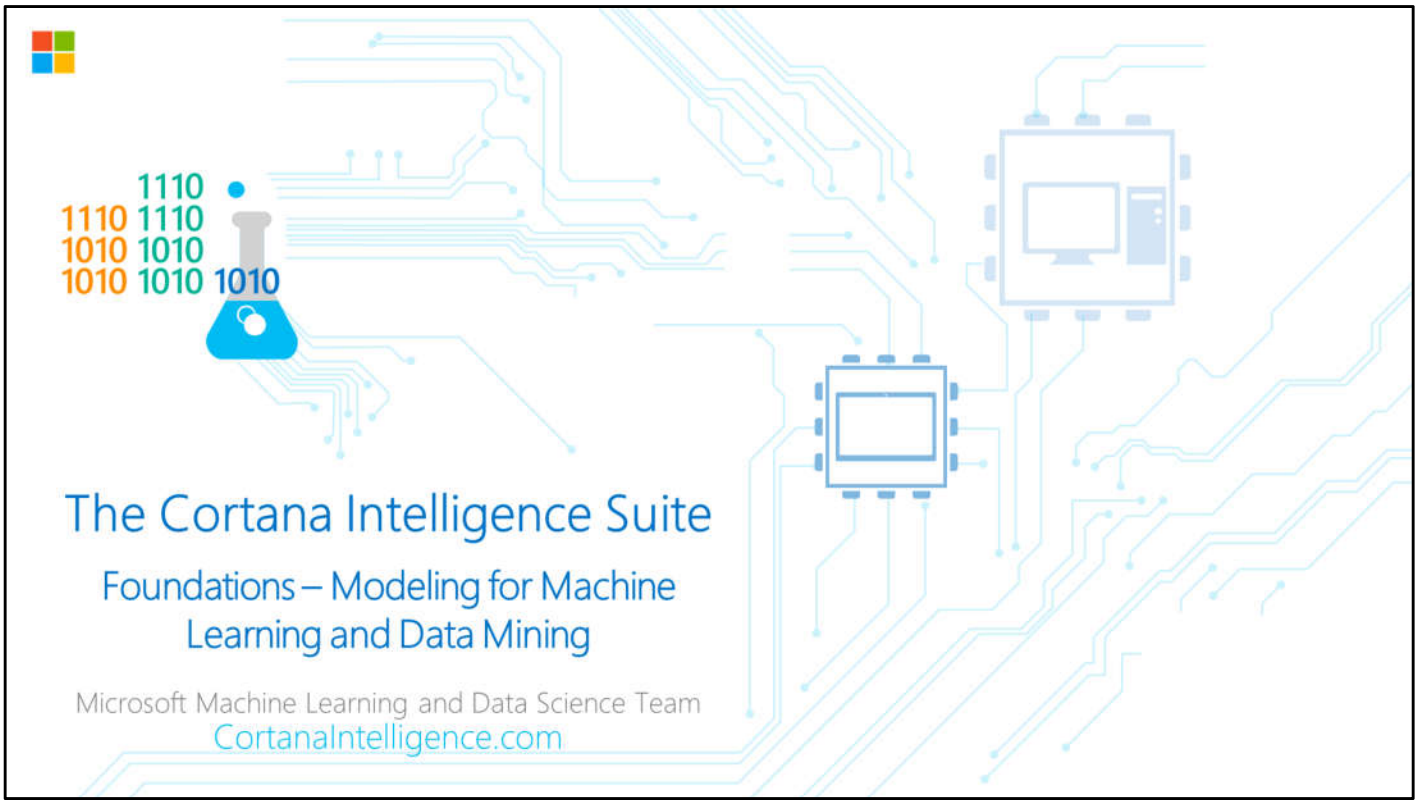


1. Main page: http://cortanaanalytics.com
2. To begin this module, you should have:
    1. Basic Math and Stats skills
    2. Business and Domain Awareness
    3. General Computing Background

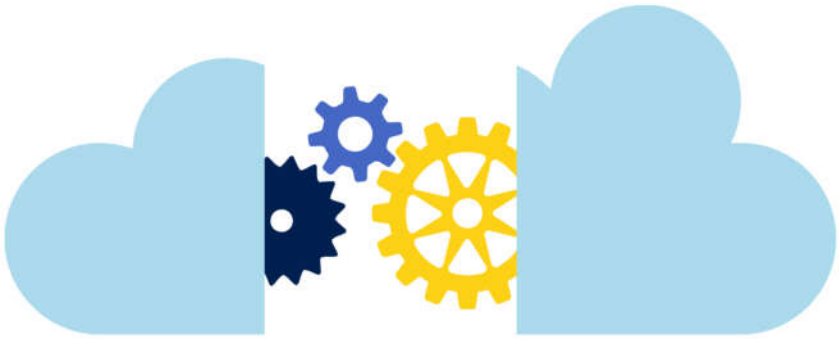
NOTE: These workbooks contain many resources to lead you through the course, and provide a rich set of references that you can use to learn much more about these topics. If the links do not resolve properly, type the link address in manually in your web browser. If the links have changed or been removed, simply enter the title of the link in a web search engine to find the new location or a corollary reference.

