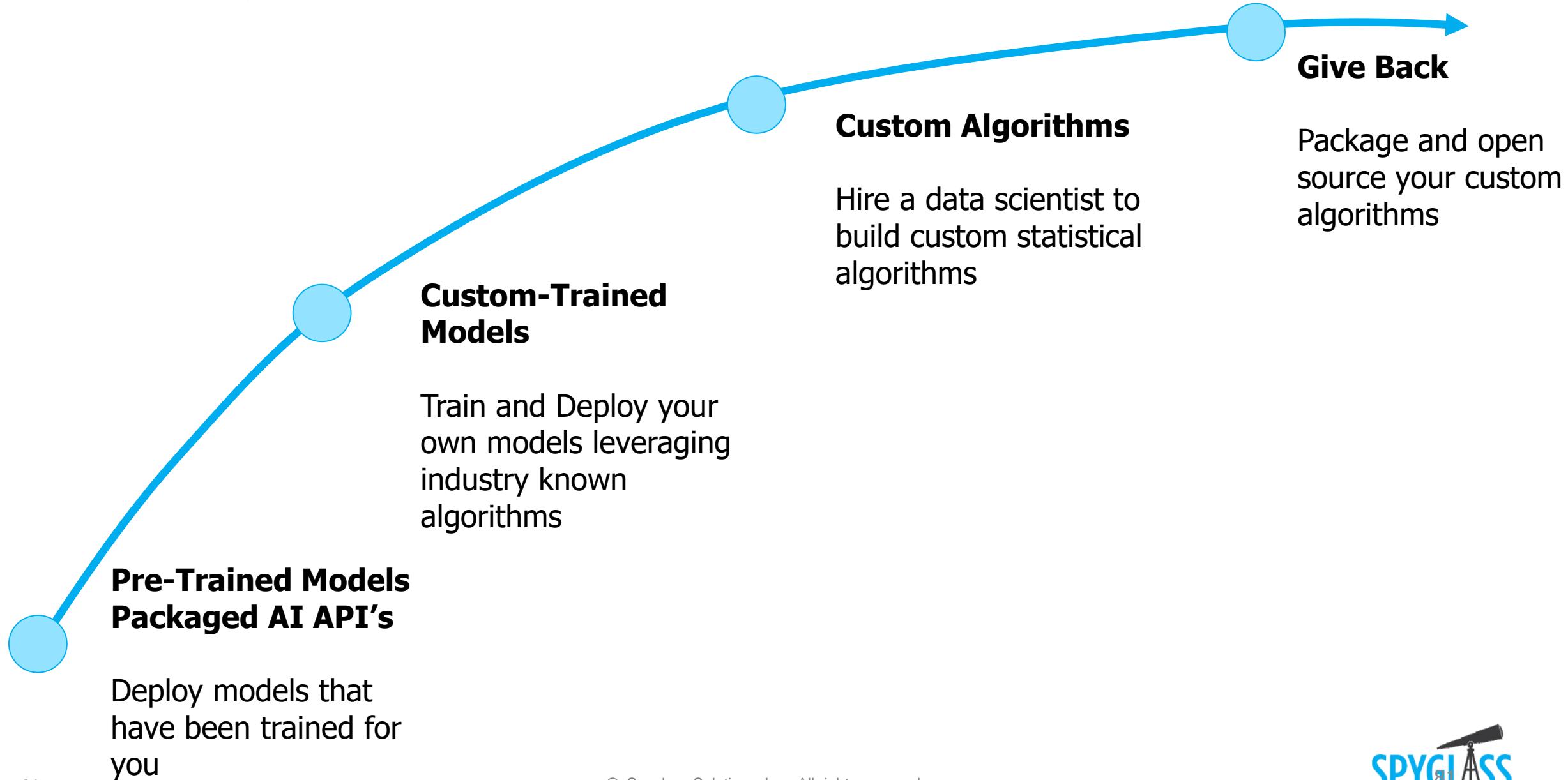
Demo





Moving forward

AI Maturity Model



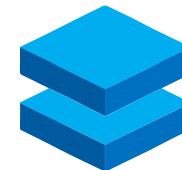
Productive Services

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.



