Machine Learning in Microsoft Azure

Presented by Suchit Majumdar
Data Science Evangelist

Boot Camp Structure

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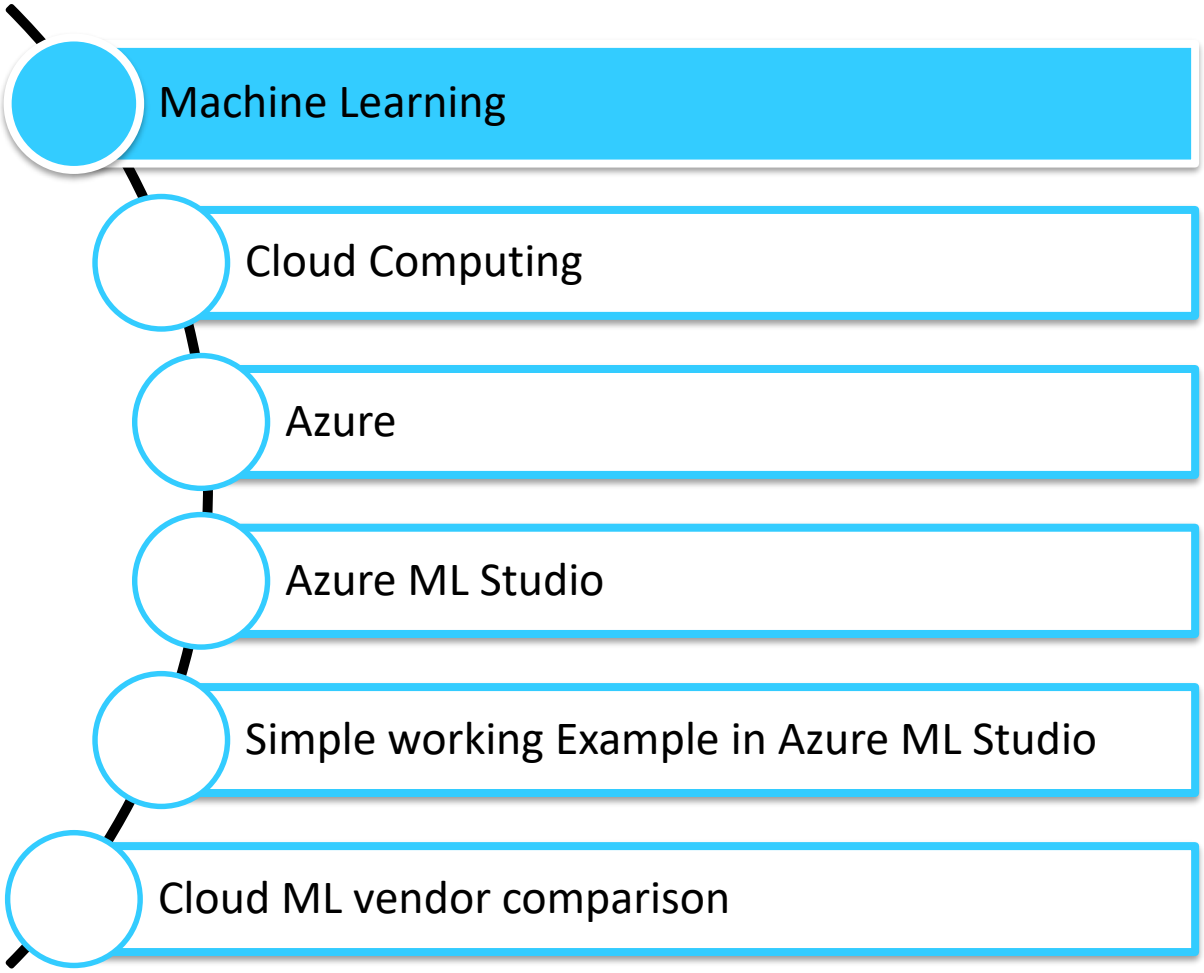
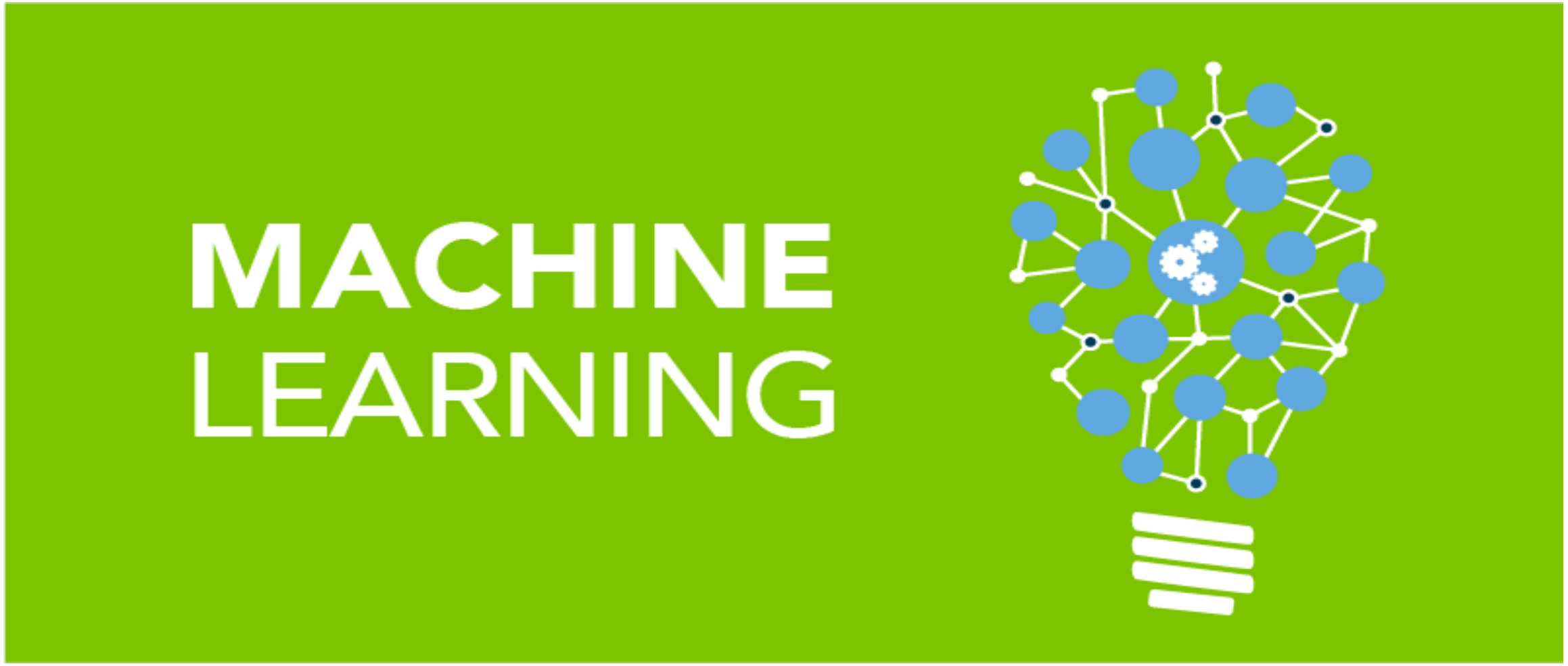
Intro.to Azure ML Studio	Simple use cases using modules in Azure studio	Unsupervised Learning
Supervised Learning I	Supervised Learning II	Recap & Conclusion

Boot Camp Expectation

- Introduction to Azure ML Studio
- Simple use cases using modules in Azure studio
- Cluster Analysis on Crime data
- Classification Analysis on Breast Cancer data
- Regression Analysis on Air Quality data
- Recap and conclusion


Machine Learning
Cloud Computing
Azure
Azure ML Studio
Simple working Example in Azure ML Studio
Cloud ML vendor comparison

1. Machine Learning

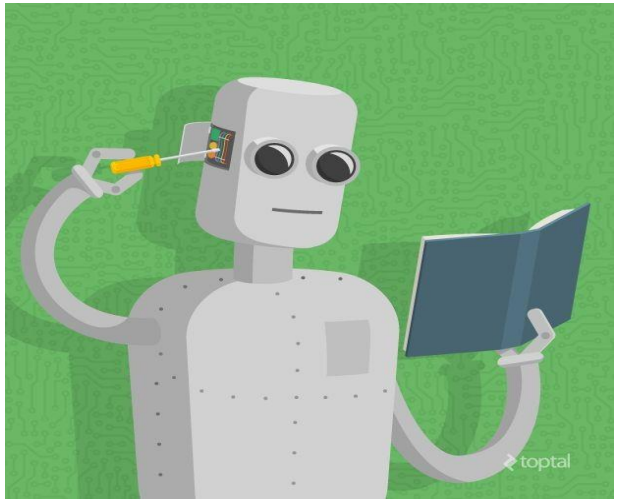


What is Learning

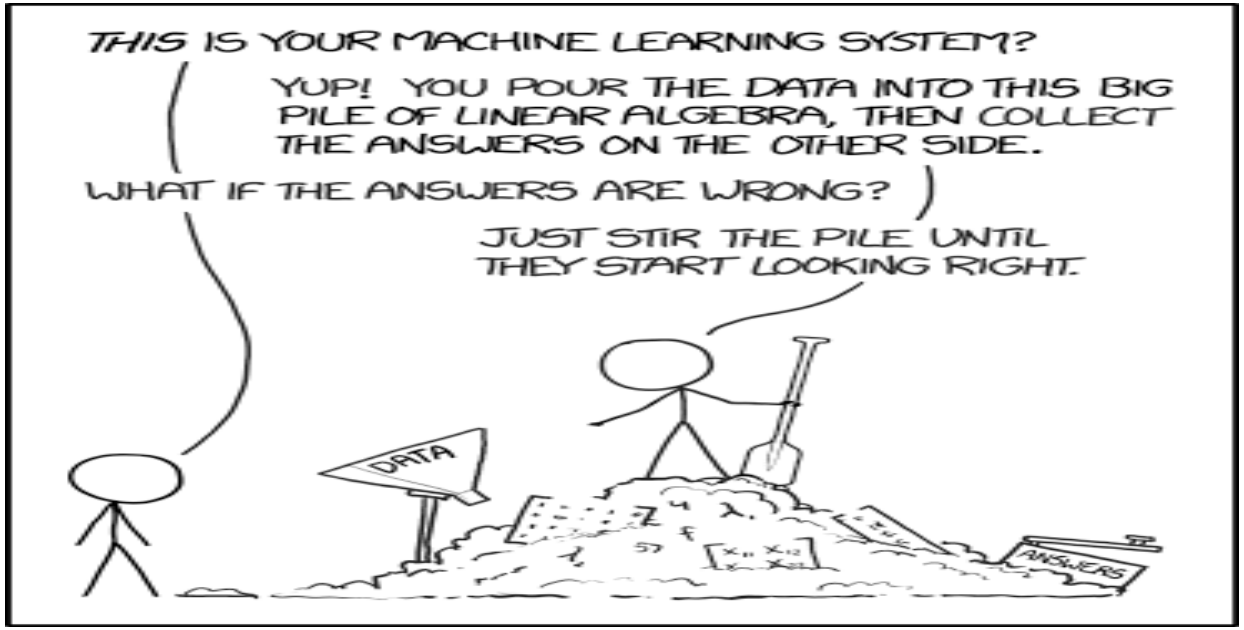
“Learning involves strengthening correct responses and weakening incorrect responses. Learning involves
adding new information to your memory. Learning involves making sense of the presented material by attending to relevant information, mentally reorganizing it, and connecting it with what you already know.”

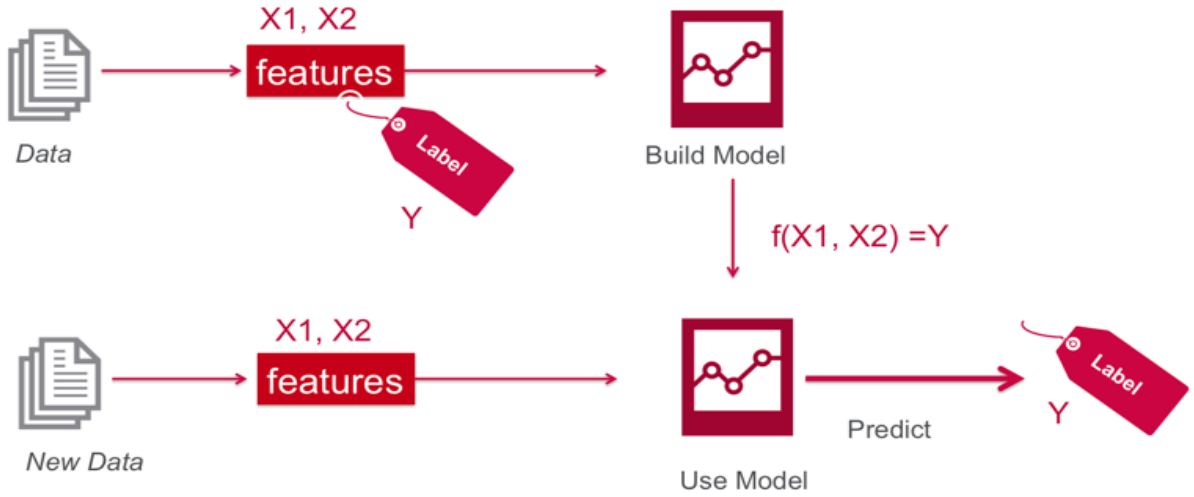
From eLearning and the Science of Instruction by Ruth C. Clark and Richard E. Mayer

What is Machine Learning ?



Machine learning is an application of artificial intelligence (AI) that provides systems the ability to automatically learn and improve from experience without being explicitly programmed.

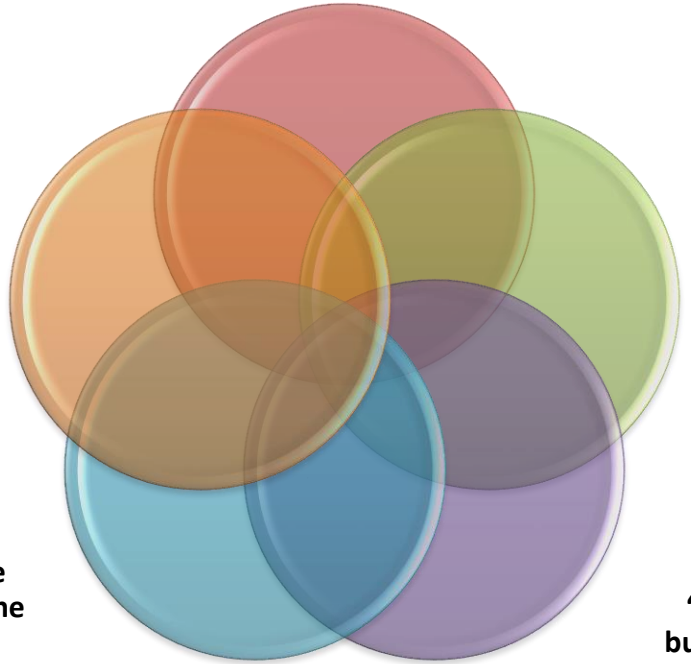




Why Study Machine Learning: A Few Quotes

"A breakthrough in machine learning would be worth ten Microsofts" - (Bill Gates, Microsoft)

"Machine learning is going to result in a real revolution" - (Greg Papadopoulos, CTO, Sun)



"Machine learning is the next Internet" - (Tony Tether, Former Director, DARPA)

"Web rankings today are mostly a matter of machine learning" - (Prabhakar Raghavan, Dir. Research, Yahoo)

"Software Is Eating the World, but AI Is Going to Eat Software" - (Jensen Huang, CEO, NVidia)