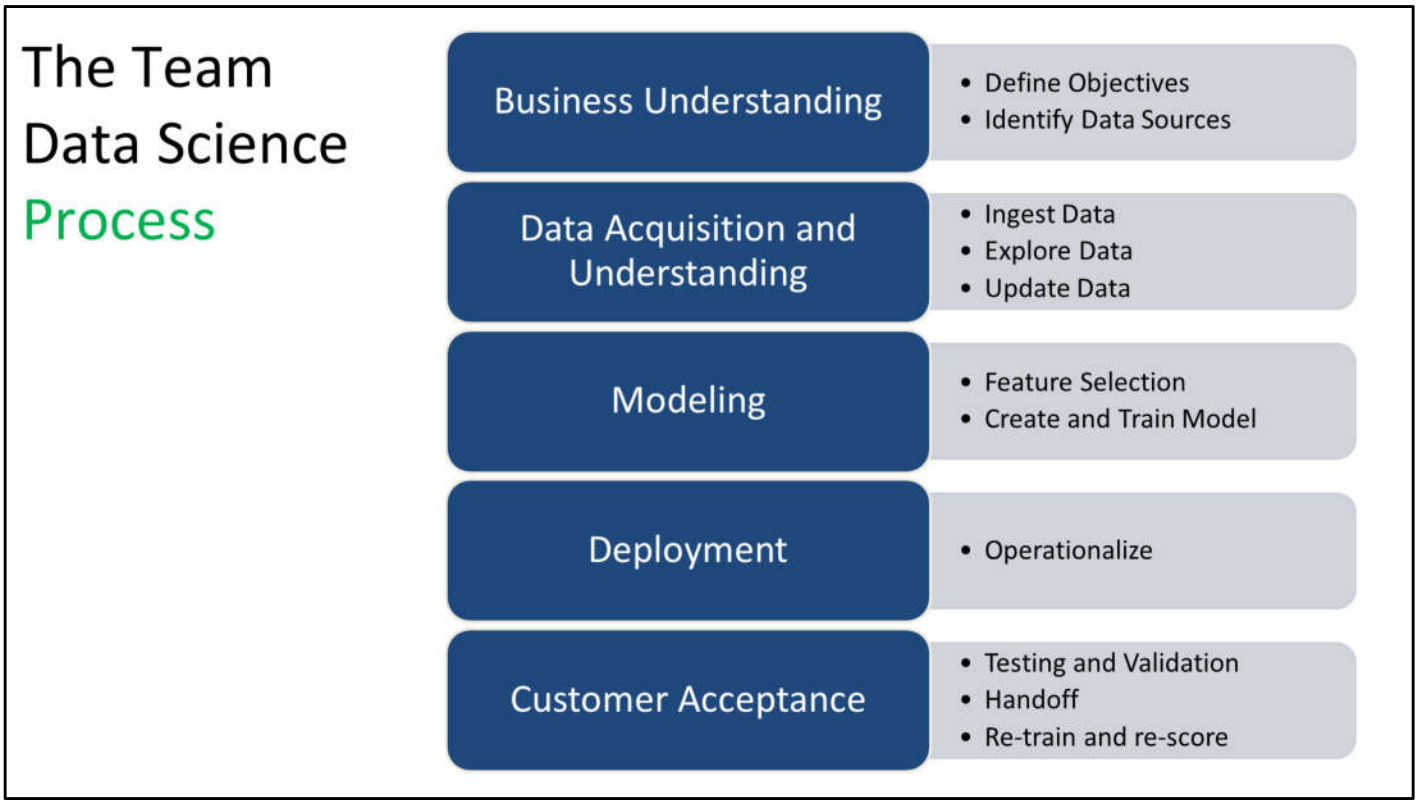
Section 4 Learning Objectives

1. Understand Azure ML and how experiments are created
2. Understand how MRS can be used to perform Machine Learning experiments
3. Use ADF to schedule Azure ML Activities

1. At the end of this Module, you will:
    1. Understand Azure ML and how experiments are created
    2. Understand how MRS can be used to perform Machine Learning experiments
    3. Use ADF to schedule Azure ML Activities