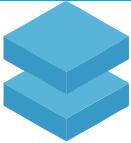
Azure Databricks
Apache Spark-based big-data service

Prepare data clean data at massive scale
Enable collaboration between data scientists and data engineers
Access machine learning optimized clusters

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)



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 auteterminate
- 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

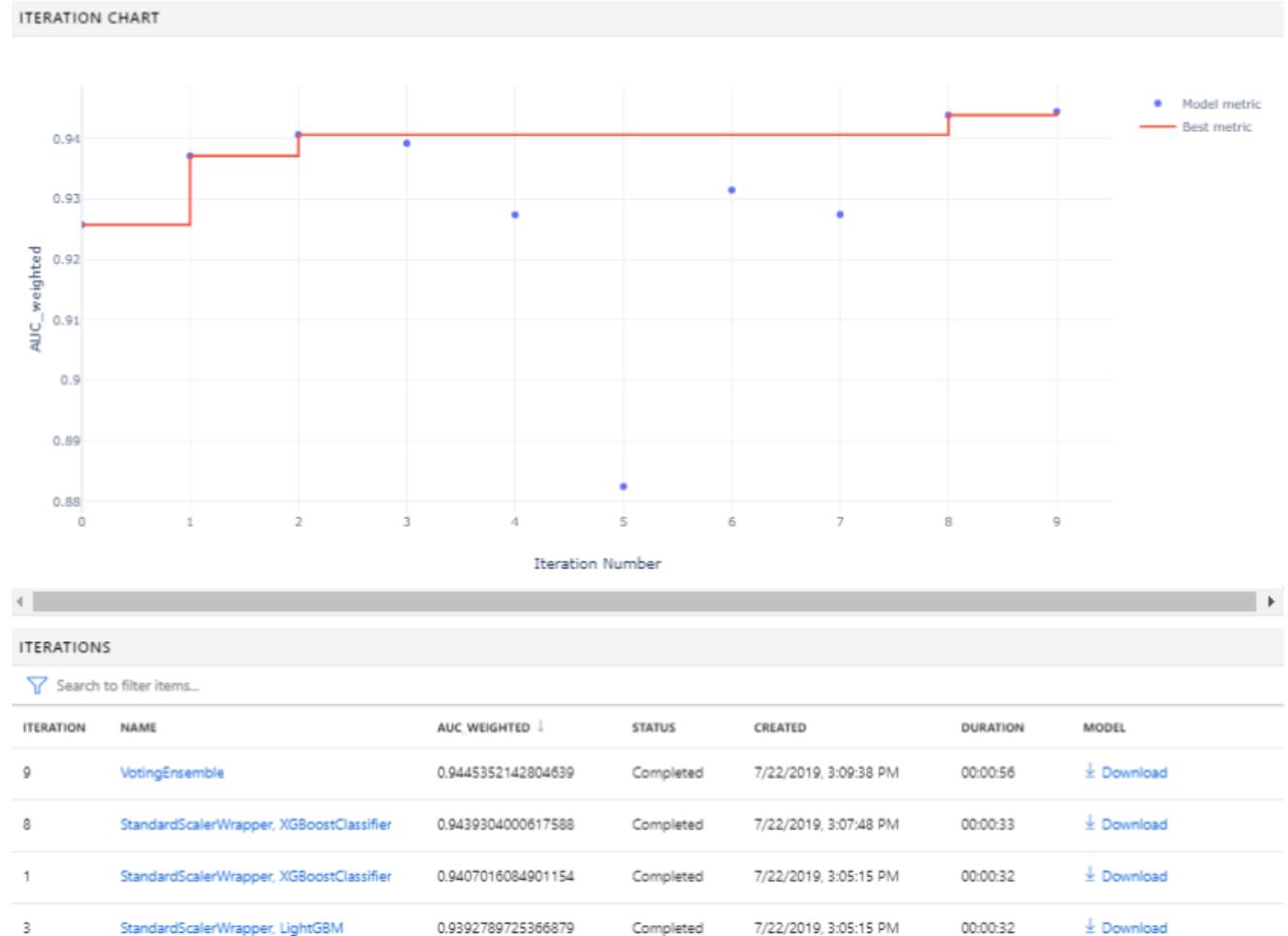
- Automated machine learning
- Managed compute
- DevOps for machine learning
- Simple deployment
- Tool agnostic Python SDK
- Support for open source frameworks