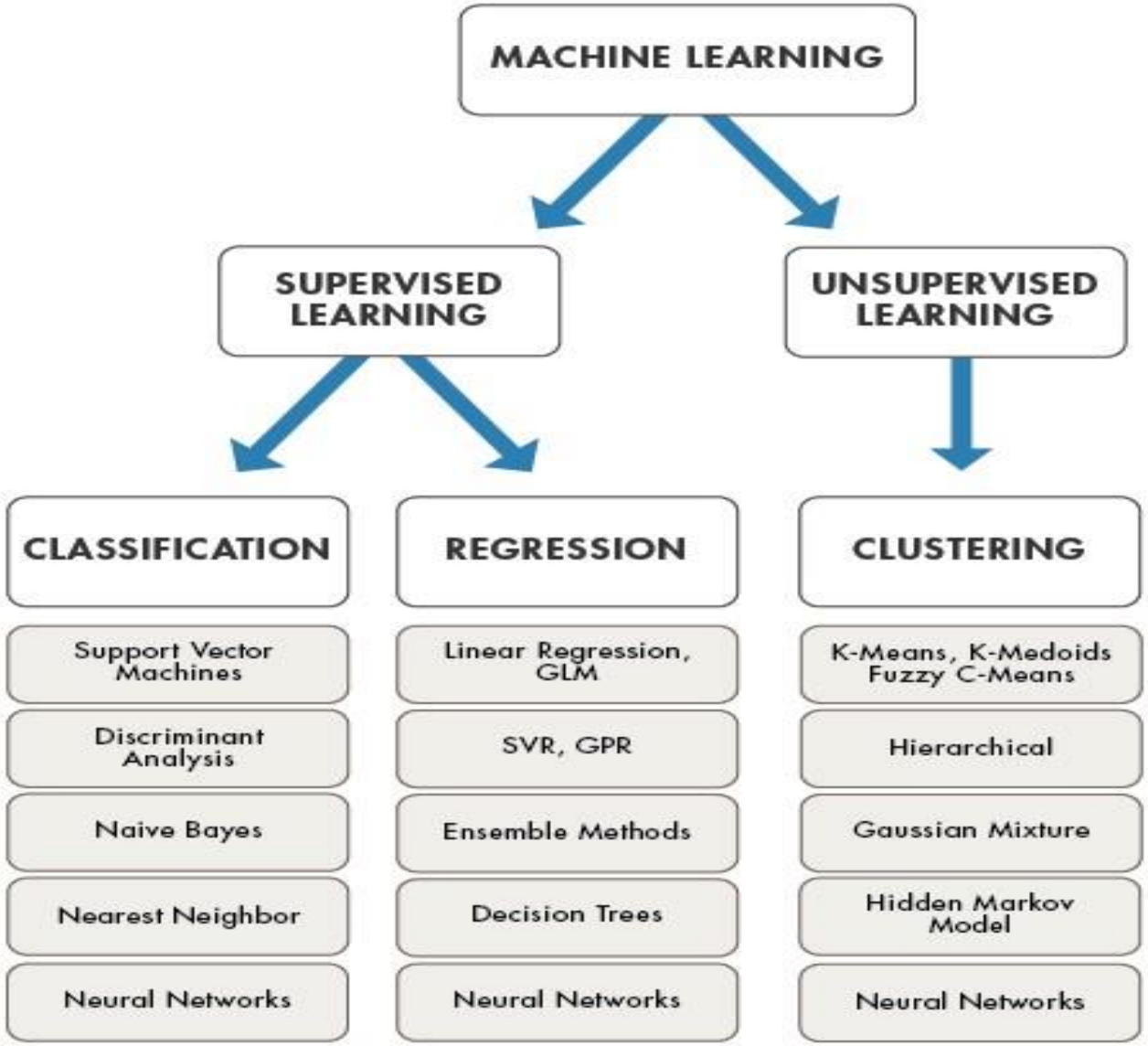
ML Terminologies

Features	•The number of features or distinct traits that can be used to describe each item in a quantitative manner.
Samples	•A sample is an item to process (e.g. classify). It can be a document, a picture, a sound, a video, a row in database or CSV file, or whatever you can describe with a fixed set of quantitative traits.
Feature vector	•Is an n-dimensional vector of numerical features that represent some object.
Feature extraction	•Preparation of feature vector •Transforms the data in the high-dimensional space to a space of fewer dimensions.
Training/Evolution set	•Set of data to discover potentially predictive relationships.
Test/Validate set	•Set of data to validate the predictive relationship
Scoring	•Evaluating the performance based on statistical metric

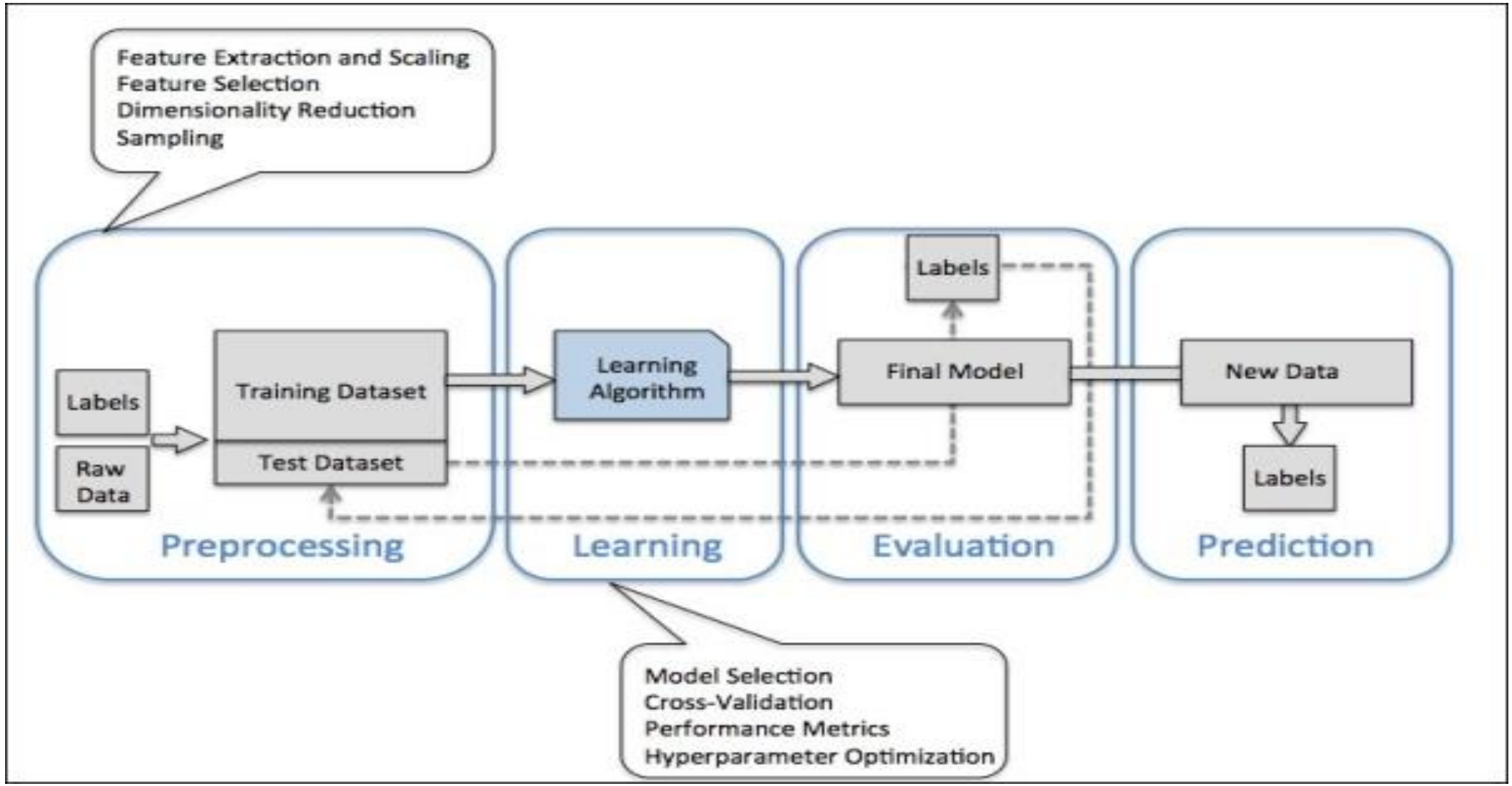
Did you know?

1. *In machine learning, a target is called a label.*
2. *In statistics, a target is called a dependent variable.*
3. *A variable in statistics is called a feature in machine learning.*
4. *A transformation in statistics is called feature creation in machine learning.*

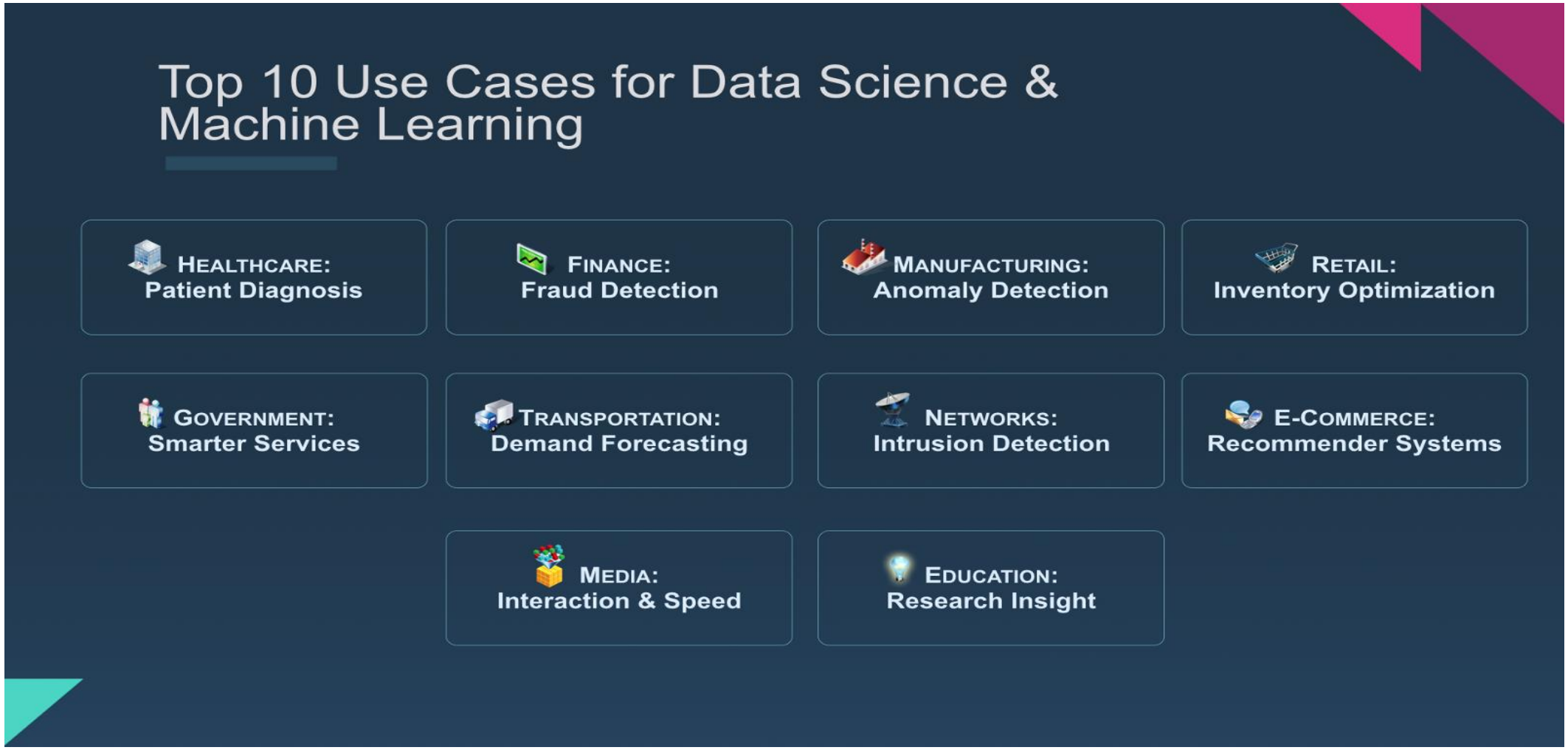
Types of Machine Learning



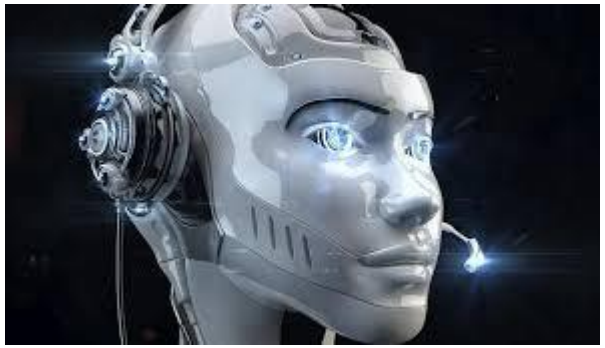
Machine Learning workflow

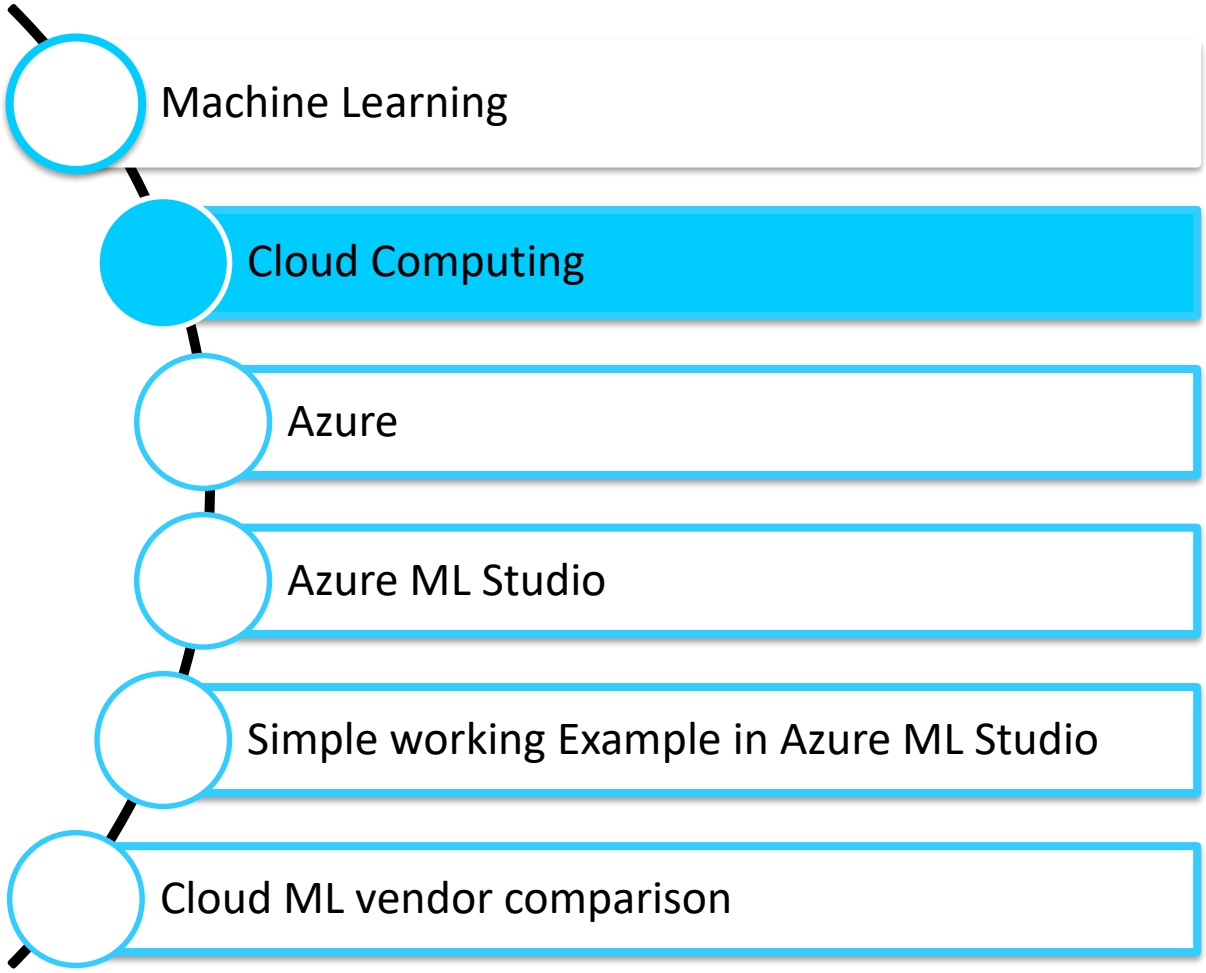


Who is using Machine Learning?



ML/AI going to transform & create new Industries

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Cloud ML vendor comparison

2. What is Cloud?

The term **Cloud** refers to a **Network** or **Internet**. In other words, we can say that Cloud is something, which is present at remote location.

Cloud can provide services over network, i.e., on public networks or on private networks, i.e., WAN, LAN or VPN.

Applications such as **e-mail, web conferencing, customer relationship management (CRM),** all run in cloud.