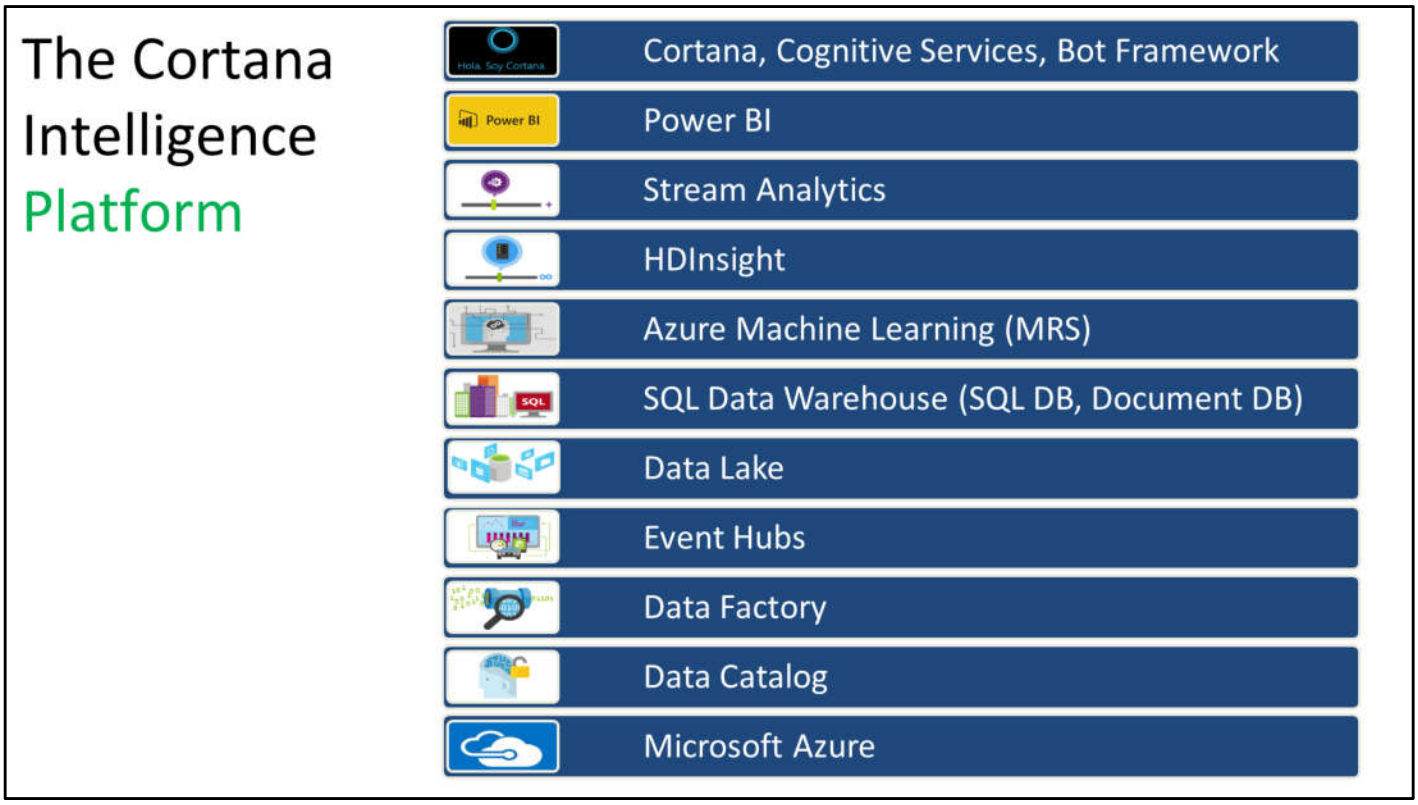
The Data Science Process and Platform





1. This process largely follows the CRISP-DM model: http://www.sv-europe.com/crisp-dm-methodology/
2. It also references the Cortana Intelligence process: https://azure.microsoft.com/en-us/documentation/articles/data-science-process-overview/
3. A complete process diagram is here: https://azure.microsoft.com/en-us/documentation/learning-paths/cortana-analytics-process/
4. Some walkthrough's of the various services: https://azure.microsoft.com/en-us/documentation/articles/data-science-process-walkthroughs/
5. An integrated process and toolset allows for a more close-to-intent deployment

6. Iterations are required to close in on the solution – but are harder tio management and monitor



1. Platform and Storage: Microsoft Azure – http://microsoftazure.com Storage: https://azure.microsoft.com/en-us/documentation/services/storage/ (Host It)
2. Azure Data Catalog: http://azure.microsoft.com/en-us/services/data-catalog (Doc It)
3. Azure Data Factory: http://azure.microsoft.com/en-us/services/data-factory/ (Move It)
4. Azure Event Hubs: http://azure.microsoft.com/en-us/services/event-hubs/ (Bring It)
5. Azure Data Lake: http://azure.microsoft.com/en-us/campaigns/data-lake/ (Store It)
6. Azure DocumentDB: https://azure.microsoft.com/en-us/services/documentdb/ , Azure SQL Data Warehouse: http://azure.microsoft.com/en-us/services/sql-data-warehouse/ (Relate It)
7. Azure Machine Learning: http://azure.microsoft.com/en-us/services/machine-learning/ (Learn It)
8. Azure HDInsight: http://azure.microsoft.com/en-us/services/hdinsight/ (Scale It)
9. Azure Stream Analytics: http://azure.microsoft.com/en-us/services/stream-analytics/ (Stream It)
10. Power BI: https://powerbi.microsoft.com/ (See It)
11. Cortana: http://blogs.windows.com/buildingapps/2014/09/23/cortana-integration-and-speech-recognition-new-code-samples/ and https://blogs.windows.com/buildingapps/2015/08/25/using-cortana-to-interact-with-your-customers-10-by-10/ and https://developer.microsoft.com/en-us/Cortana (Say It)
12. Cognitive Services: https://www.microsoft.com/cognitive-services
13. Bot Framework: https://dev.botframework.com/
14. All of the components within the suite: https://www.microsoft.com/en-us/server-cloud/cortana-intelligence-suite/what-is-cortana-intelligence.aspx
15. What can I do with it? https://gallery.cortanaintelligence.com/

16. Getting Started Quickly: https://cags.azure.net/#gallery

Module 1:
Azure ML

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1. Example paths for using Azure ML: https://azure.microsoft.com/en-us/documentation/articles/machine-learning-data-science-plan-sample-scenarios/

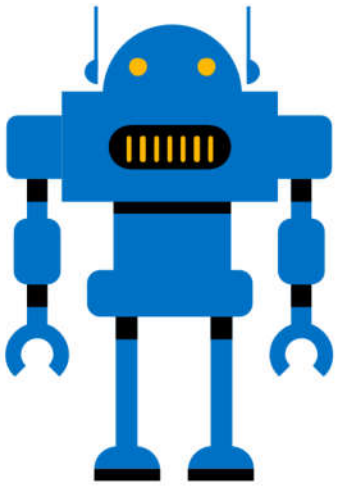
Machine Learning in 5 Minutes

The Formal one:

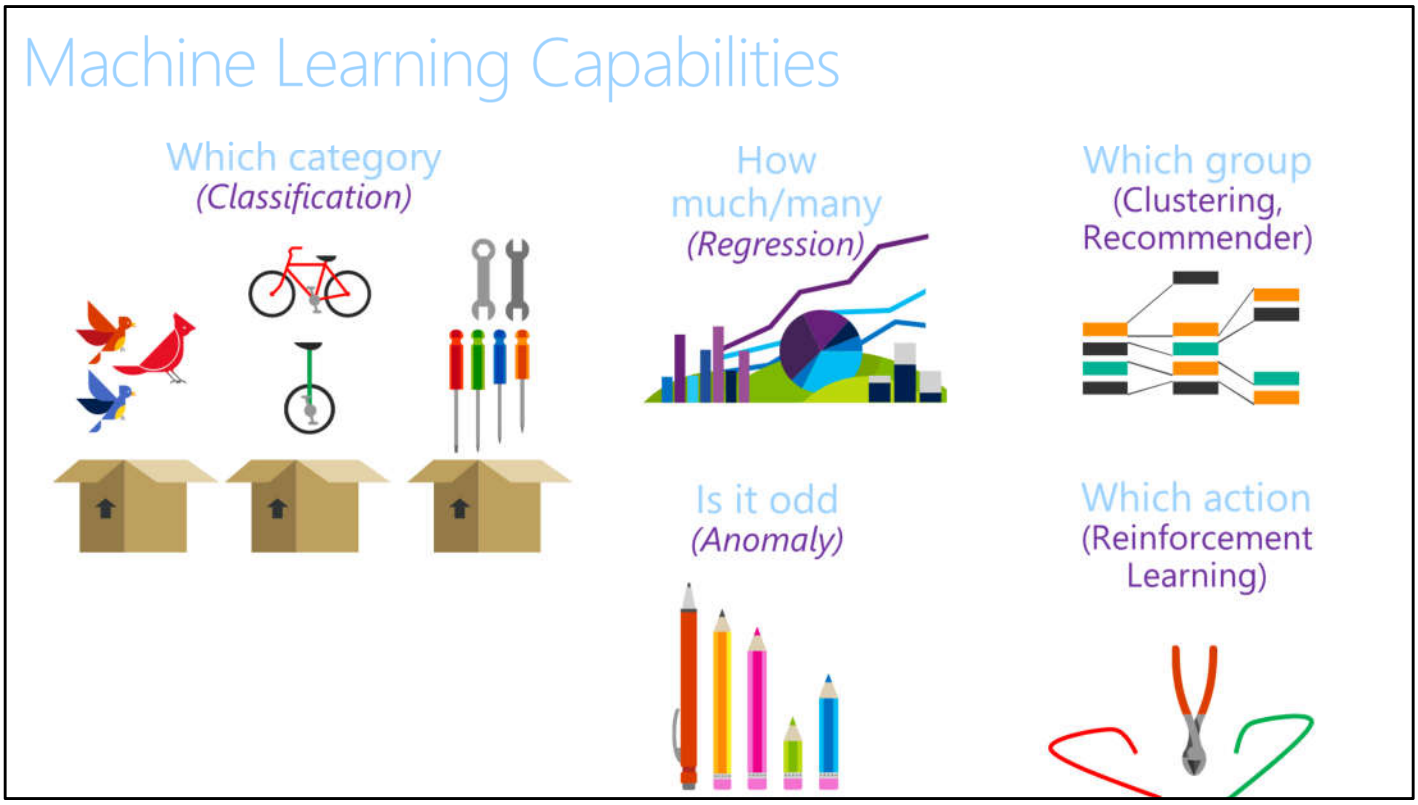
"A computer program is said to learn from experience E with respect to some class of tasks T and performance measure P if its performance at tasks in T, as measured by P, improves with experience E."

A Practical Example:

Look at data. Do the thing. Better? No? Look at the data. Do something different. Better? Yes? *Do that again*. (Repeat)



1. Choosing an Algorithm for Machine Learning: https://azure.microsoft.com/en-us/documentation/articles/machine-learning-algorithm-choice/



1. Regression: Predict a real value for each item (stock/currency value, temperature). – How much/how many?
2. Classification: Assign a category to each item (Chinese | French | Indian | Italian | Japanese restaurant). – Which Category?
3. Clustering/Recommendation: Partition items into homogeneous groups (clustering twitter posts by topic). – Which Groups?
4. Anomaly: Identify when something unexpected happens. – Is this weird?
5. Reinforcement Learning: Make an appropriate action for some new data. – Which action?

Machine Learning Algorithms

Split into two main categories:

- Supervised learning
  - Predicting the future
  - Learn from known past examples to predict future
  - Labels provided
- Unsupervised learning
  - Making sense of data
  - Understanding the past
  - Learning the structure of data
  - Labels no provided