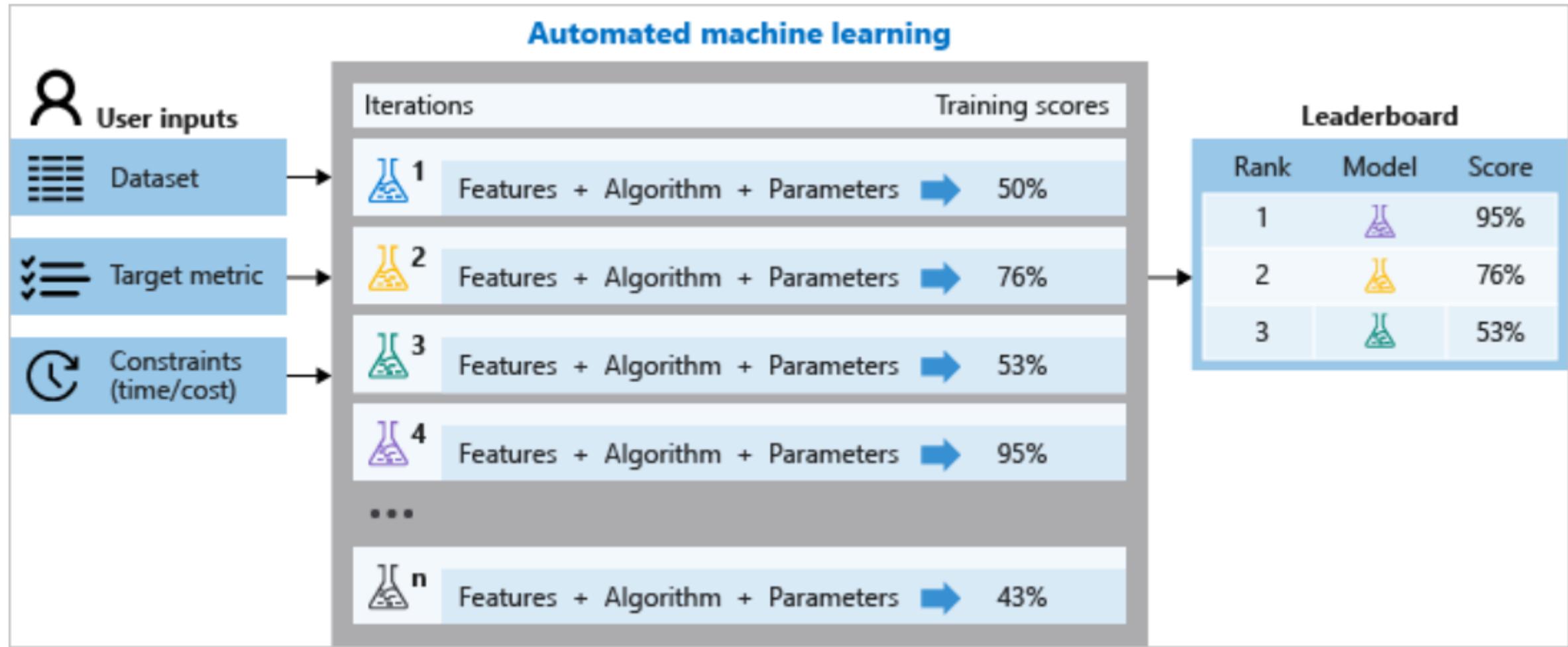
Seamlessly integrated with the Azure Portfolio