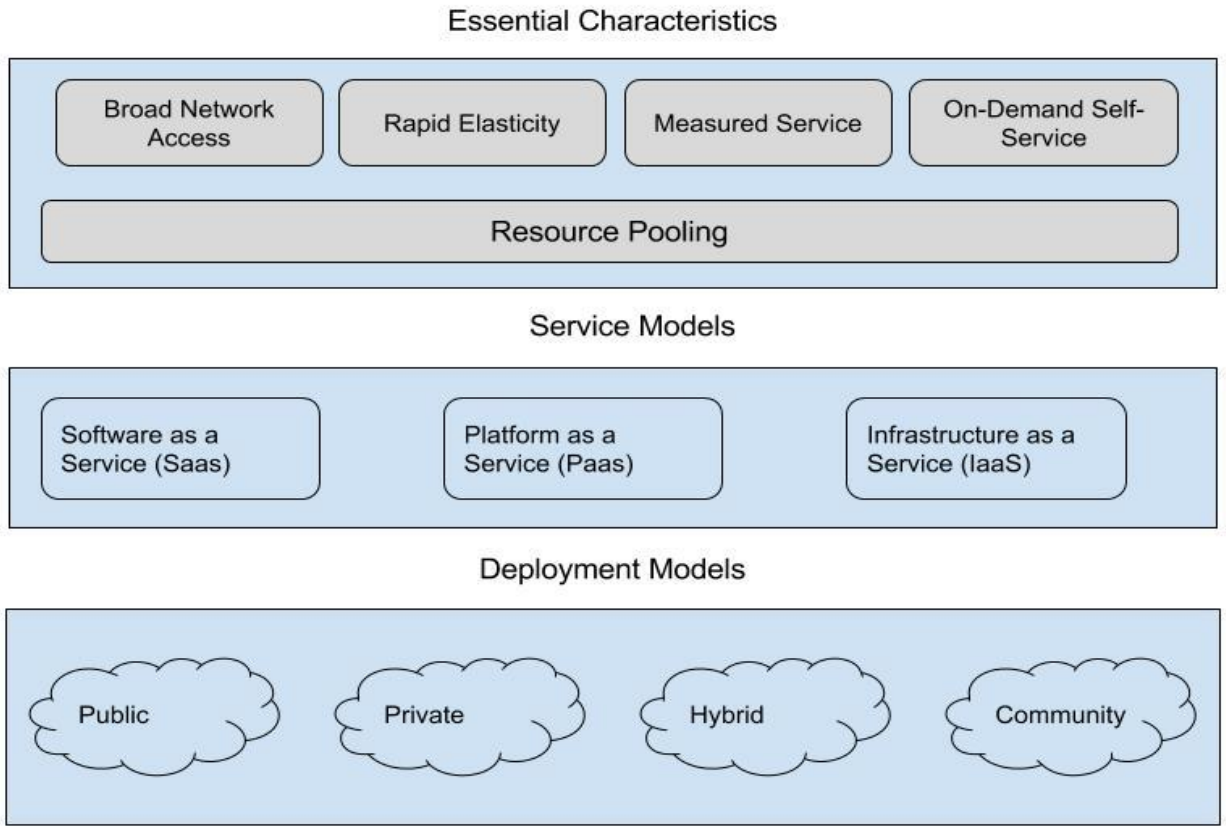


Figure 1 - NIST Visual Model of Cloud Computing Definition [CSA11]

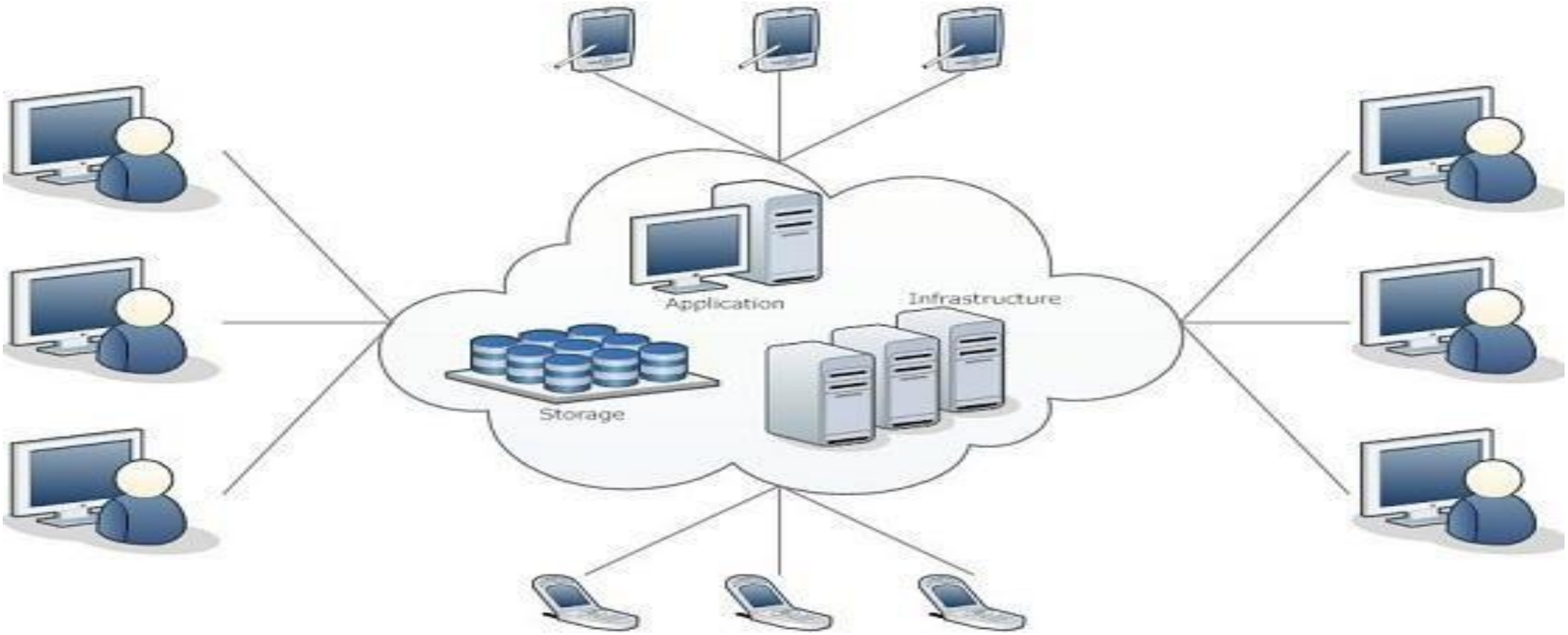
What is Cloud Computing?

Cloud Computing refers to **manipulating, configuring,** and **accessing** the applications online.

It offers online data storage, infrastructure and application.

Cloud Computing is both a combination of software and hardware based computing resources delivered as a network service.

Cloud Computing Architecture



Service Models & Types

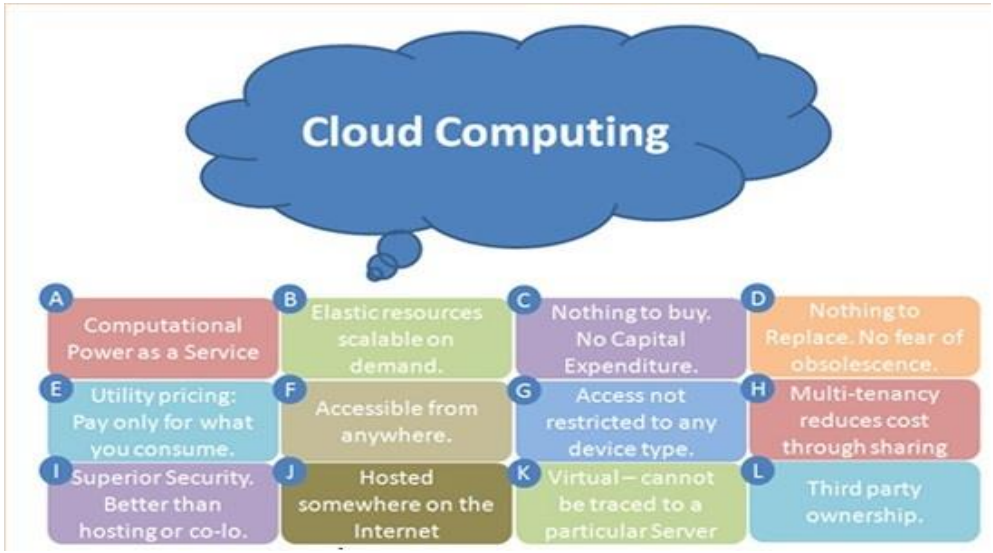
Service Models are the reference models on which the Cloud Computing is based. These can be categorized into three basic service models as listed below:

IaaS is the delivery of technology infrastructure as an on demand scalable service.

PaaS provides the runtime environment for applications, development & deployment tools, etc.

SaaS model allows to use software applications as a service to end users.

Increased Demand for Cloud



- Standing alone, cloud is on its way to becoming an essential computing commodity in many fields. But integration of machine learning will increase need for intelligent clouds in market.
- With all capabilities provided by intelligent cloud, it is definitely the most disruptive technological change in market.
- With ever-increasing competition, the intelligent cloud will become a core necessity in managing big companies and help them stay on top of the competition.

Advantages & Disadvantages of Cloud

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Advantages

- Lower computer costs
- Improved performance
- Reduced software costs
- Instant software updates
- Improved document format compatibility
- Unlimited storage capacity
- Increased data reliability
- Universal document access
- Latest version availability
- Easier group collaboration
- Device independence

Disadvantages

- Requires a constant Internet connection
- Does not work well with low-speed connections
- Features might be limited
- Can be slow
- Stored data can be lost
- Stored data might not be secure

MLaaS

Machine Learning as a Service

Machine Learning as-a-Service(MLaaS)

- All major cloud service providers now have some ML offering

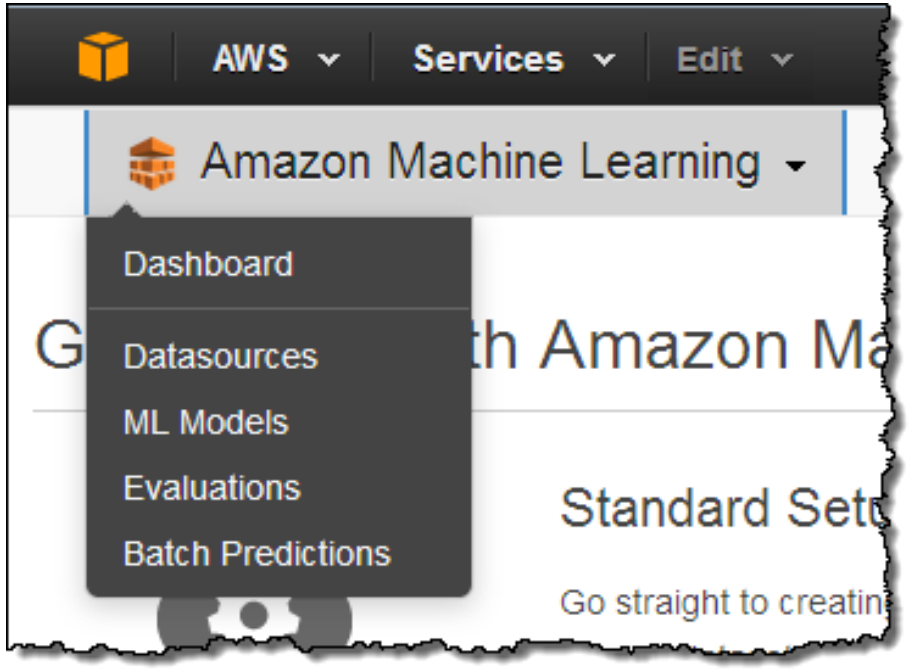
- Startup costs are low-to-no

- Seamless leverage of cloud resources for scale-ups = $'s

- Open source ML options are now common

- Very large models now possible

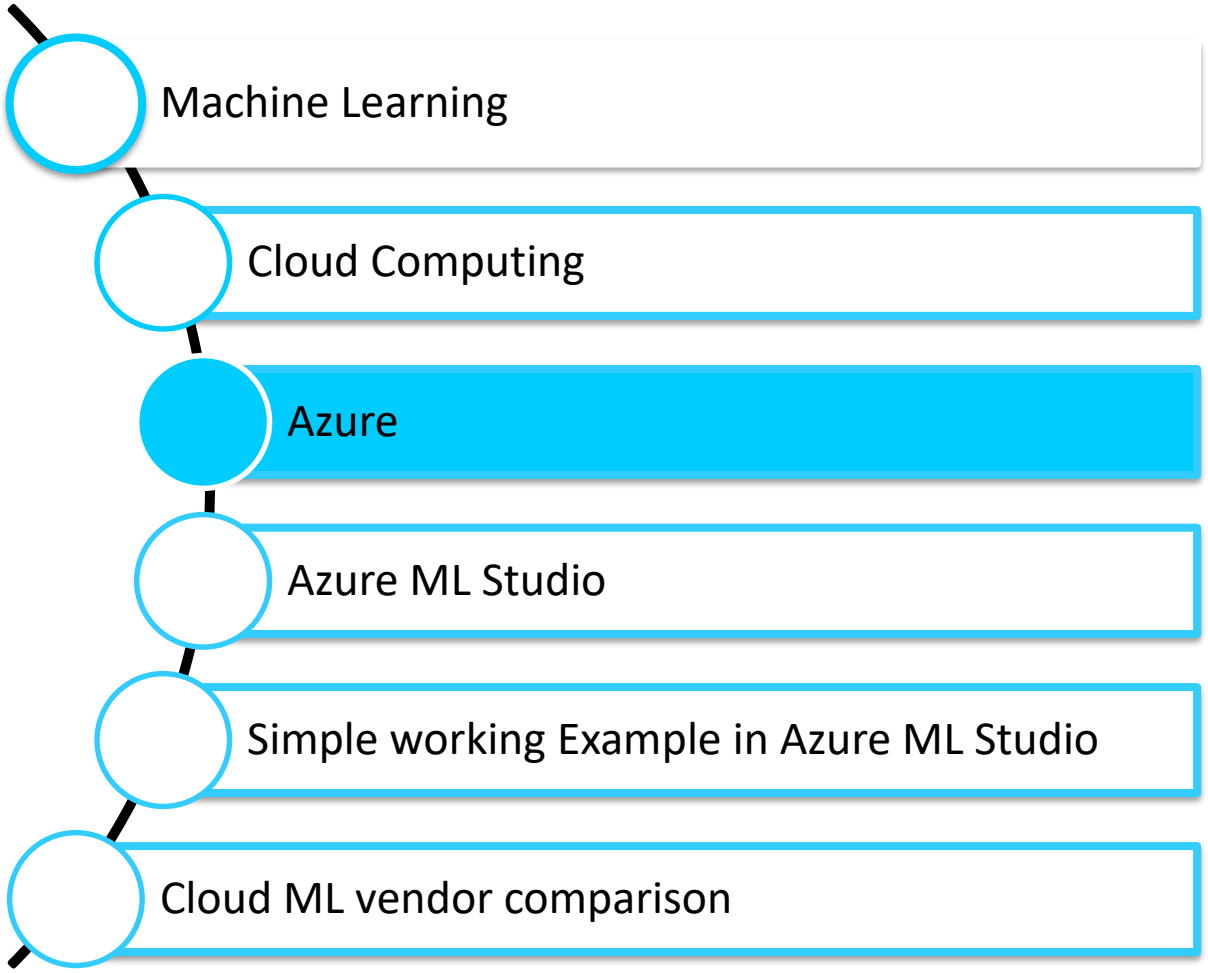
- Open data sets proliferating



ML as a Service - The celebrities:

- Microsoft **Azure ML**
- Google **Prediction APIs**
- Amazon **AWS ML**

  - Allows users to create and train models,
    then turn them into ready-to-be-consumed APIs. All through a beautifully intuitive web interface.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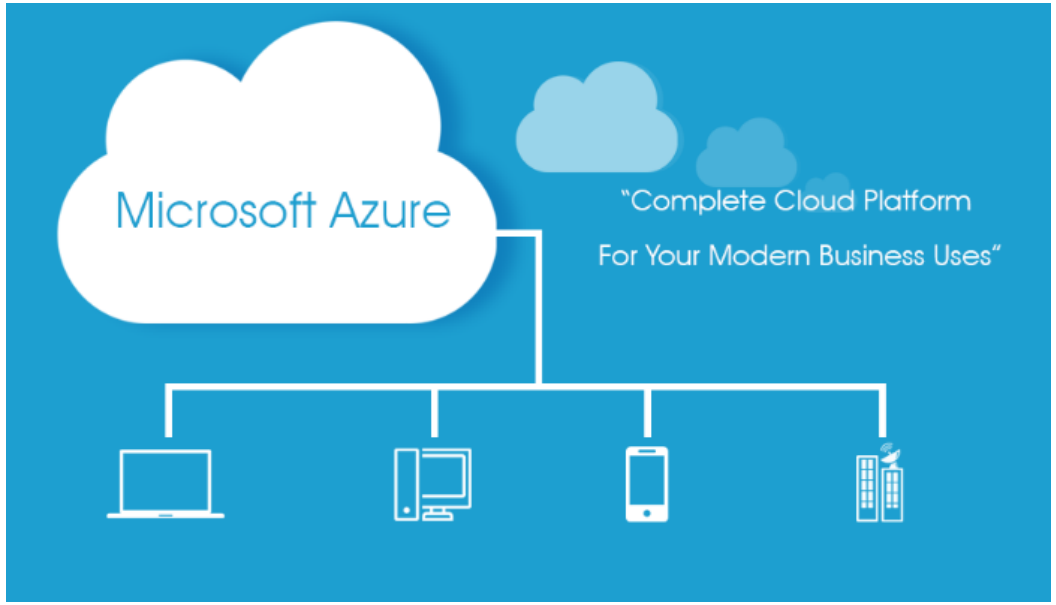
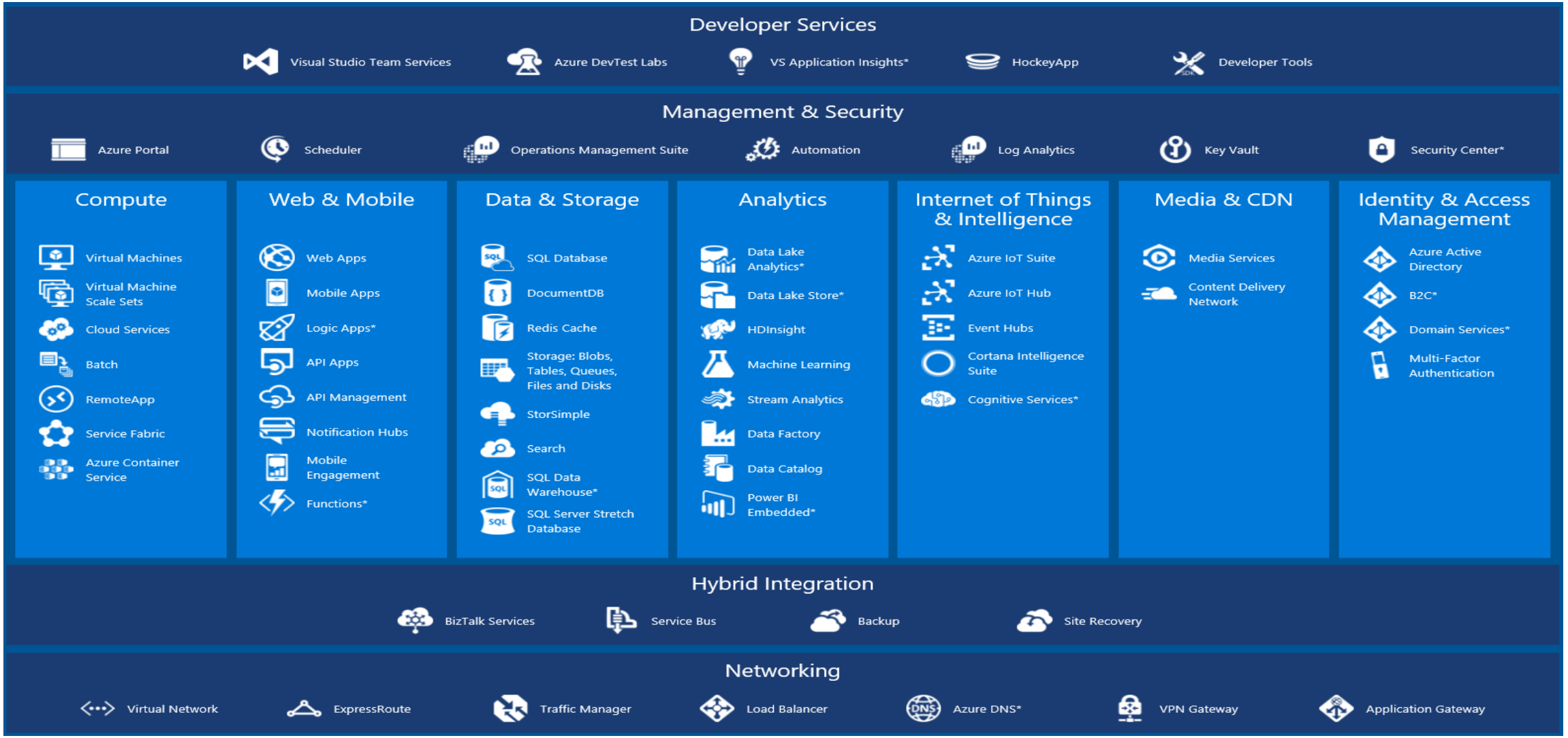
3. What is Azure?