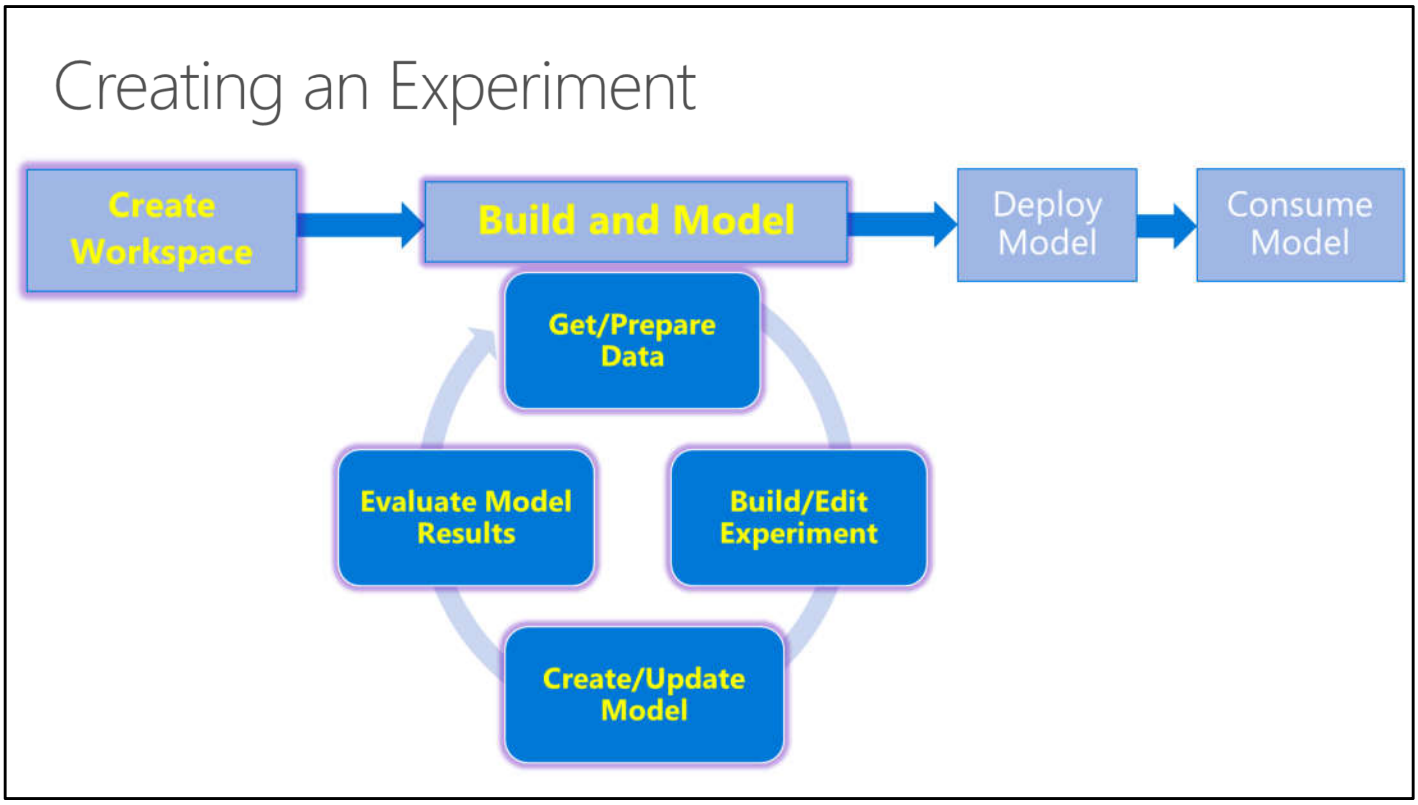
1. Algorithm Documentation: https://msdn.microsoft.com/library/dn905974.aspx
2. Exploring: https://azuremlsimpleds.azurewebsites.net/simpleds/

The Azure ML Environment

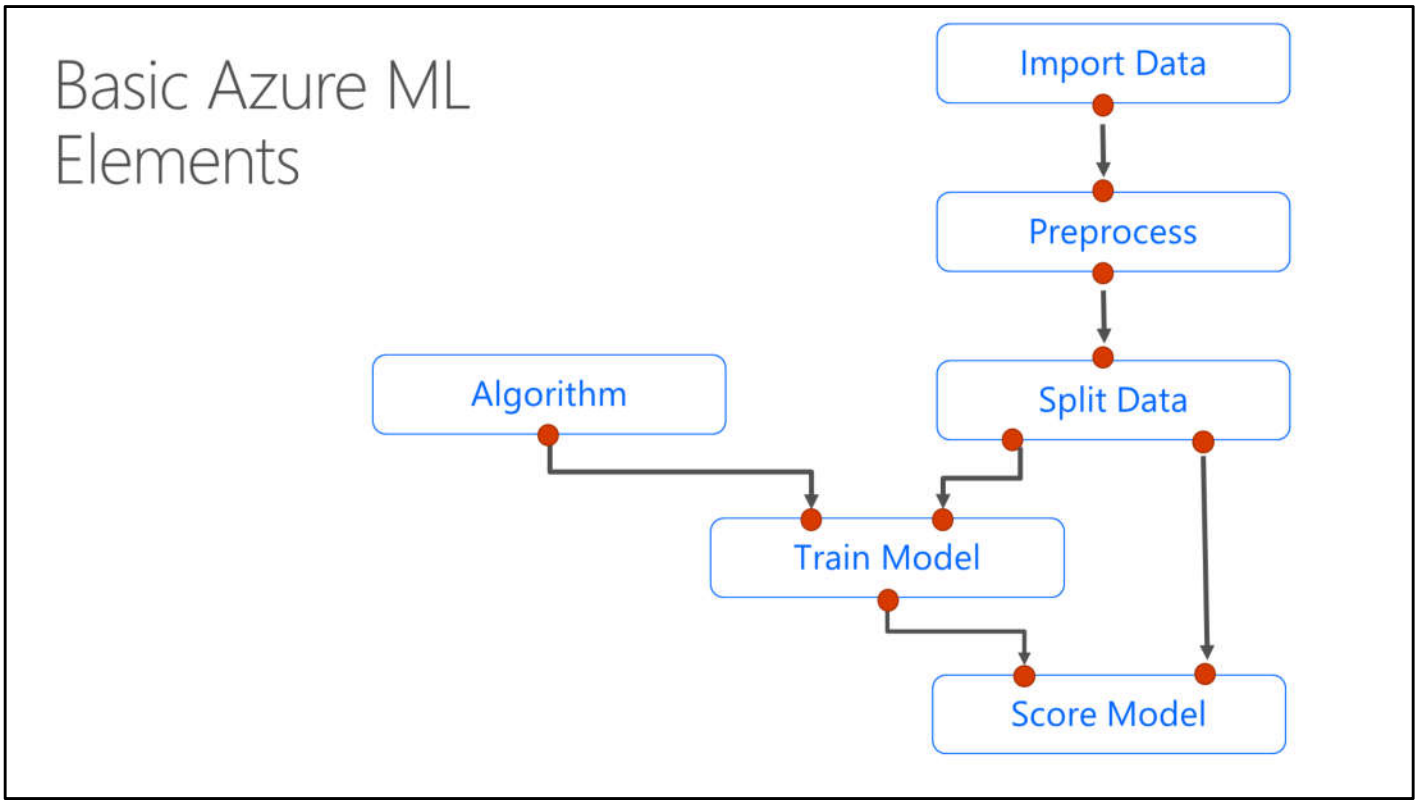
Development Environment
- Creating Experiments
- Sharing a Workspace