Azure Machine Learning

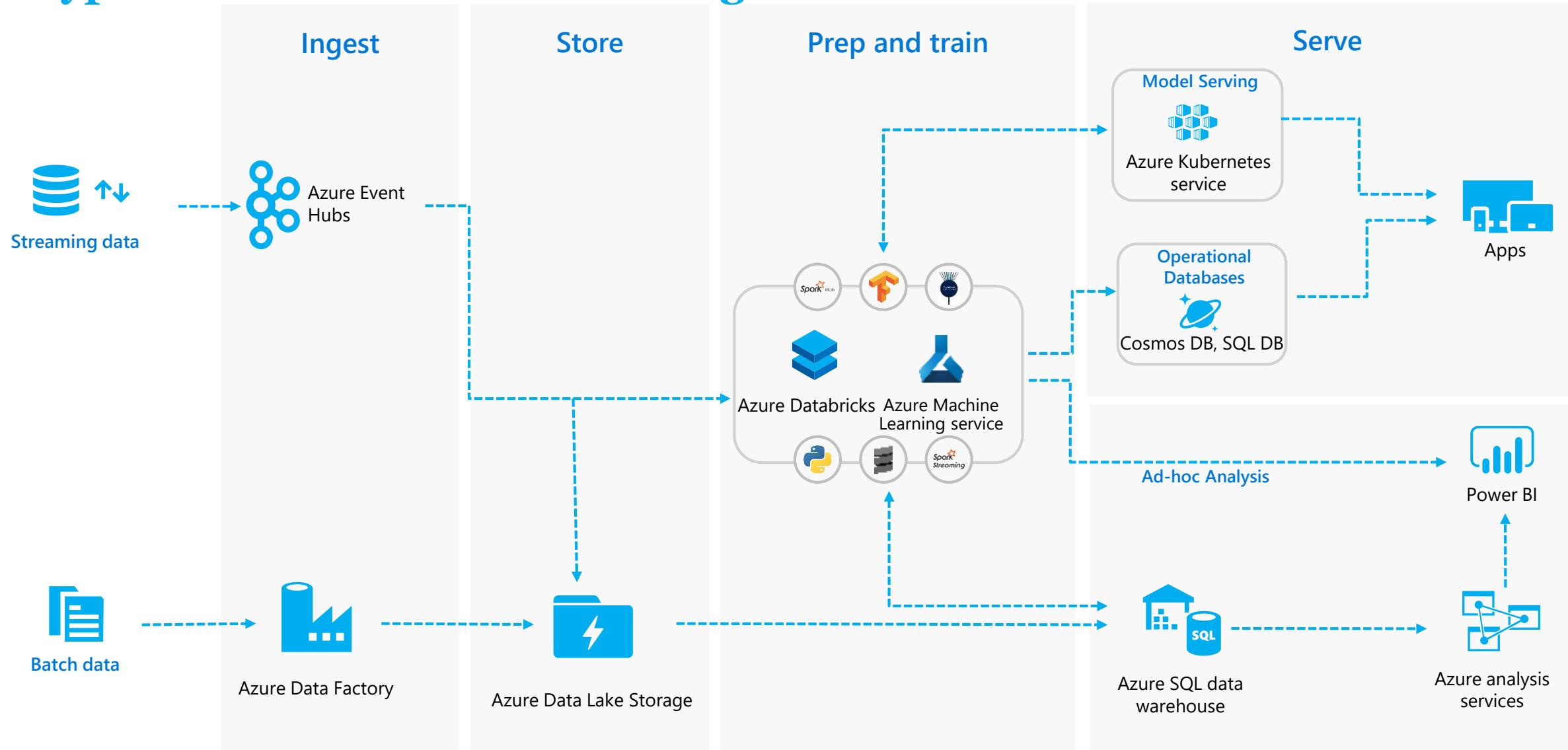
- A Cloud-Based environment
- Auto prep data, train and optimize ML models
- Code and No-Code model development
- Train & Retrain models
- Test Predictions
- Package & Deploy Models
- Manage Experiments, Models, Pipelines and Compute
- Track Model Versioning, Experiment Logging, Etc.....