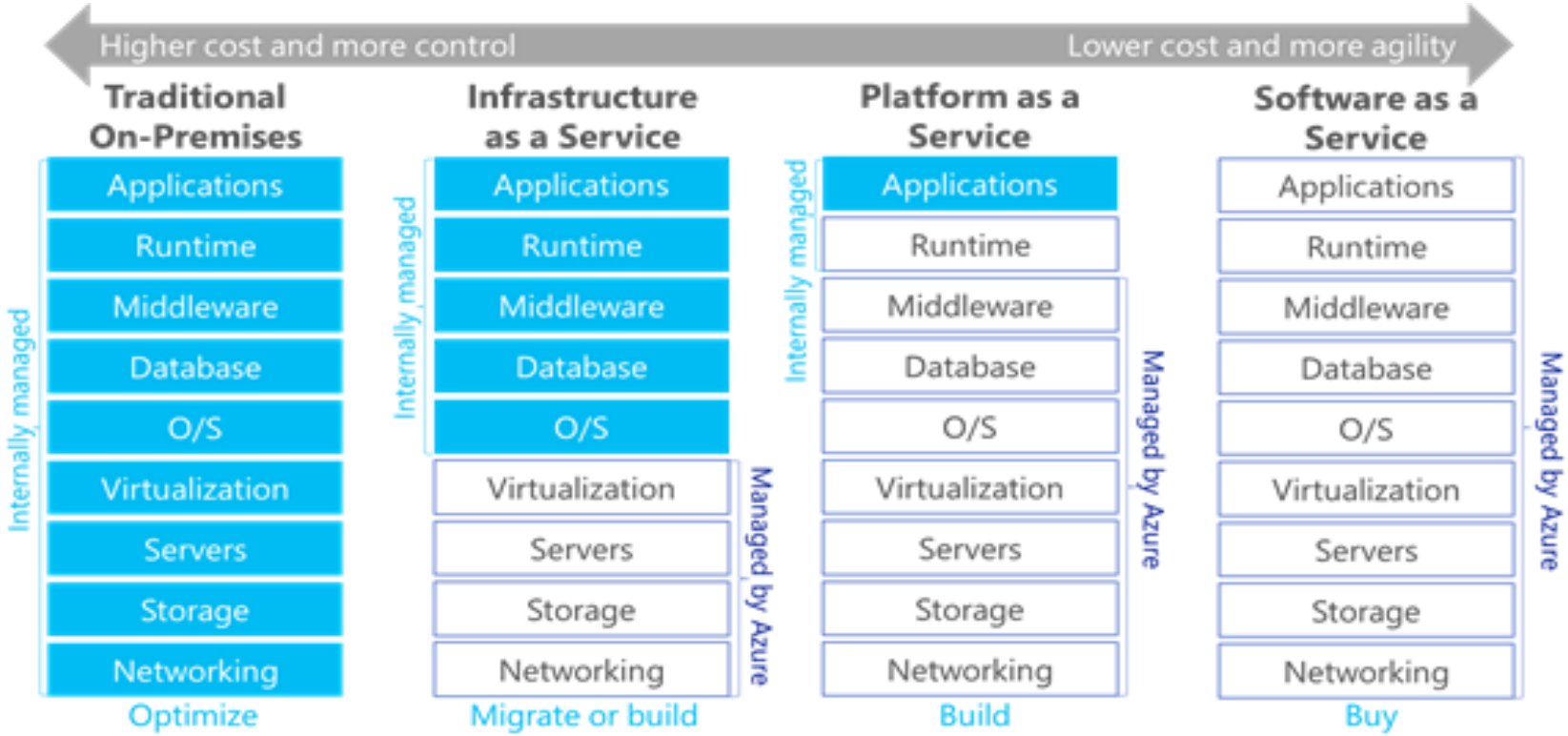
- Microsoft Azure, formerly known as Windows Azure, is Microsoft's public cloud computing platform.
- It provides a range of cloud services, including those for compute, analytics, storage and networking.
- Users can pick and choose from these services to develop and scale new applications, or run existing applications, in the public cloud.



Cloud Services Offered by Microsoft Azure



Azure at Different Stages of Service



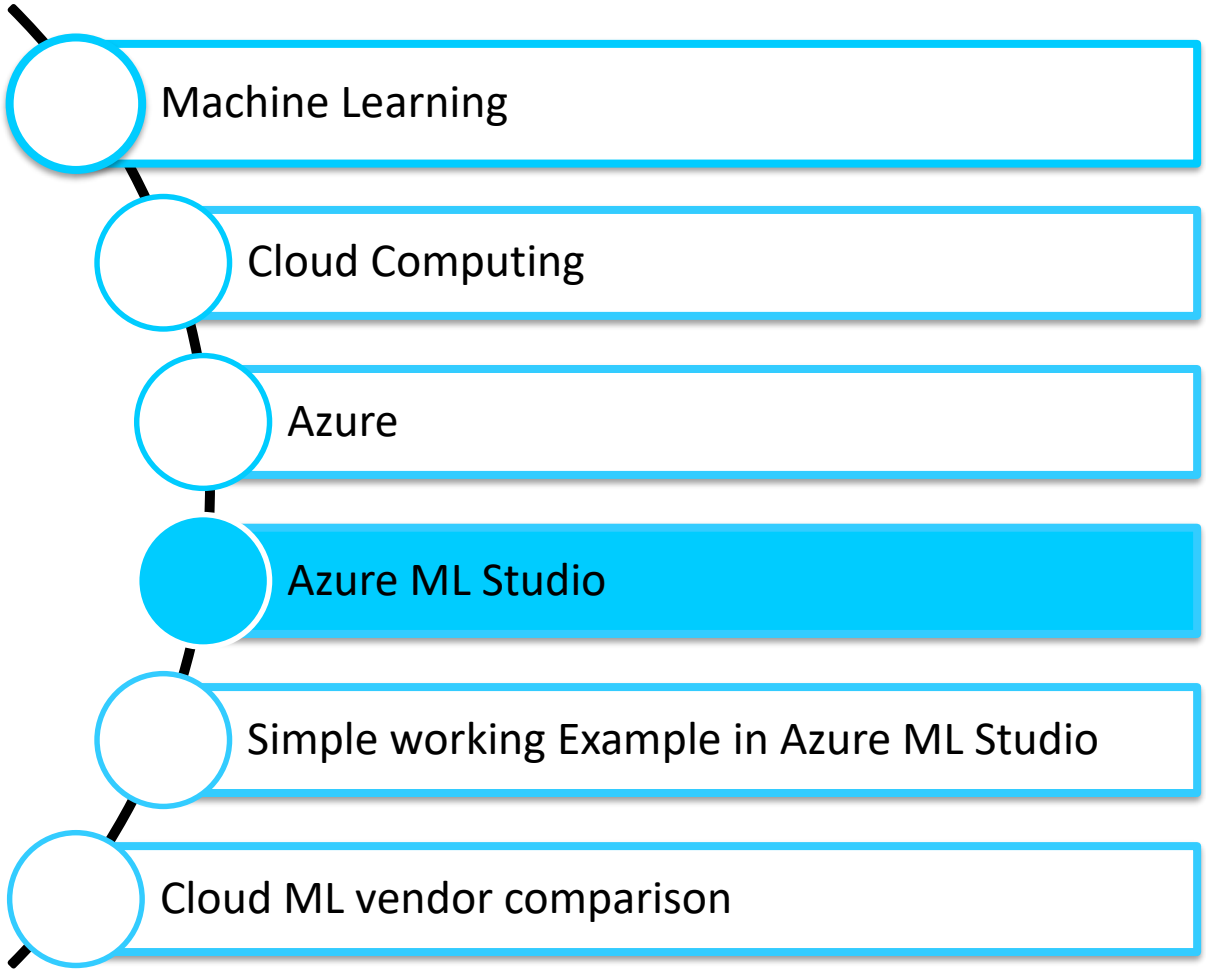
Why Azure

Read on

Why Azure


Why Use the Azure?
Run App Anywhere
99.99% Up time
Extend your existing IT Infrastructure
Protect your Data
Back ups &
Recovery


Why Use the Azure?
Speed
• Faster than Traditional Application Development
Scale
• Scale out Quickly
• Provide Global Scale
Economics
• Lower Cost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4. Azure Machine Learning Studio

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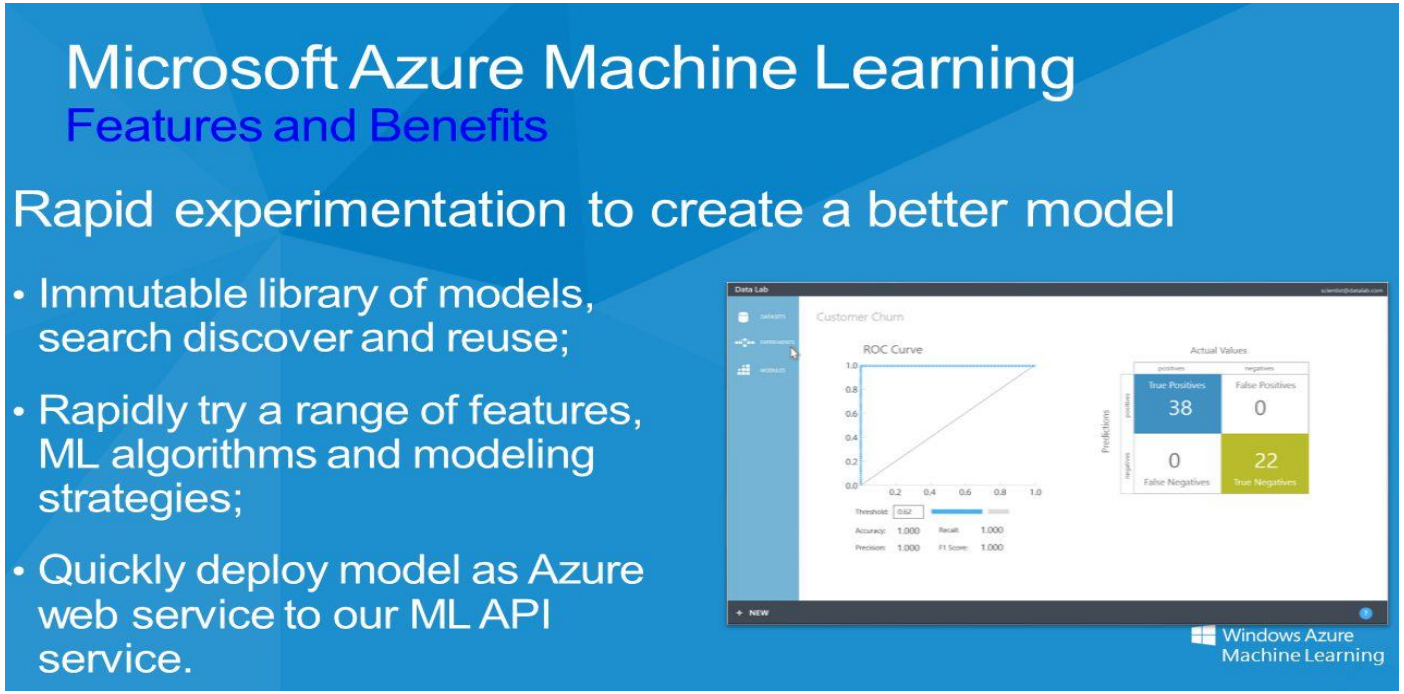
1. Azure Machine Learning Studio is a cloud based workspace for data analysis

2. It's a simple drag & drop tool that enables non-programmers to use it

3. It's a collaborative environment where cloud resource, data science meet.

Predictive Analytical solutions prepared in Azure ML Studio are

"Easy to Build".
"Easy to Deploy".
"Easy to share".



Azure ML Studio

Quick Recap

- Machine Learning Introduction
- Machine Learning types
- ML Workflow
- Usage of ML

- Cloud Computing
- Cloud services
- Merit & Demerits of Cloud Computing
- ML in Cloud
- Mlaas tools
- Azure
- Why Azure

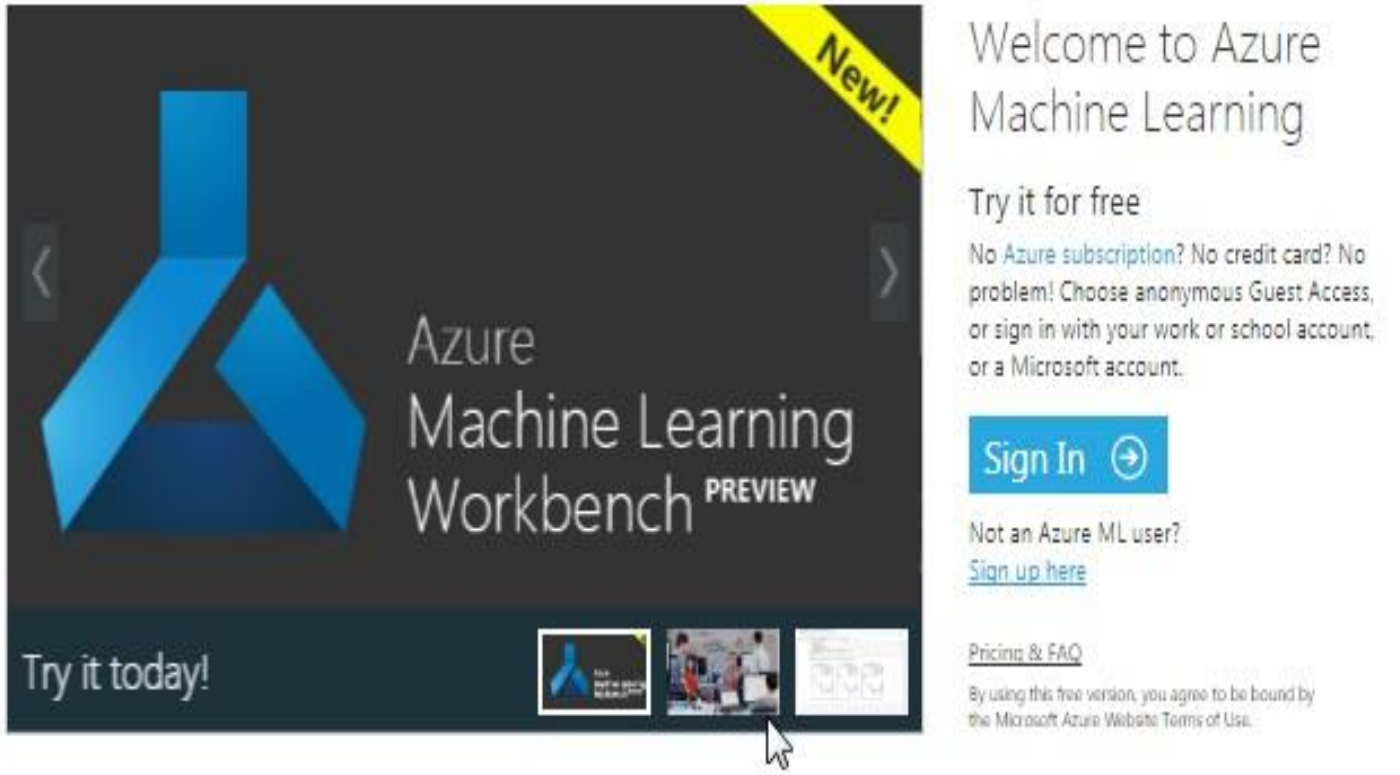
Getting Started With ML Studio

All you need is a **web browser!** Go to Azure ML [website](https://studio.azureml.net/) https://studio.azureml.net/ & Choose:

Free workspace: start using **all the features** of Studio immediately, **no credit card** required!