Deployment Environment
- Publishing the Model
- Using the API
- Consuming in various tools

1. Guided tutorials: https://azure.microsoft.com/en-us/documentation/services/machine-learning/
2. Microsoft Azure Virtual Academy course: https://mva.microsoft.com/en-US/training-courses/microsoft-azure-machine-learning-jump-start-8425?l=ehQZFoKz_7904984382



1. Beginning Series: https://azure.microsoft.com/en-us/documentation/articles/machine-learning-data-science-for-beginners-the-5-questions-data-science-answers/



1. Designing an experiment in the Studio: https://azure.microsoft.com/en-us/documentation/articles/machine-learning-what-is-ml-studio/

1. Open the **AML Student Workbook** from your \Resources folder
2. Follow the instructions you find there

Module 2:
Microsoft R Server for Machine Learning

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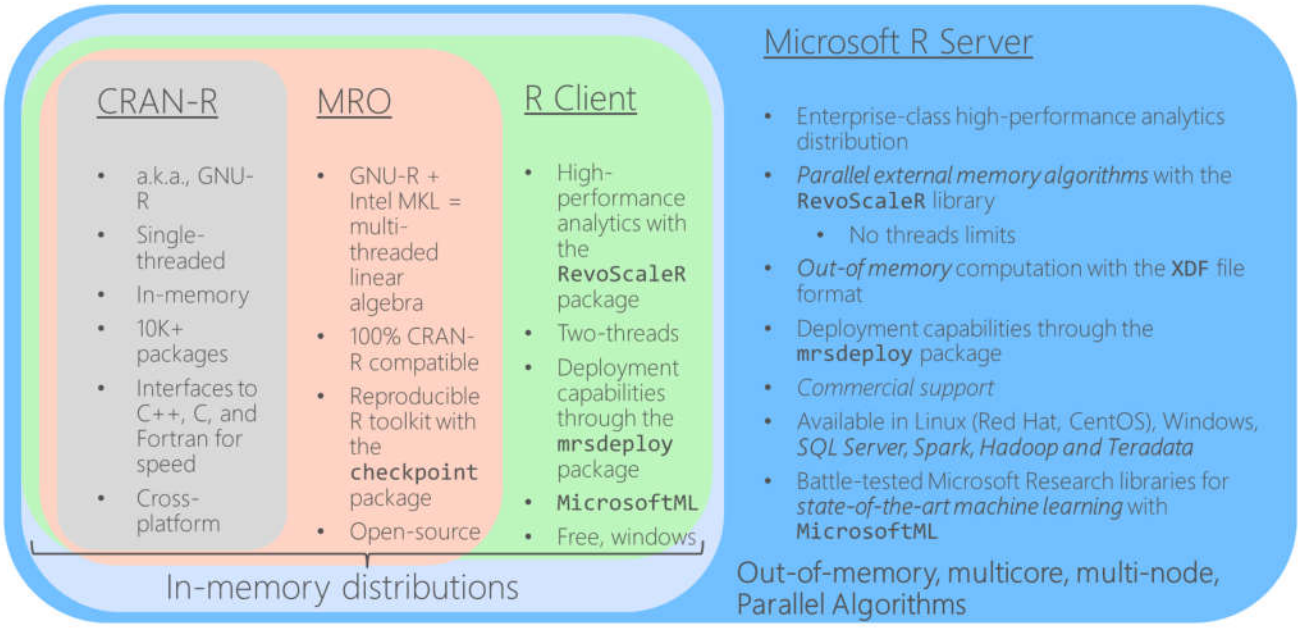
1. Primary documentation: https://www.microsoft.com/en-us/server-cloud/products/r-server/

Distributions of R



Parallelized, Distributed Execution Algorithms

Data Step
- Data import – Delimited, Fixed, SAS, SPSS, OBDC
- Variable creation & transformation
- Recode variables
- Factor variables
- Missing value handling
- Sort, Merge, Split
- Aggregate by category (means, sums)

Descriptive Statistics
- Min / Max, Mean, Median (approx.)
- Quantiles (approx.)
- Standard Deviation
- Variance
- Correlation
- Covariance
- Sum of Squares (cross product matrix for set variables)
- Pairwise Cross tabs
- Risk Ratio & Odds Ratio
- Cross-Tabulation of Data (standard tables & long form)
- Marginal Summaries of Cross Tabulations

Statistical Tests
- Chi Square Test
- Kendall Rank Correlation
- Fisher's Exact Test
- Student's t-Test

Sampling
- Subsample (observations & variables)
- Random Sampling

Predictive Models
- Sum of Squares (cross product matrix for set variables)
- Quantiles (approx.)
- Generalized Linear Models (GLM) exponential family distributions: binomial, Gaussian, inverse Gaussian, Poisson, Tweedie. Standard link functions: cauchy, identity, log, logit, probit. User defined distributions & link functions.
- Covariance & Correlation Matrices
- Logistic Regression
- Classification & Regression Trees
- Predictions/scoring for models
- Residuals for all models