Azure ML Services - AutoML



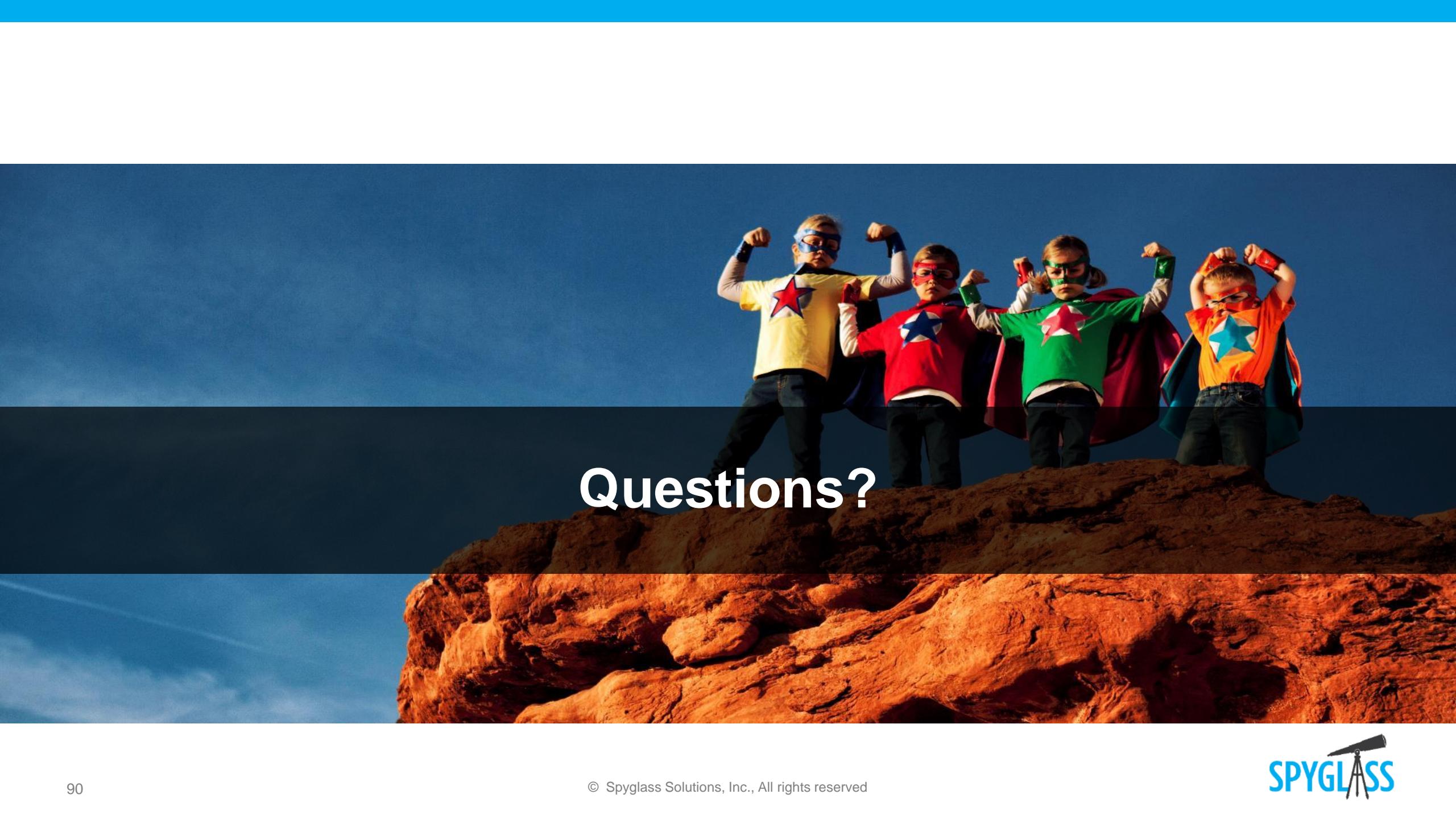
Typical Architecture for building Full-Scale ML solutions





Demo





Questions?



Thank You

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wrichard@spyglassmtg.com