Enterprise workspace: add extra storage and few additional web services features ($10/month).

Then, start working on your data from **anywhere!**



Getting Started With ML Studio

Welcome to Azure Machine Learning

Try it for free

No Azure subscription? No credit card? No problem! Choose anonymous Guest Access, or sign in with your work or school account, or a Microsoft account.

Sign In

Sign in with your Microsoft Account

Not an Azure ML user?
Sign up here

Create a Microsoft Account

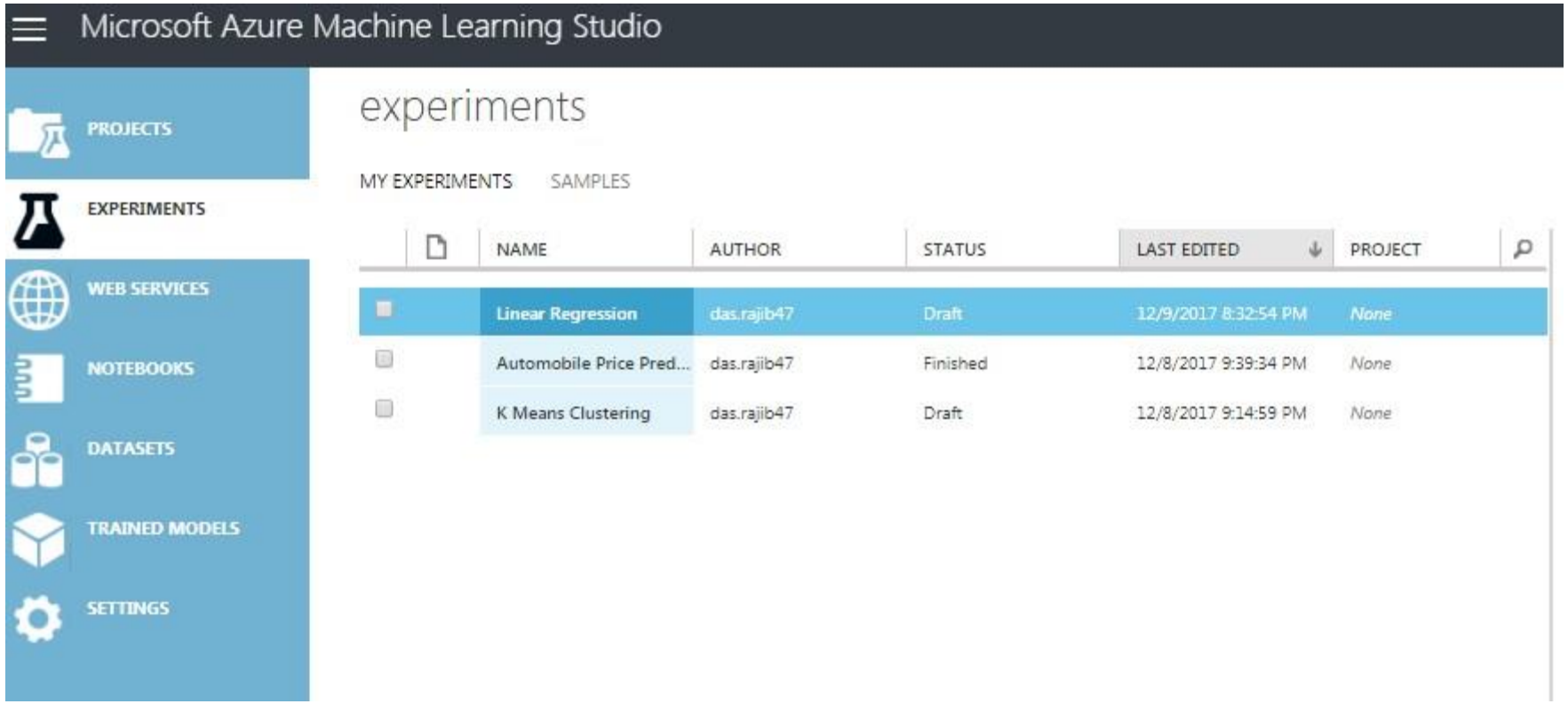
Pricing & FAQ

By using this free version, you agree to be bound by the Microsoft Azure Website Terms of Use.

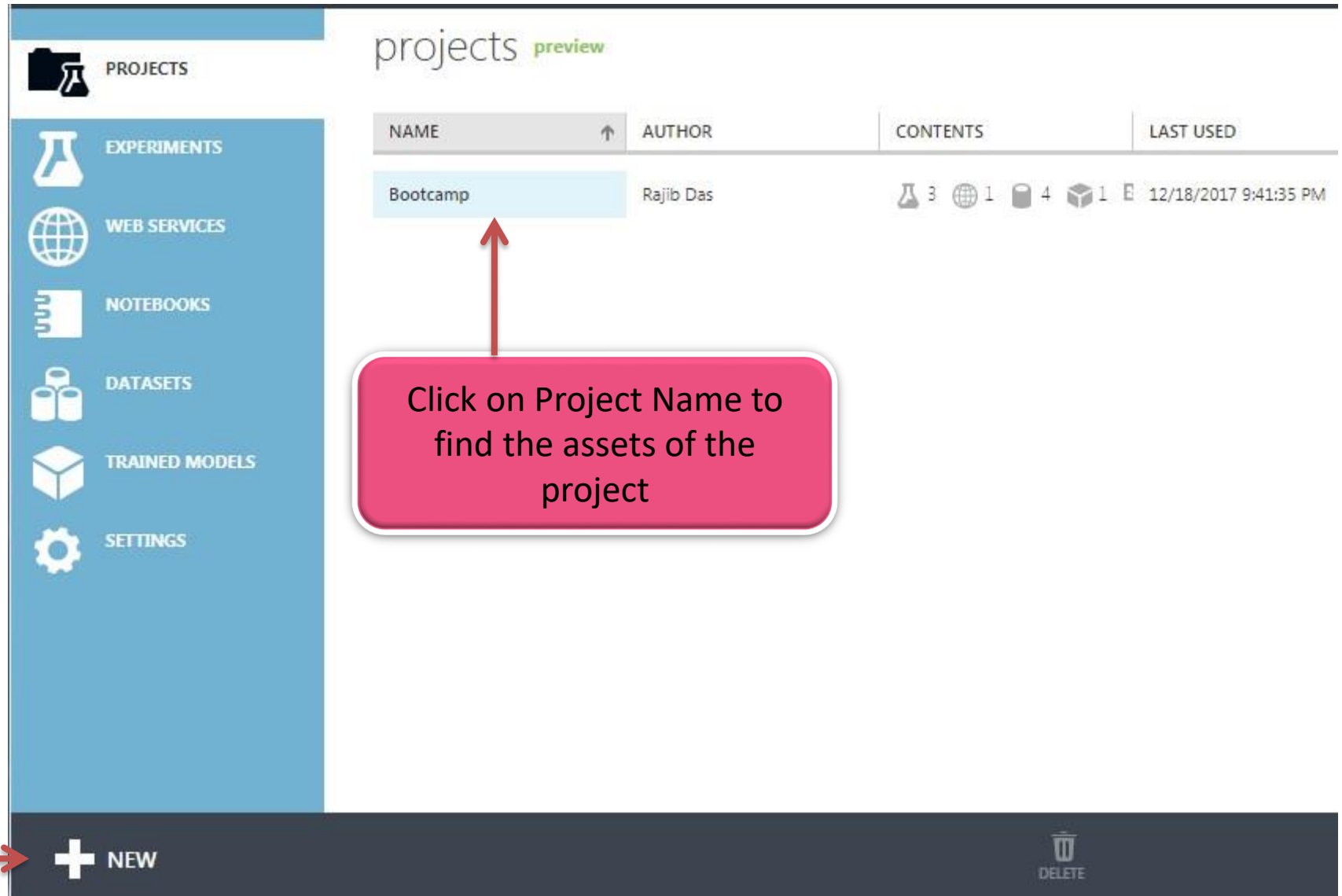
Machine Learning Studio

Once You have logged in With your Microsoft Account, this window will open up

Project: It enables you to create your own project
Experiment: It enables you to work in the data science environment where you can build predictive models using
Sample data of Azure
Web Service : Here you can see a list of web services you've created
Notebook: Here you can create notebook ,for example R Notebook , Python Notebook
Datasets : You can import datasets from your repository
Trained Model : Trained models can be kept here for predicting new data