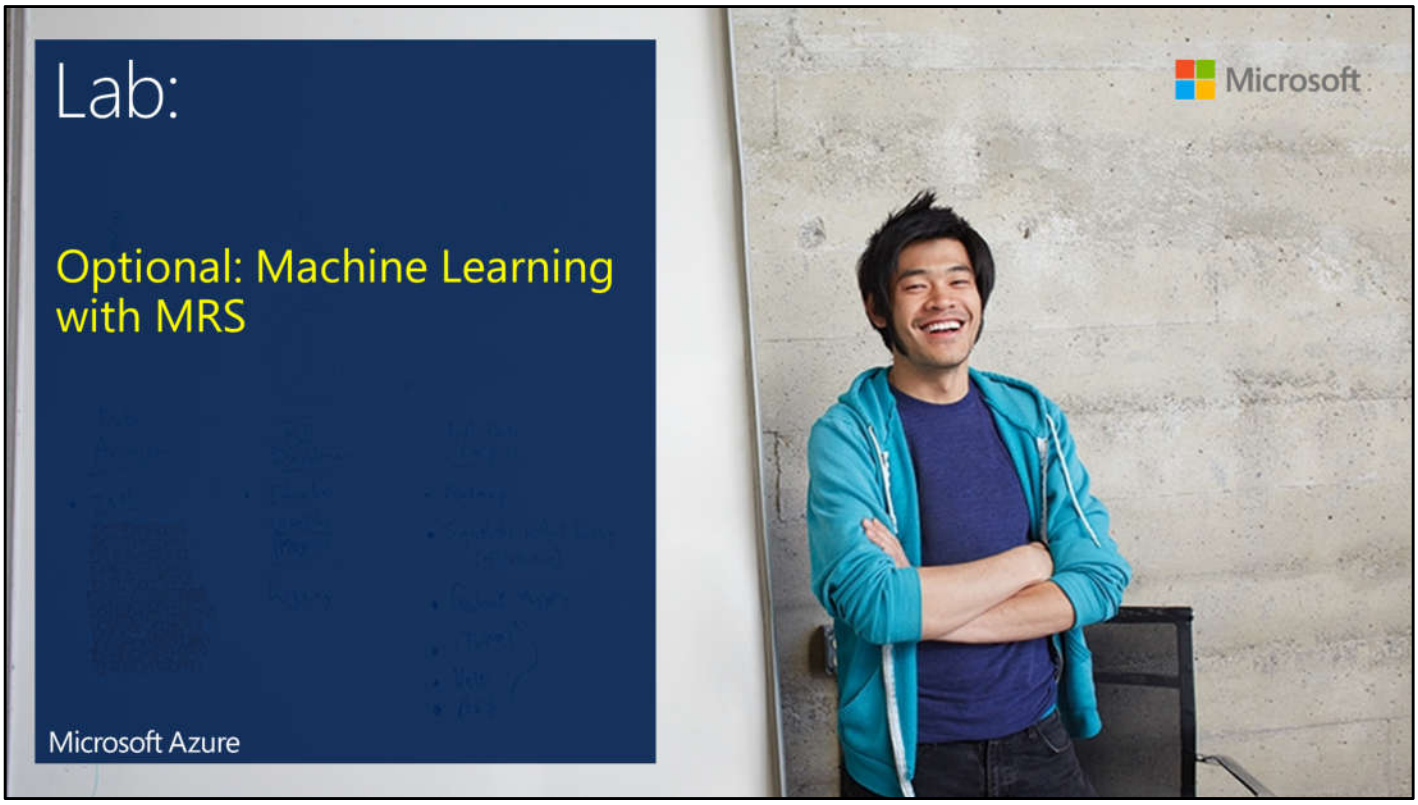
Variable Selection
- Stepwise Regression

Simulation
- Simulation (e.g. Monte Carlo)
- Parallel Random Number Generation

Cluster Analysis
- K-Means

Classification
- Decision Trees
- Decision Forests
- Gradient Boosted Decision Trees
- Naïve Bayes

Combination
- rxDataStep
- rxExec
- PEMA-R API Custom Algorithms



1. Open the MRS Student Workbook document from your \Resources file
2. Locate the section marked "Predictive Modeling with MRS" and follow the instructions there

Module 3:
Azure Data Factory and Azure ML

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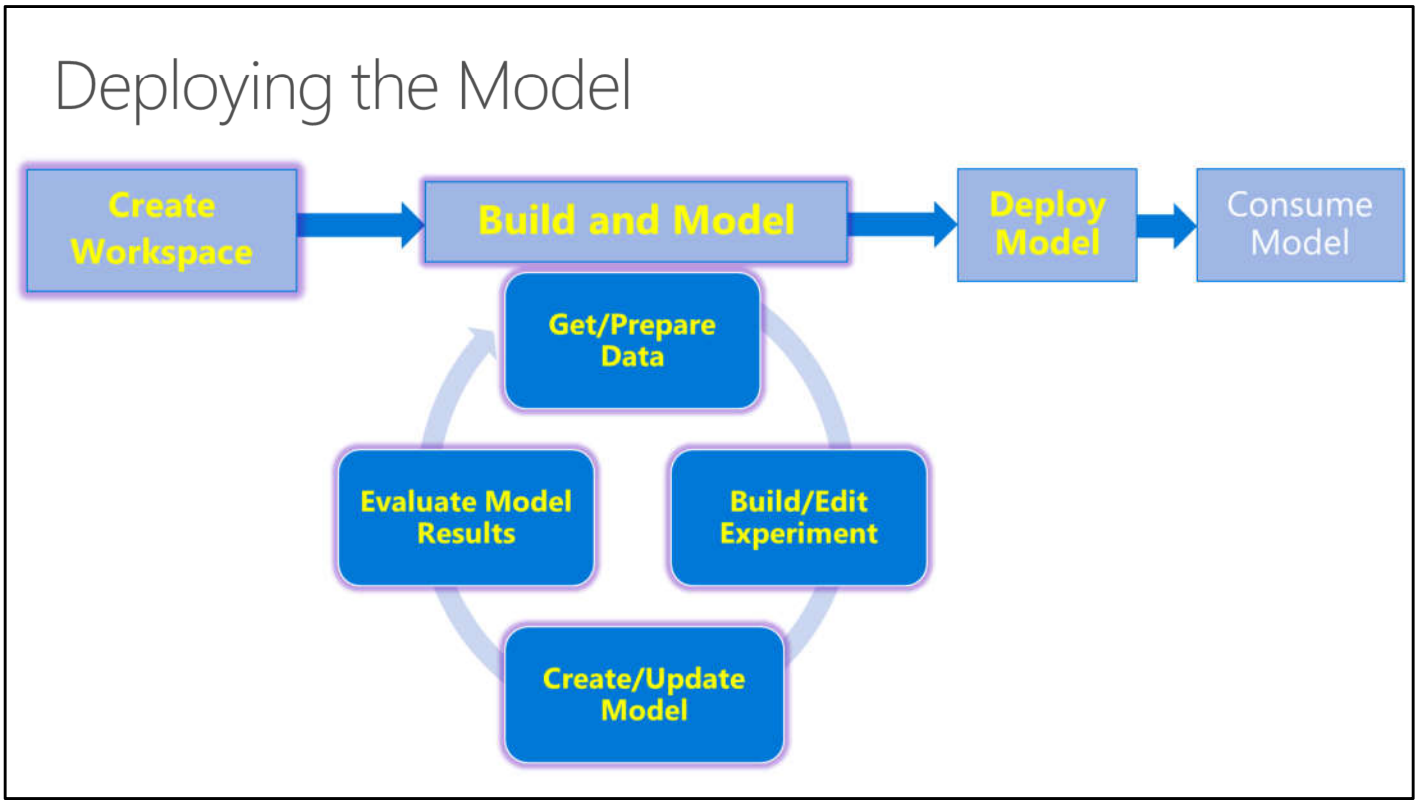
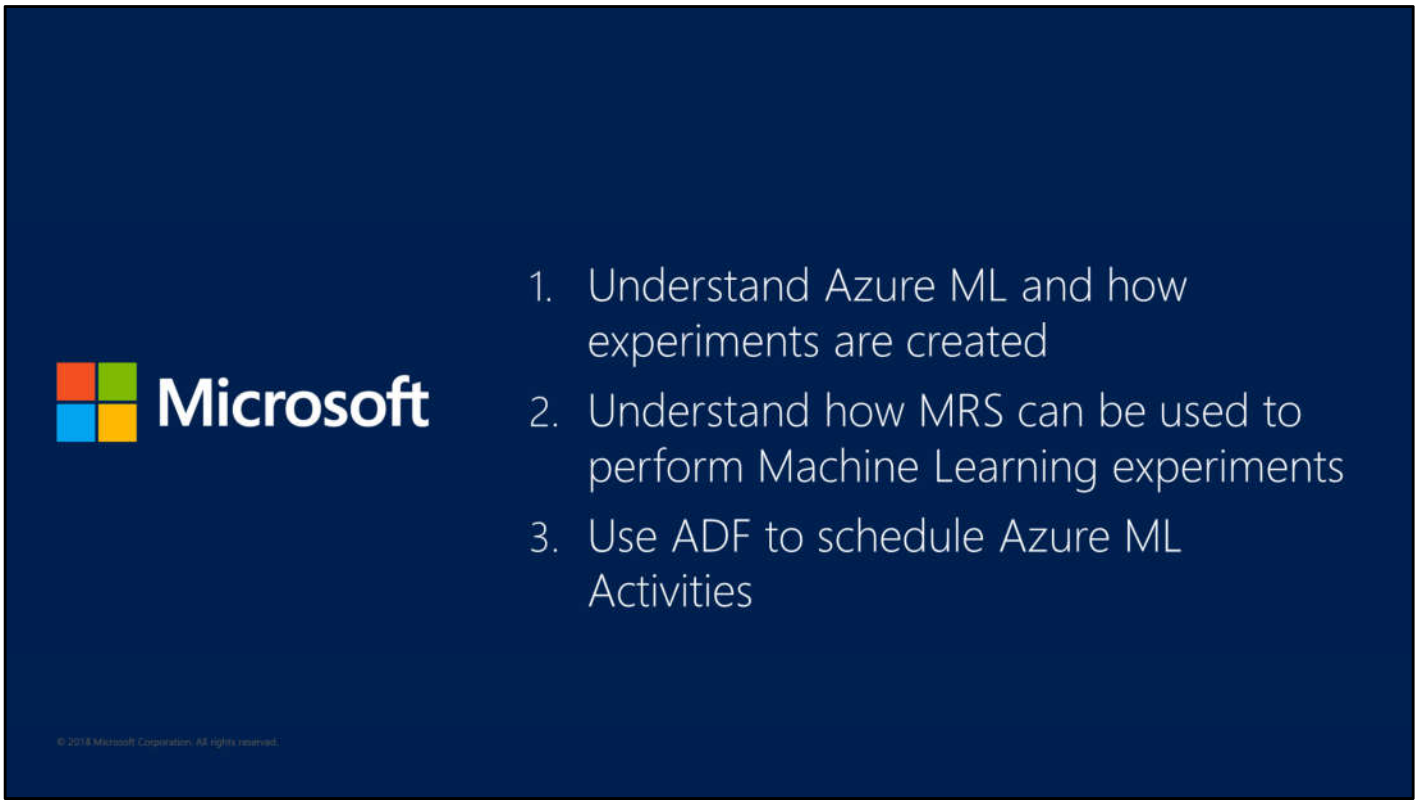
1. Create Predictive Pipelines using Azure ML Activities in ADF: https://azure.microsoft.com/en-us/documentation/articles/data-factory-azure-ml-batch-execution-activity/



1. Deploying the Azure ML Model: https://azure.microsoft.com/en-us/documentation/articles/machine-learning-walkthrough-5-publish-web-service/


Microsoft
1. Understand Azure ML and how experiments are created
2. Understand how MRS can be used to perform Machine Learning experiments
3. Use ADF to schedule Azure ML Activities

Questions?