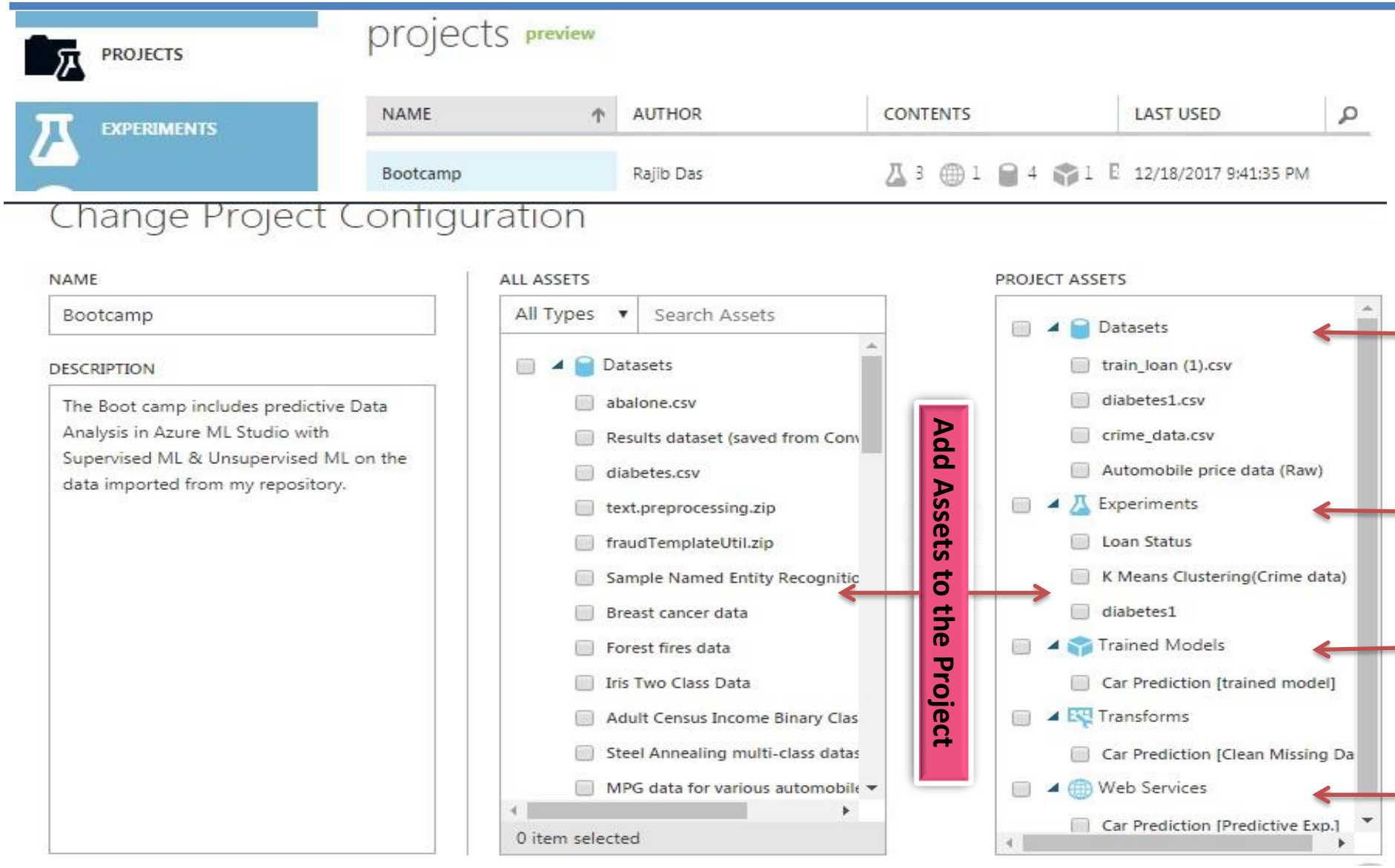


Azure ML Studio: Project



To Create New Project

Azure ML Studio: Project



Project Assets

Project consists of Datasets

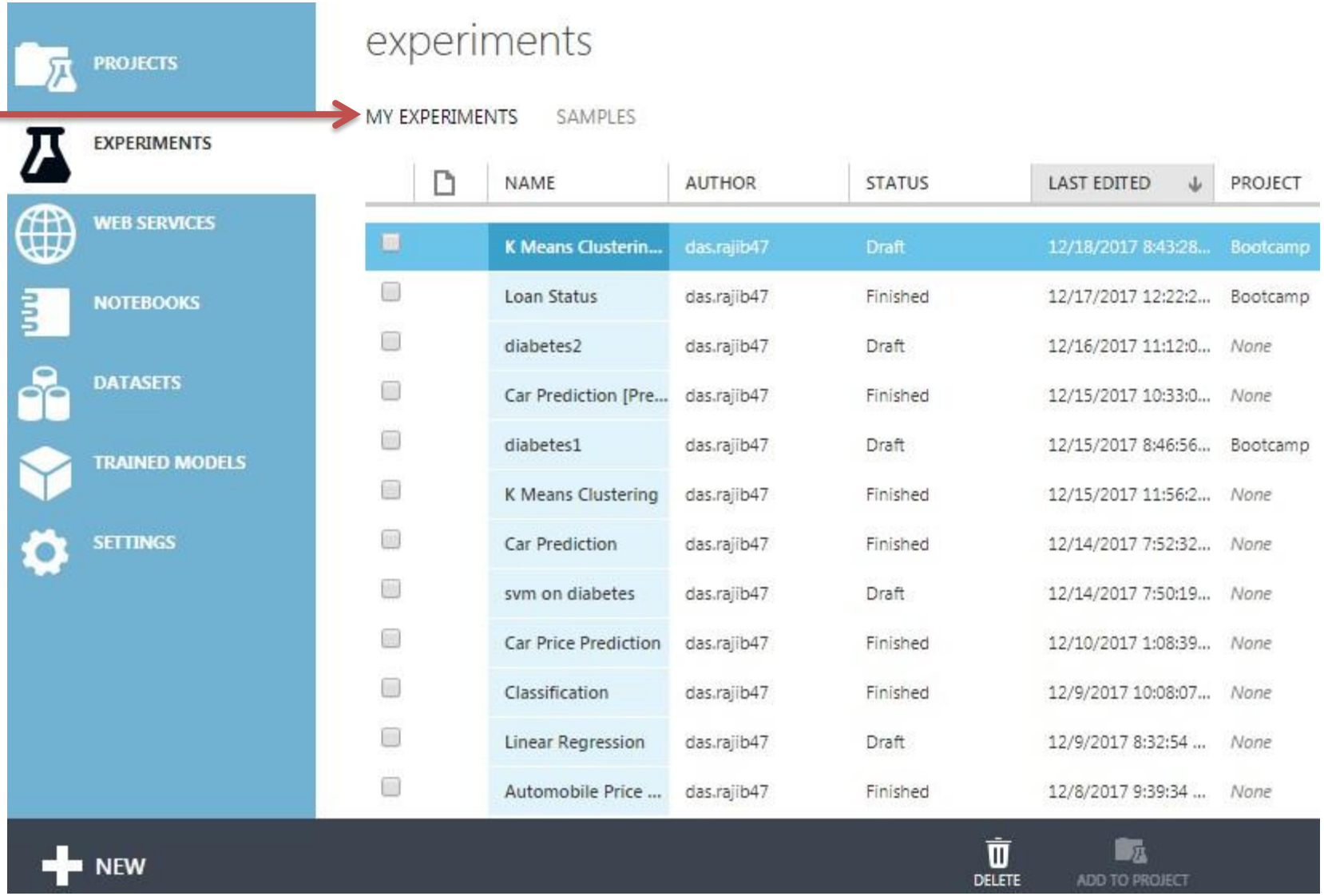
Project consists of Experiments

Project consists of saved Trained_model

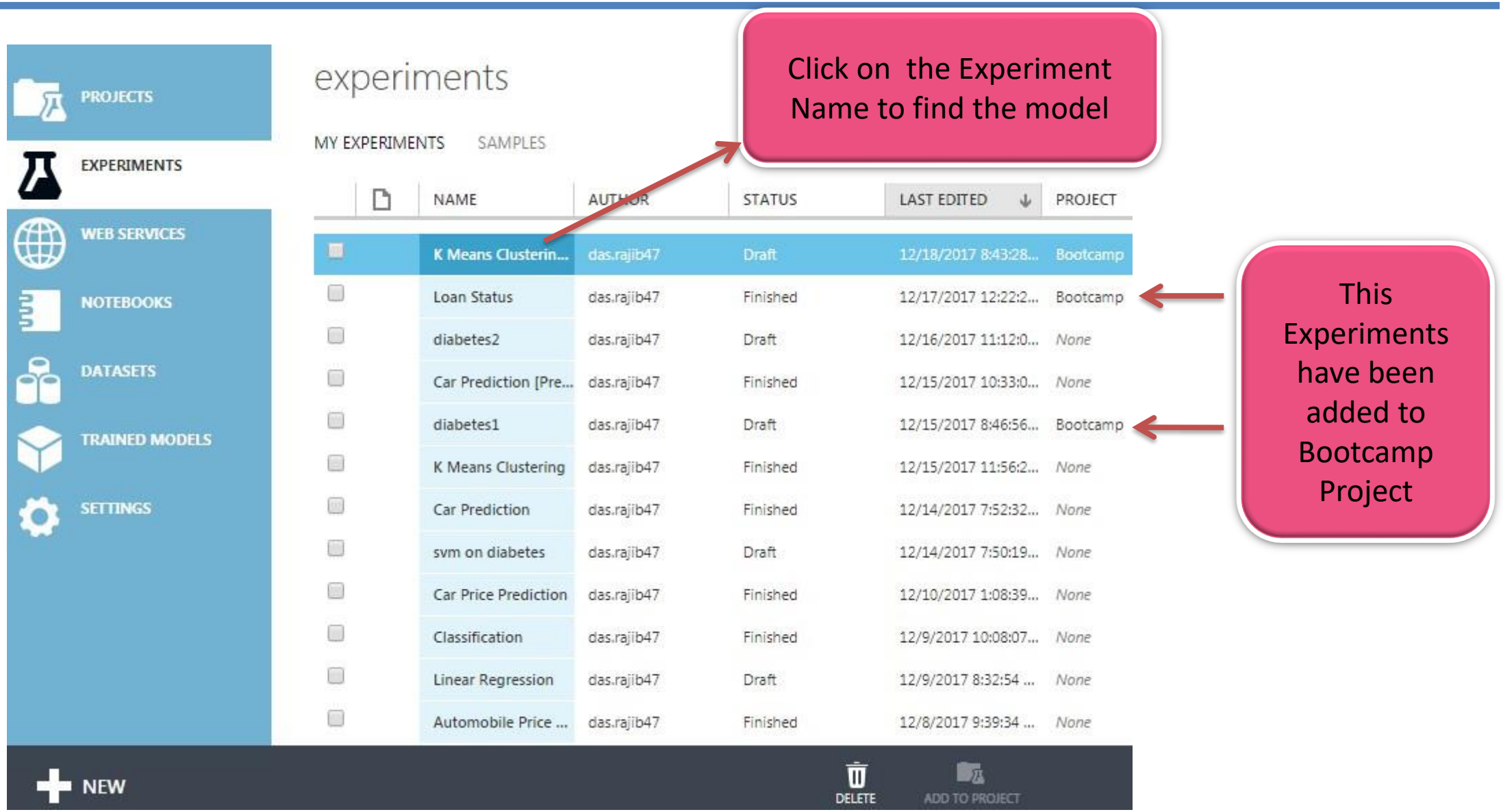
Project consists of Web service where model is deployed

Azure ML Studio: Experiment

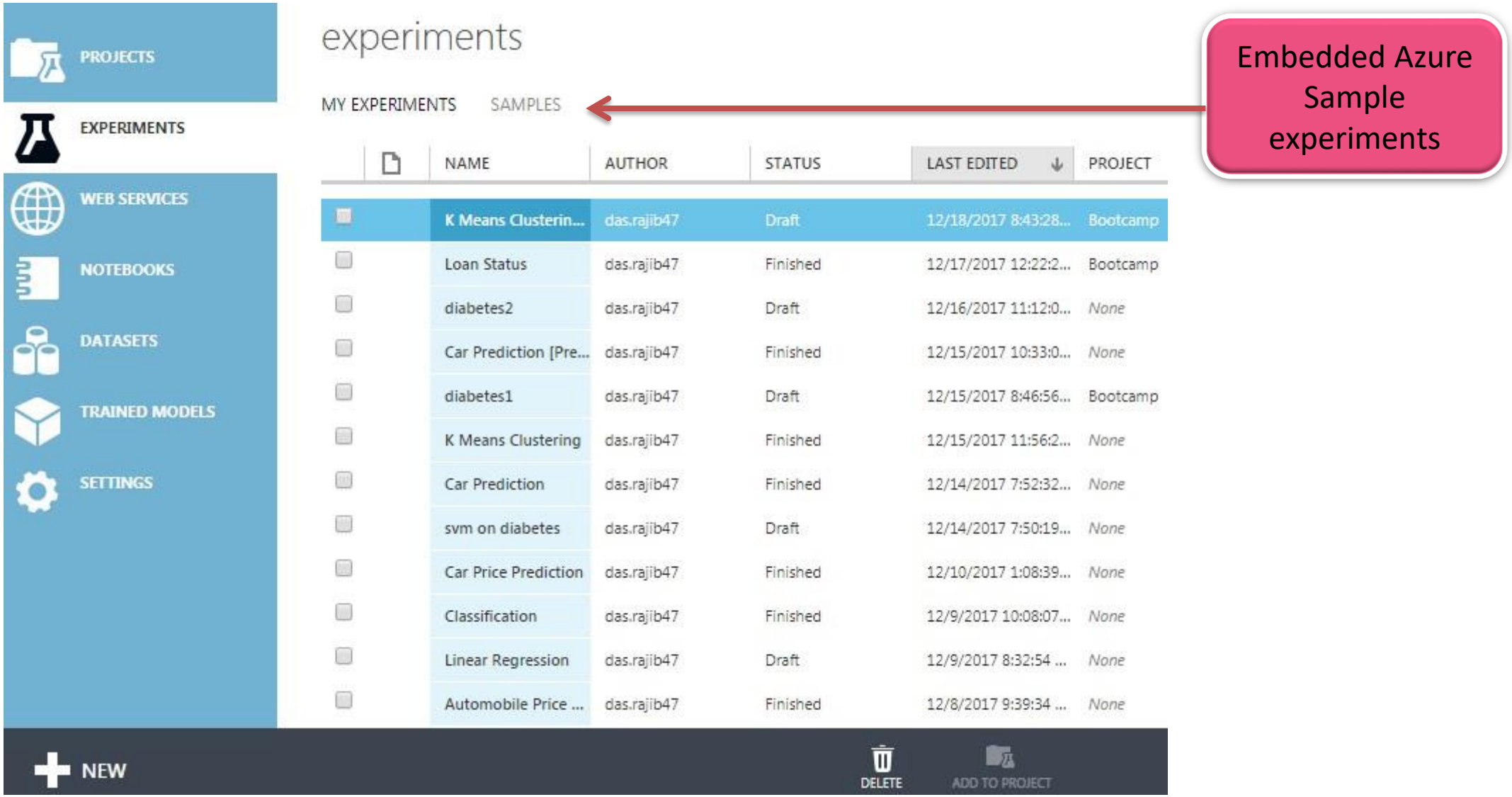
Enables to find experiments created by users.



Azure ML Studio: Experiment

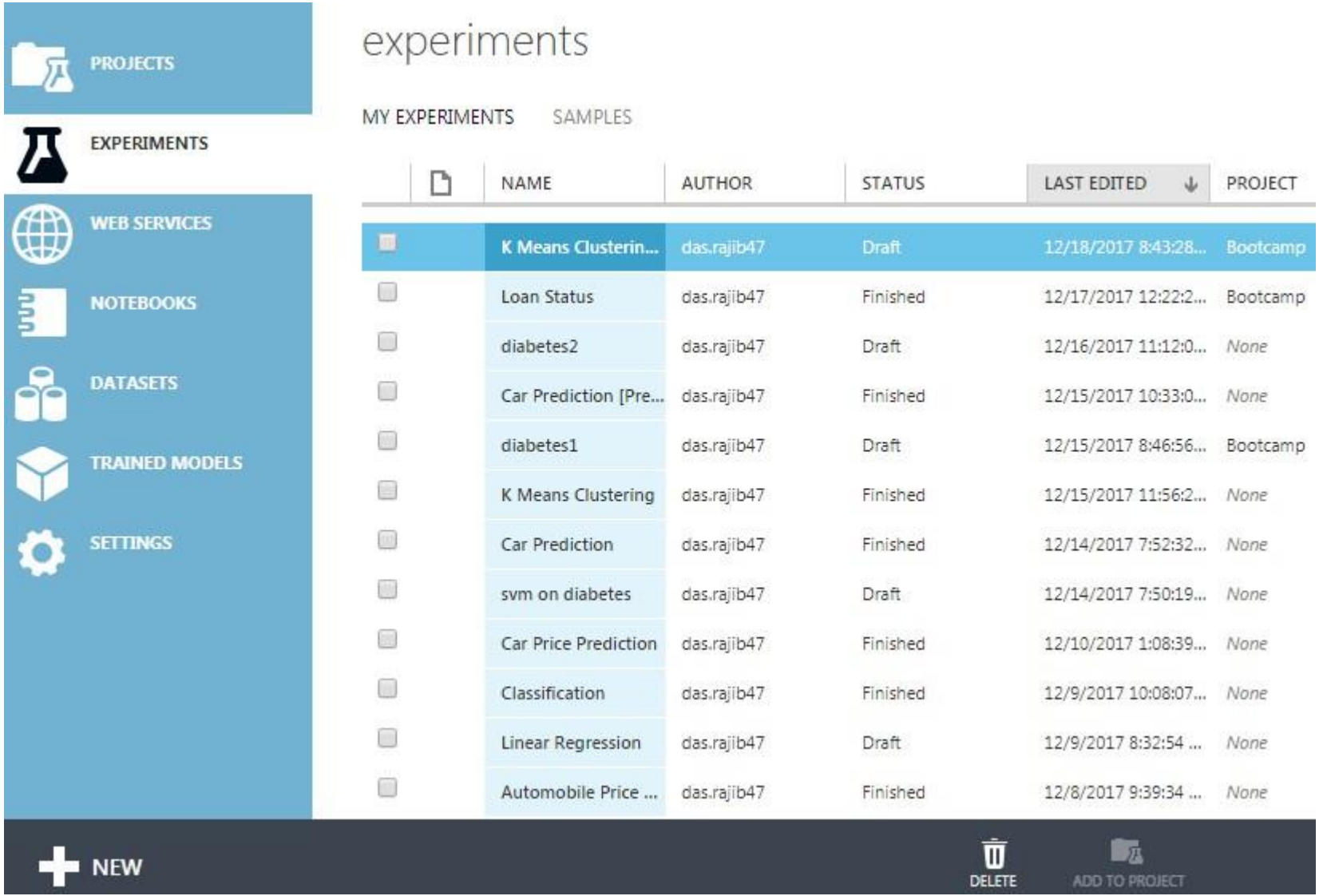


Azure ML Studio: Experiment



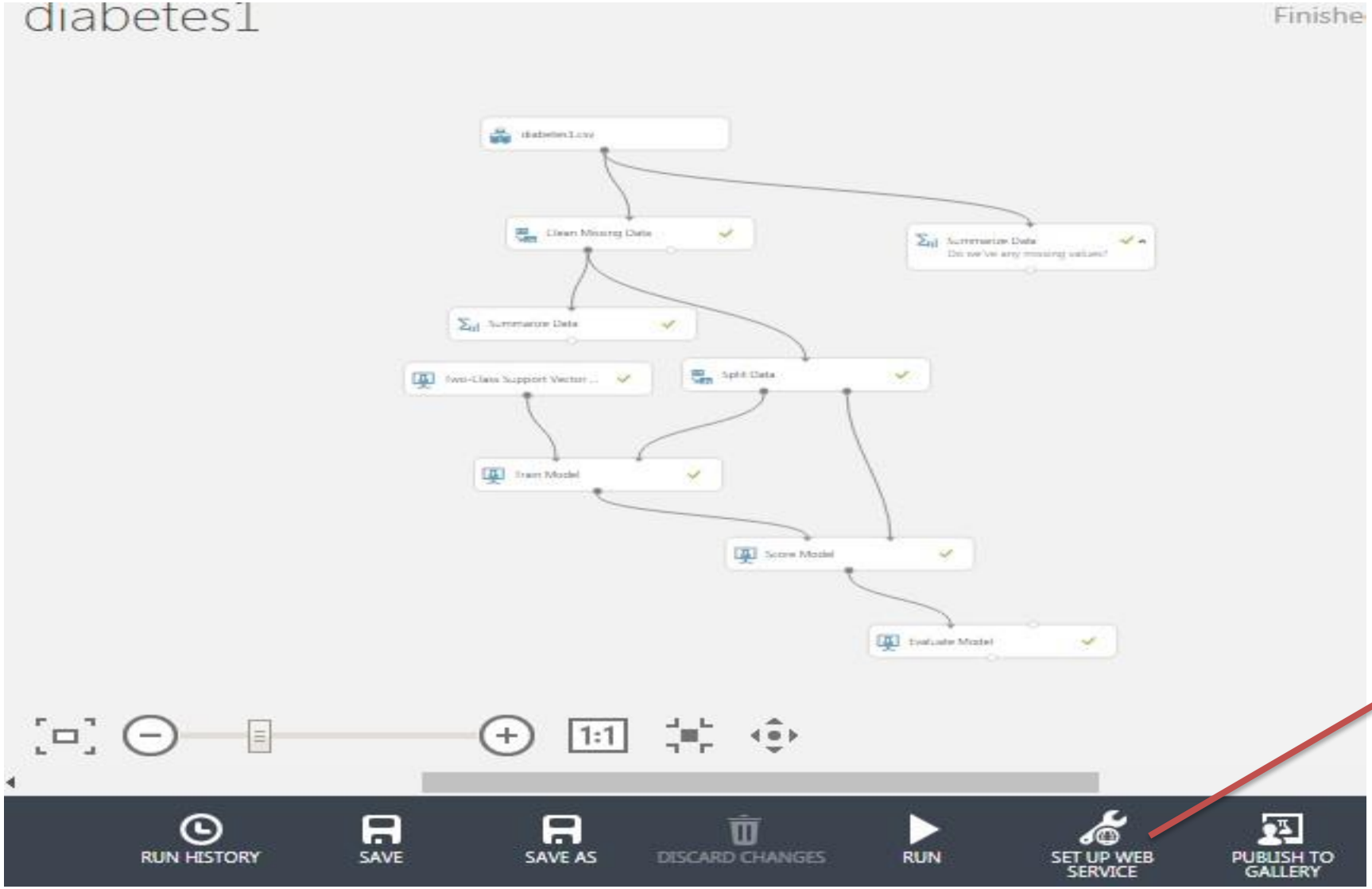
Embedded Azure Sample experiments

Azure ML Studio: Experiment



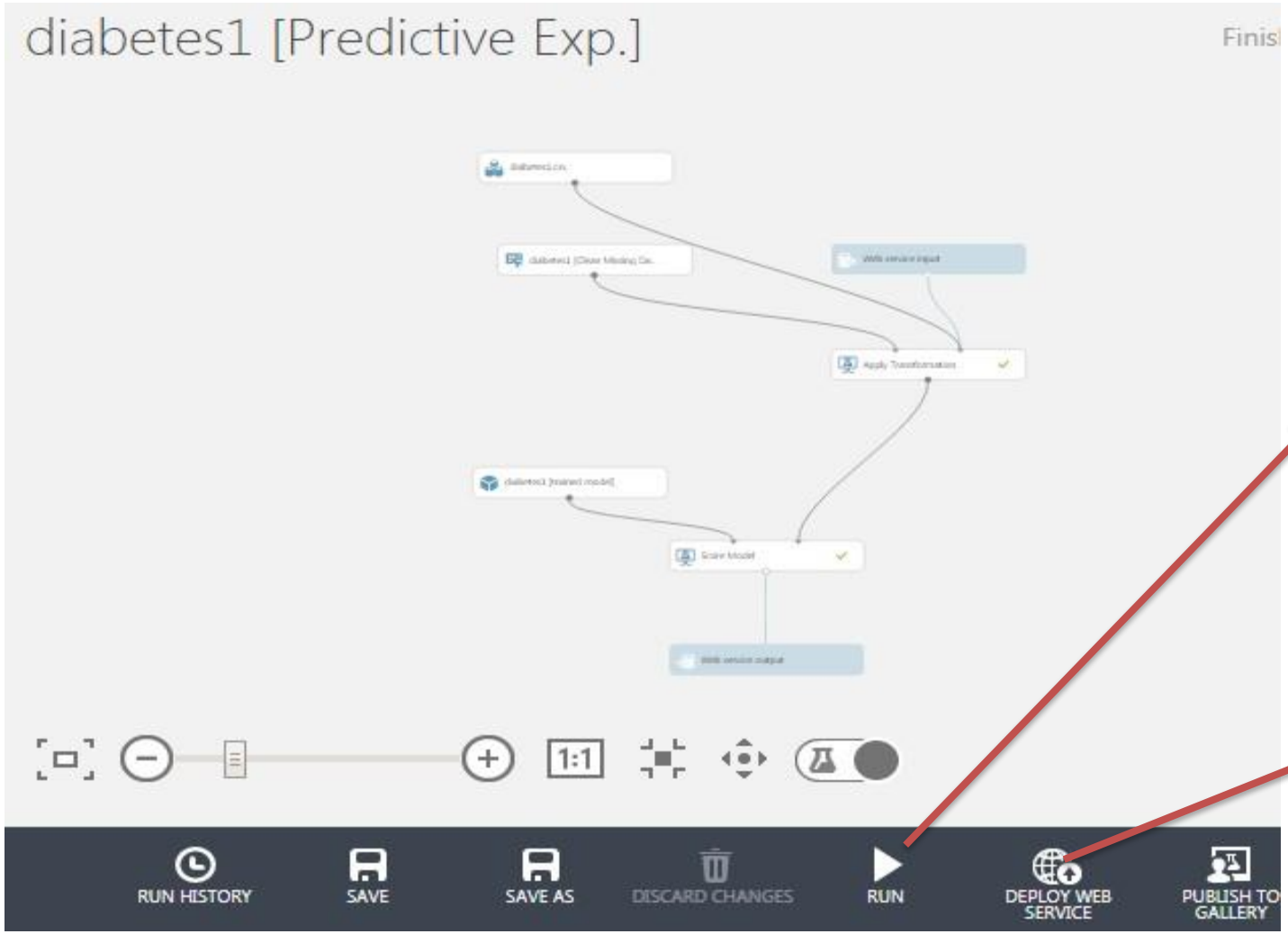
To Create New Experiment in ML studio workspace , click on NEW

Azure ML Studio: Web Services



This enables to get the model deployed on Web for making prediction with the same features

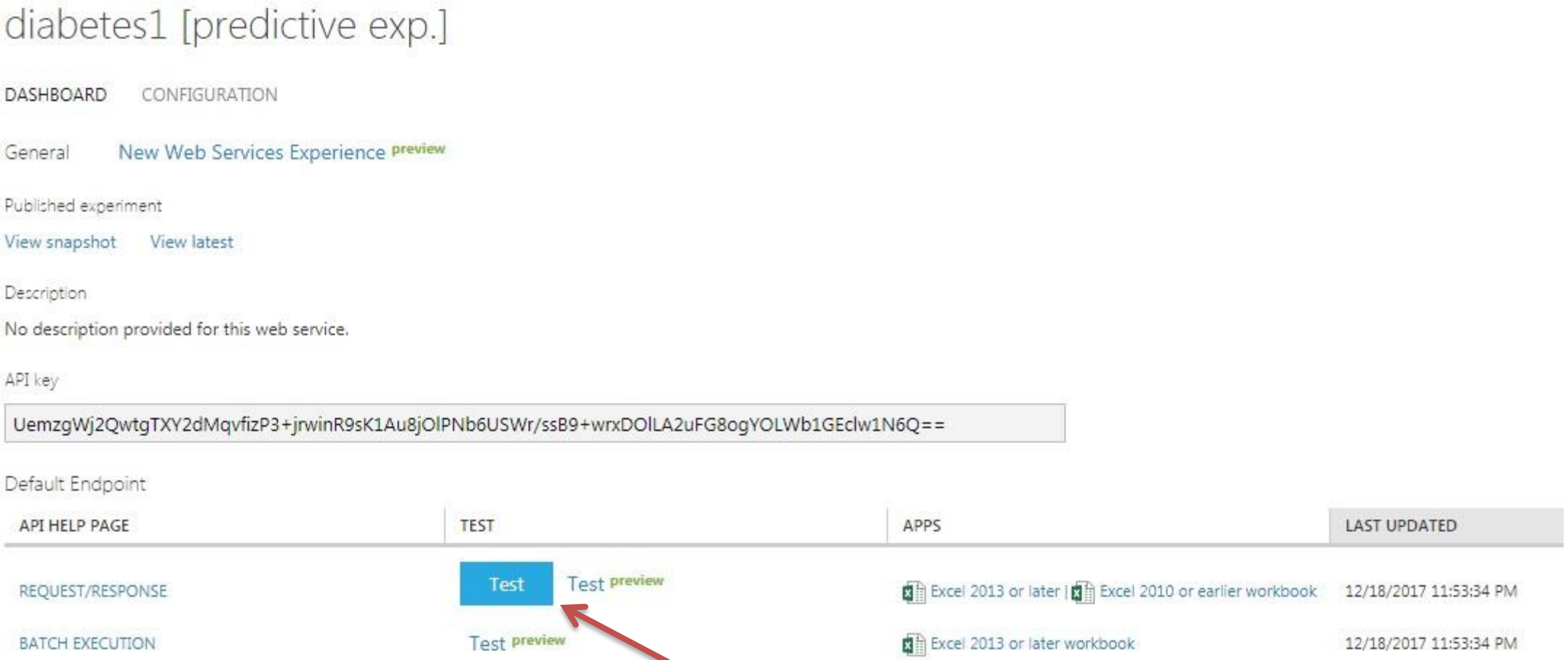
Azure ML Studio: Web Services



1. Run all the modules before deploying on web service

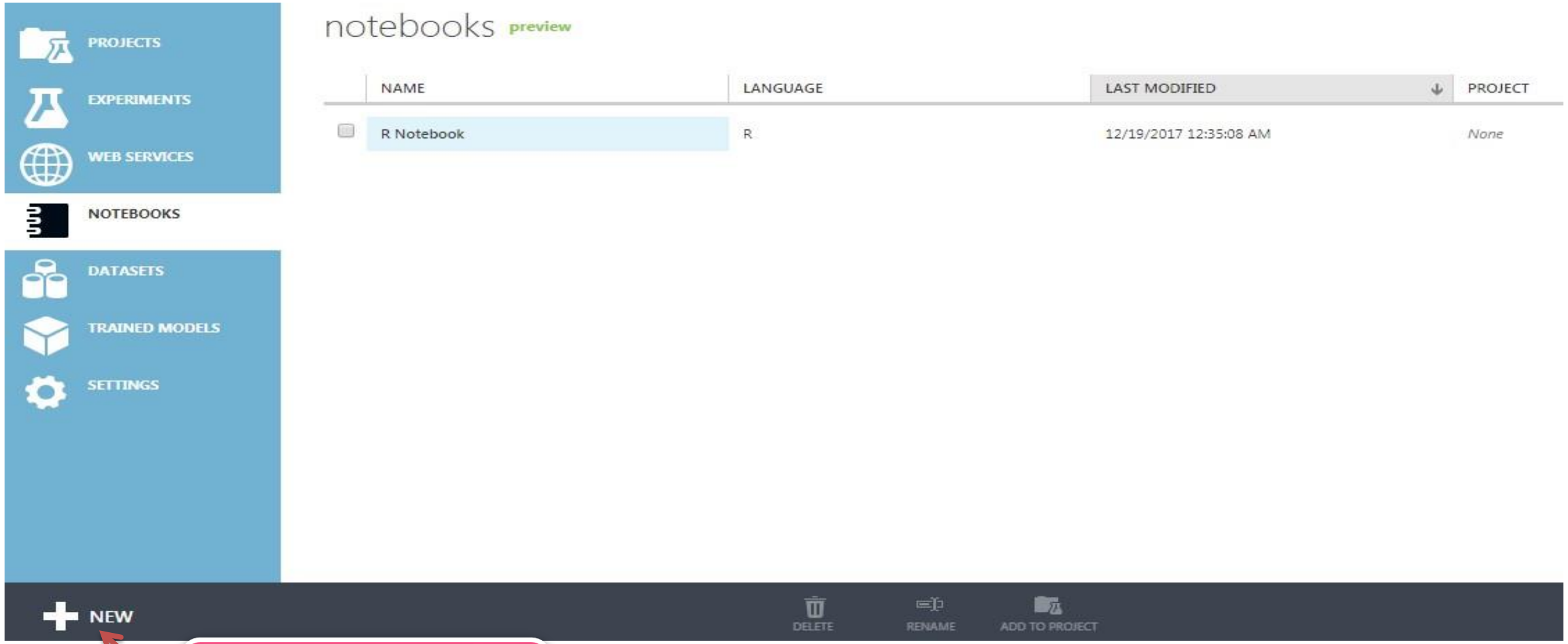
2. Deploy web service enables to get the model(diabetes1) available on web as Predictive Experiment

Azure ML Studio: Web Services



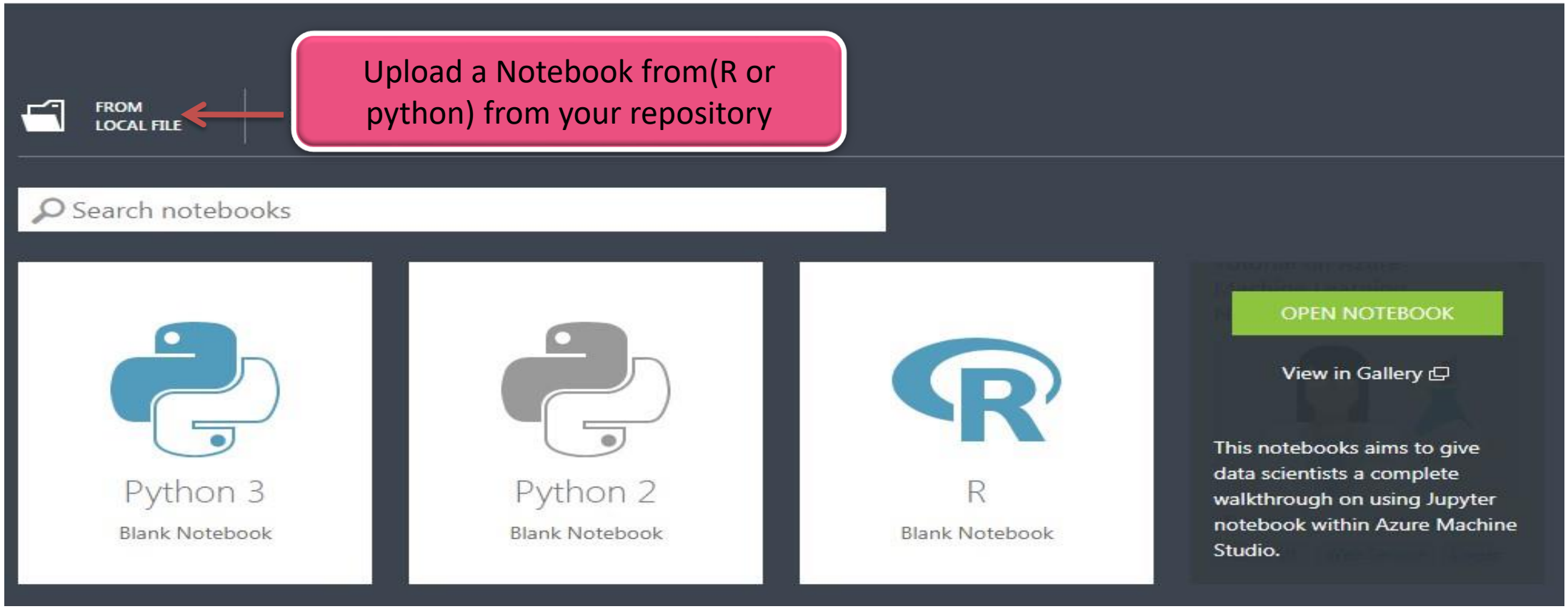
Azure ML Studio: Web Services

Azure ML Studio: Notebook



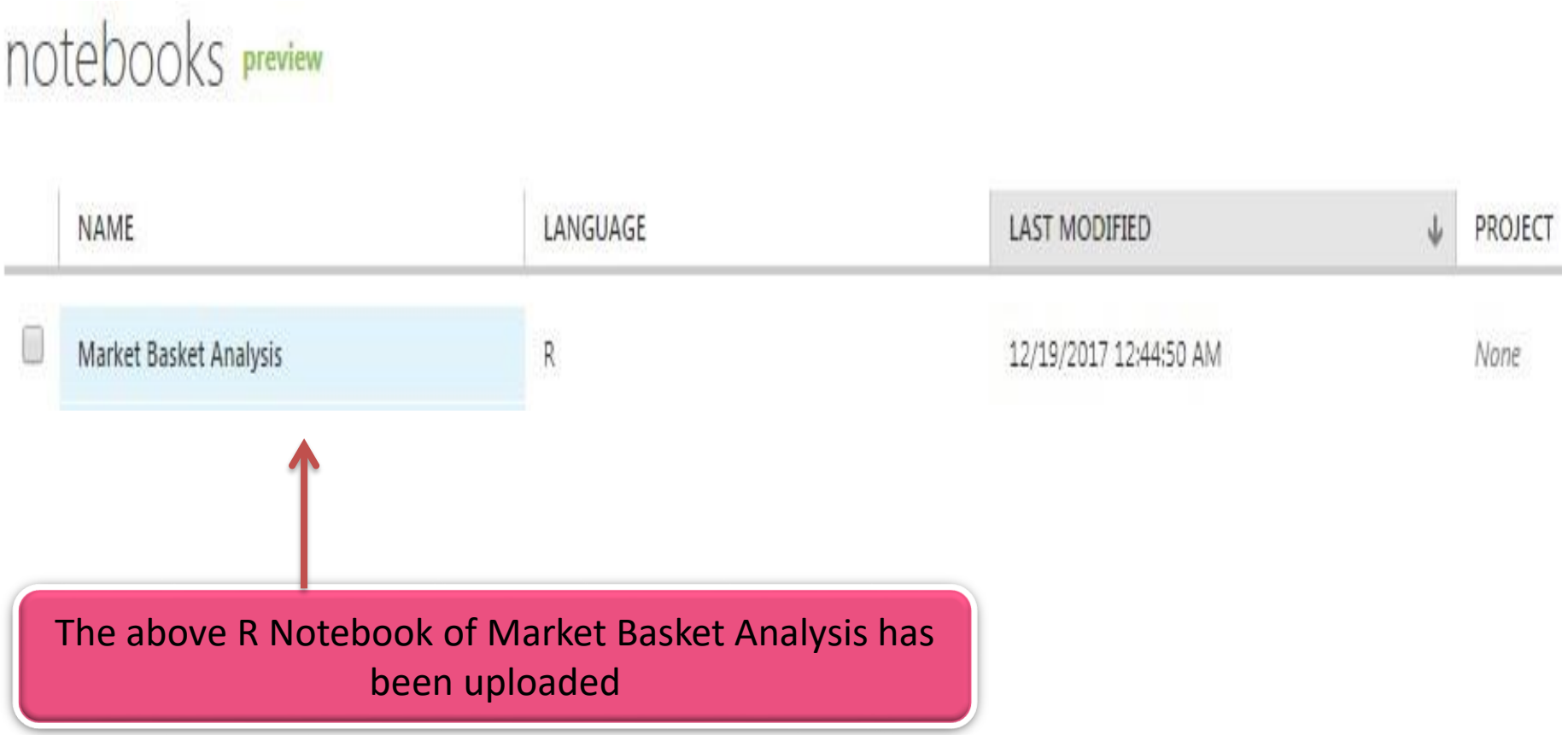
Clicking on New will open up a window in next slide

Azure ML Studio: Notebook



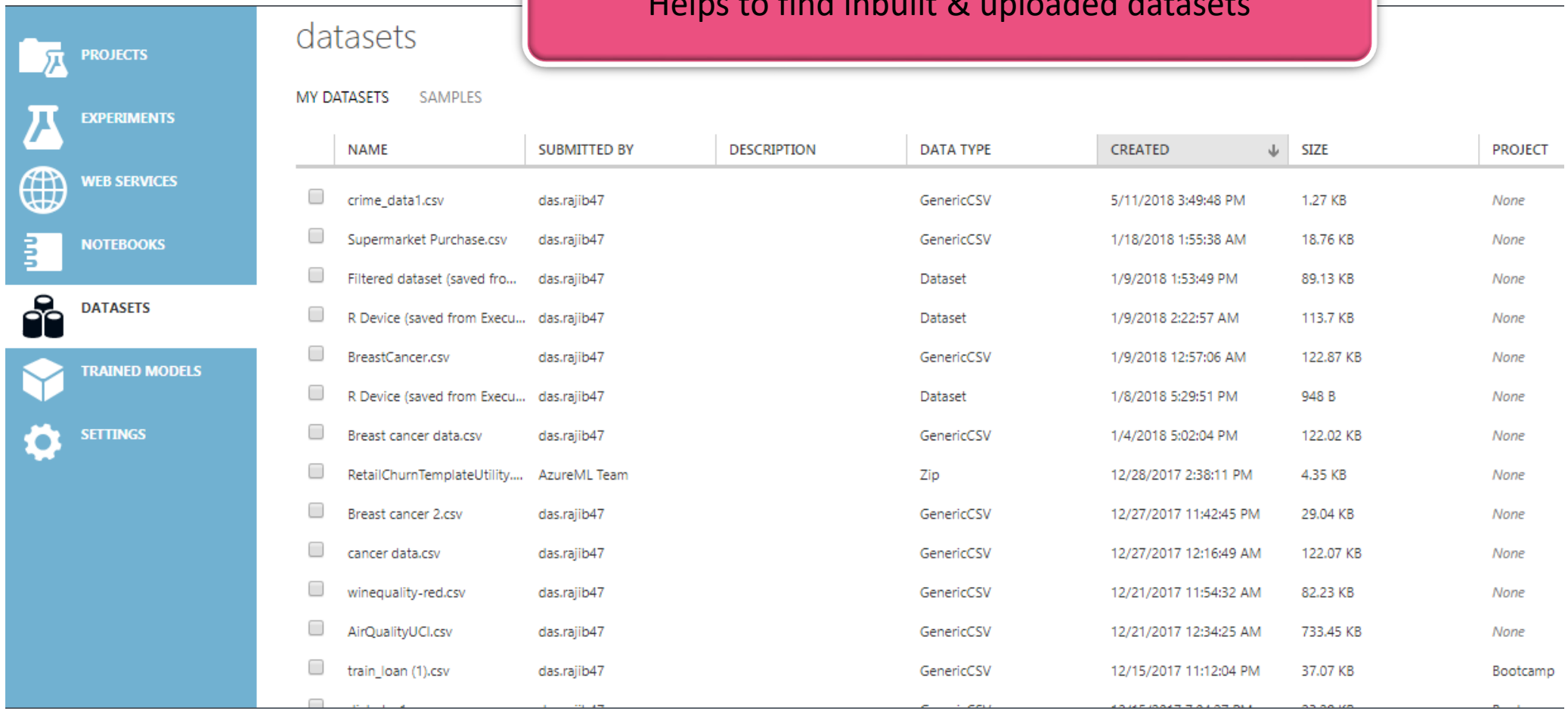
Create a Notebook in any scripting Language(R or Python)

Azure ML Studio: Notebook



Azure ML Studio: Datasets

Helps to find inbuilt & uploaded datasets

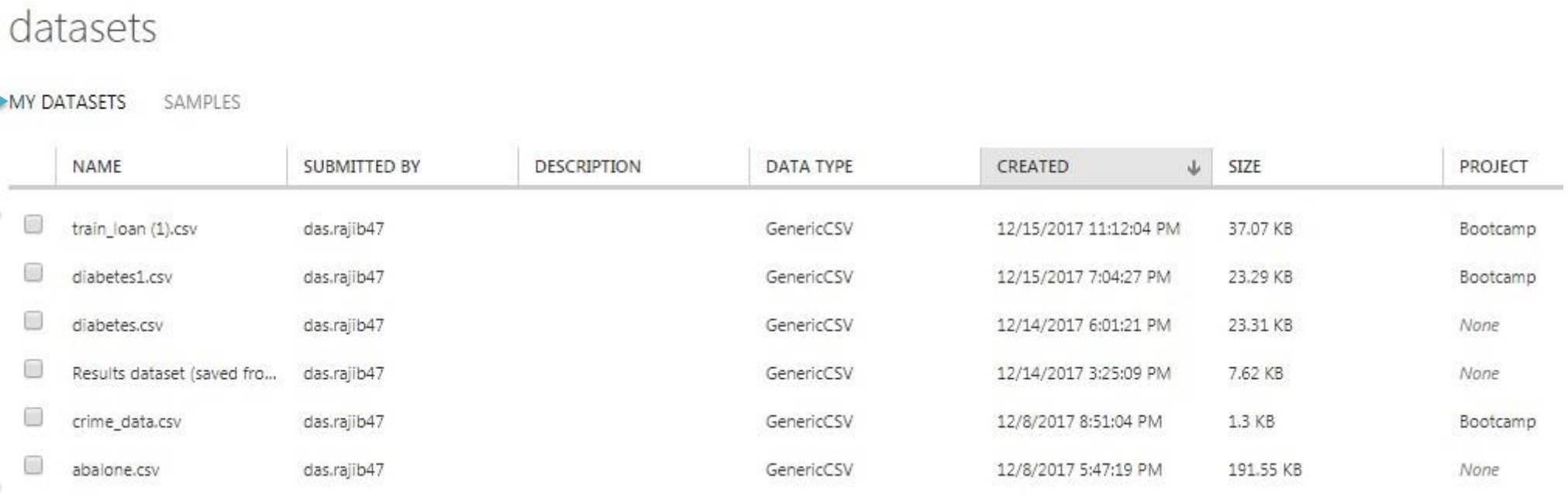


NAME	SUBMITTED BY	DESCRIPTION	DATA TYPE	CREATED	SIZE	PROJECT
crime_data1.csv	das.rajib47		GenericCSV	5/11/2018 3:49:48 PM	1.27 KB	None
Supermarket Purchase.csv	das.rajib47		GenericCSV	1/18/2018 1:55:38 AM	18.76 KB	None
Filtered dataset (saved fro...	das.rajib47		Dataset	1/9/2018 1:53:49 PM	89.13 KB	None
R Device (saved from Execu...	das.rajib47		Dataset	1/9/2018 2:22:57 AM	113.7 KB	None
BreastCancer.csv	das.rajib47		GenericCSV	1/9/2018 12:57:06 AM	122.87 KB	None
R Device (saved from Execu...	das.rajib47		Dataset	1/8/2018 5:29:51 PM	948 B	None
Breast cancer data.csv	das.rajib47		GenericCSV	1/4/2018 5:02:04 PM	122.02 KB	None
RetailChurnTemplateUtility....	AzureML Team		Zip	12/28/2017 2:38:11 PM	4.35 KB	None
Breast cancer 2.csv	das.rajib47		GenericCSV	12/27/2017 11:42:45 PM	29.04 KB	None
cancer data.csv	das.rajib47		GenericCSV	12/27/2017 12:16:49 AM	122.07 KB	None
winequality-red.csv	das.rajib47		GenericCSV	12/21/2017 11:54:32 AM	82.23 KB	None
AirQualityUCI.csv	das.rajib47		GenericCSV	12/21/2017 12:34:25 AM	733.45 KB	None
train_loan (1).csv	das.rajib47		GenericCSV	12/15/2017 11:12:04 PM	37.07 KB	Bootcamp

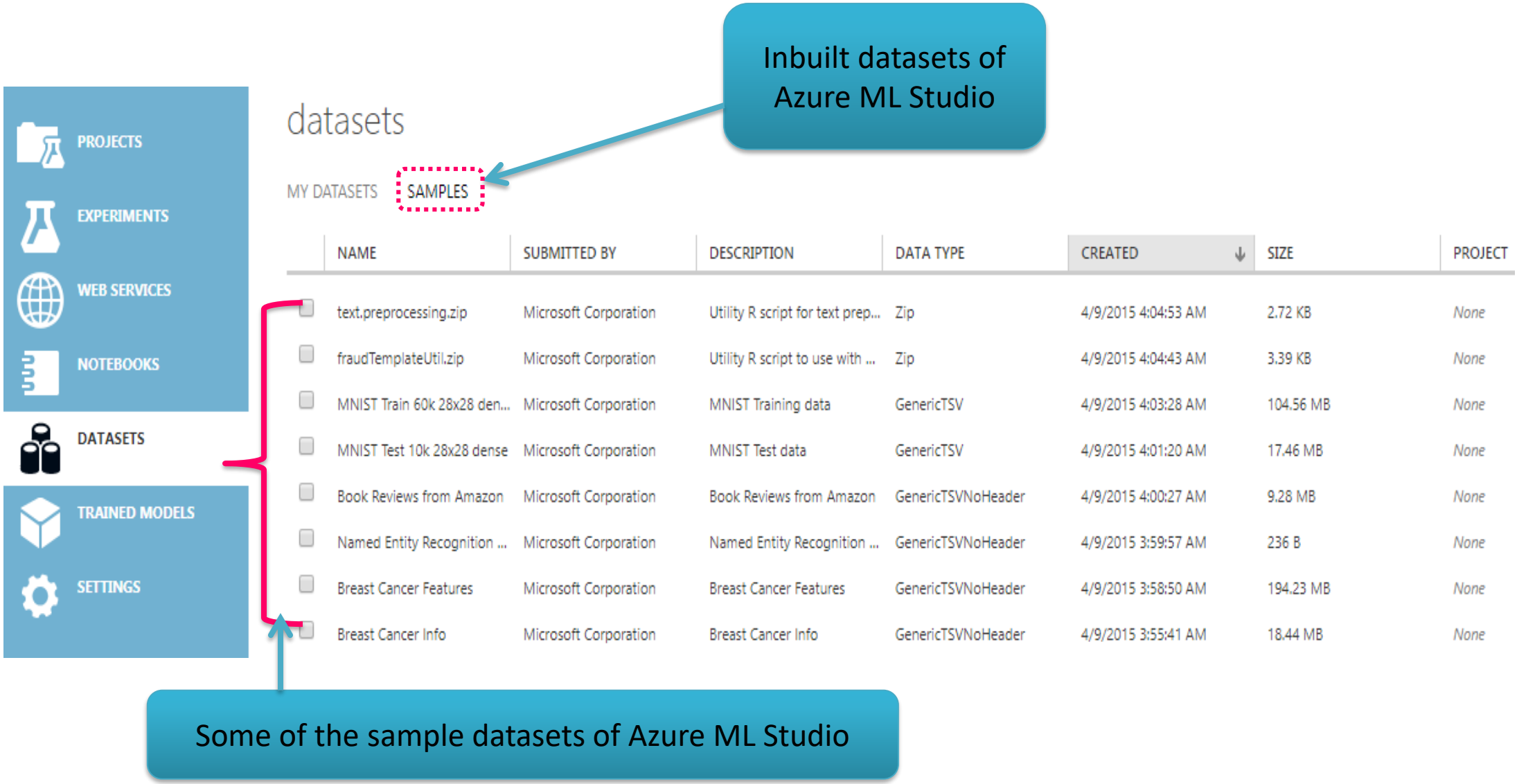
Azure ML Studio: Datasets

Enables import of datasets from local file

These datasets have been imported from Local repository



Azure ML Studio: Datasets



Azure ML Studio: Trained Model

Trained Models enables us to find the models that are deployed on Web service

trained models

NAME	SUBMITTED BY	DESCRIPTION	DATA TYPE	CREATED	PROJECT
diabetes1 [trained model]	das.rajib47		ILearnerDotNet	12/18/2017 11:46:14 PM	Bootcamp
diabetes1 [trained model]	das.rajib47		ILearnerDotNet	12/18/2017 11:15:49 PM	Bootcamp
Car Prediction [trained model]	das.rajib47		ILearnerDotNet	12/14/2017 7:53:25 PM	Bootcamp

How Azure ML Works

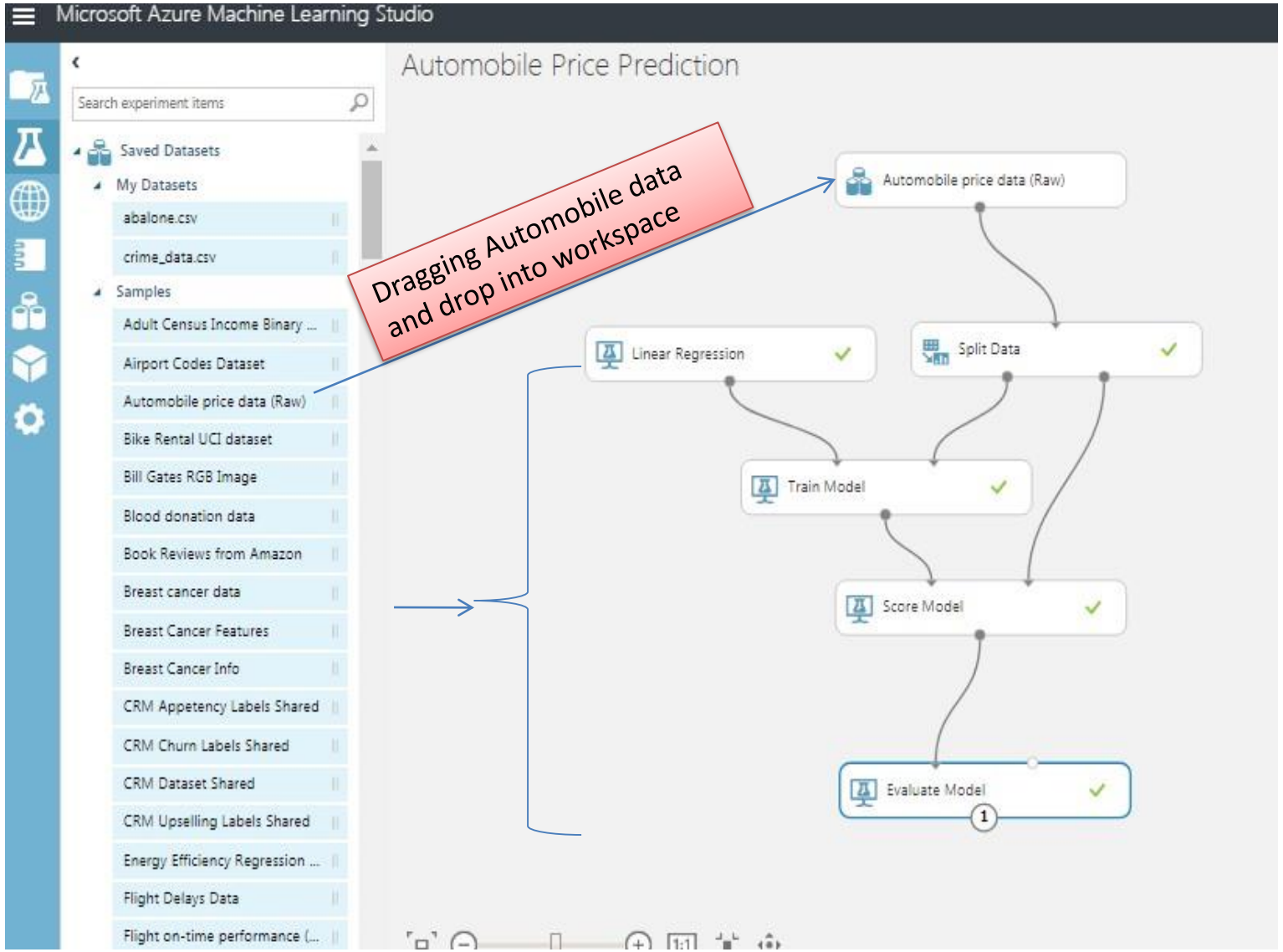
Creating a predictive model with Azure ML is as easy as…

… playing with LEGO®!

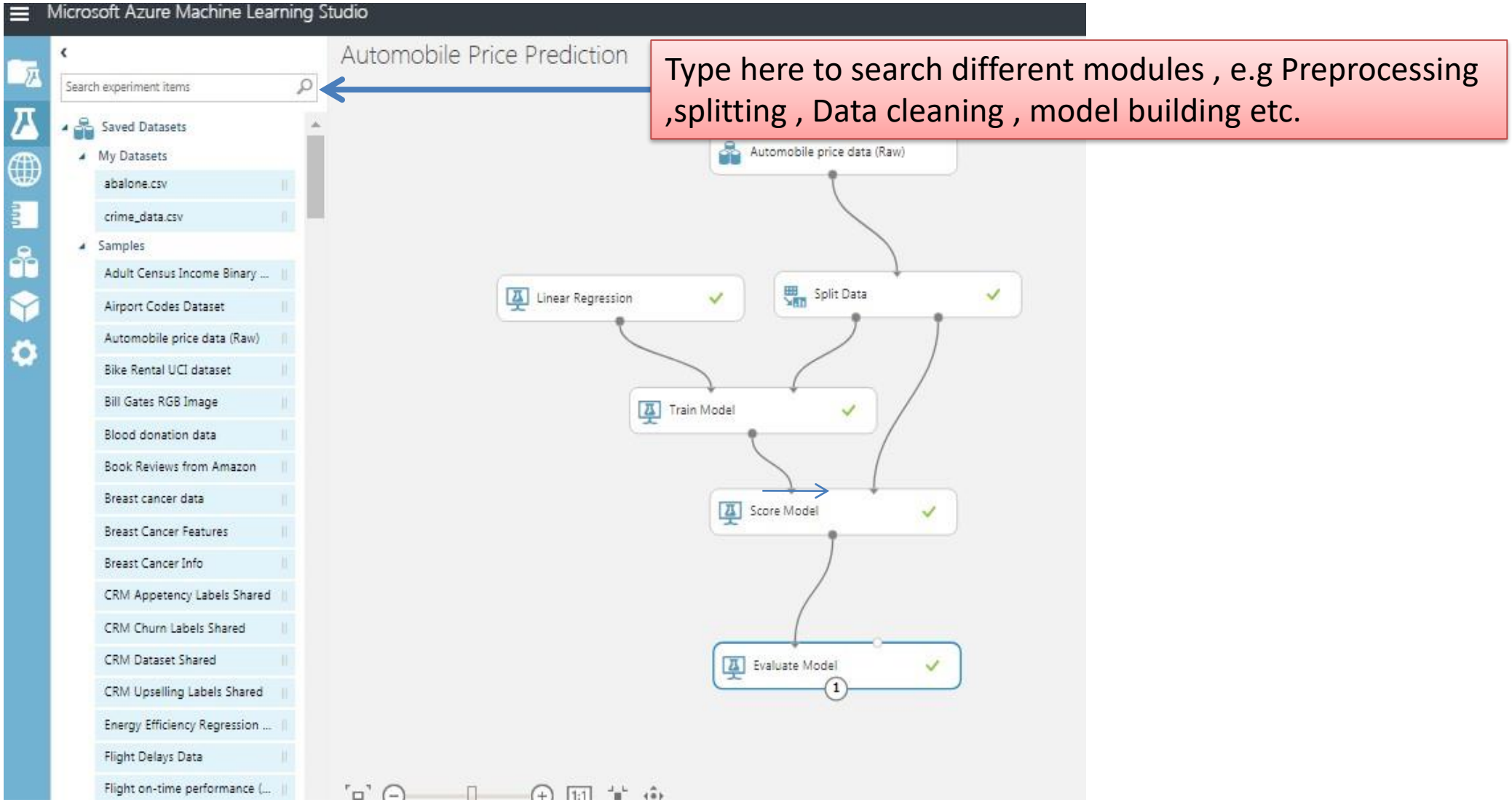
Build - main features

*To help you building your **training experiment** (model) from scratch, Studioprovides:*

- *Interactive, intuitive visual workspace.*
- *Drag-and-drop interaction to connect **modules** with each other. Forinstance:*
  - *ready-to-use **datasets**.*
  - *ready-to-use standard **ML algorithms**.*
  - *your special sauce (cooked in **Python** or **R**).*
  - *…*
- *Huge set of **samples** and **templates**.*

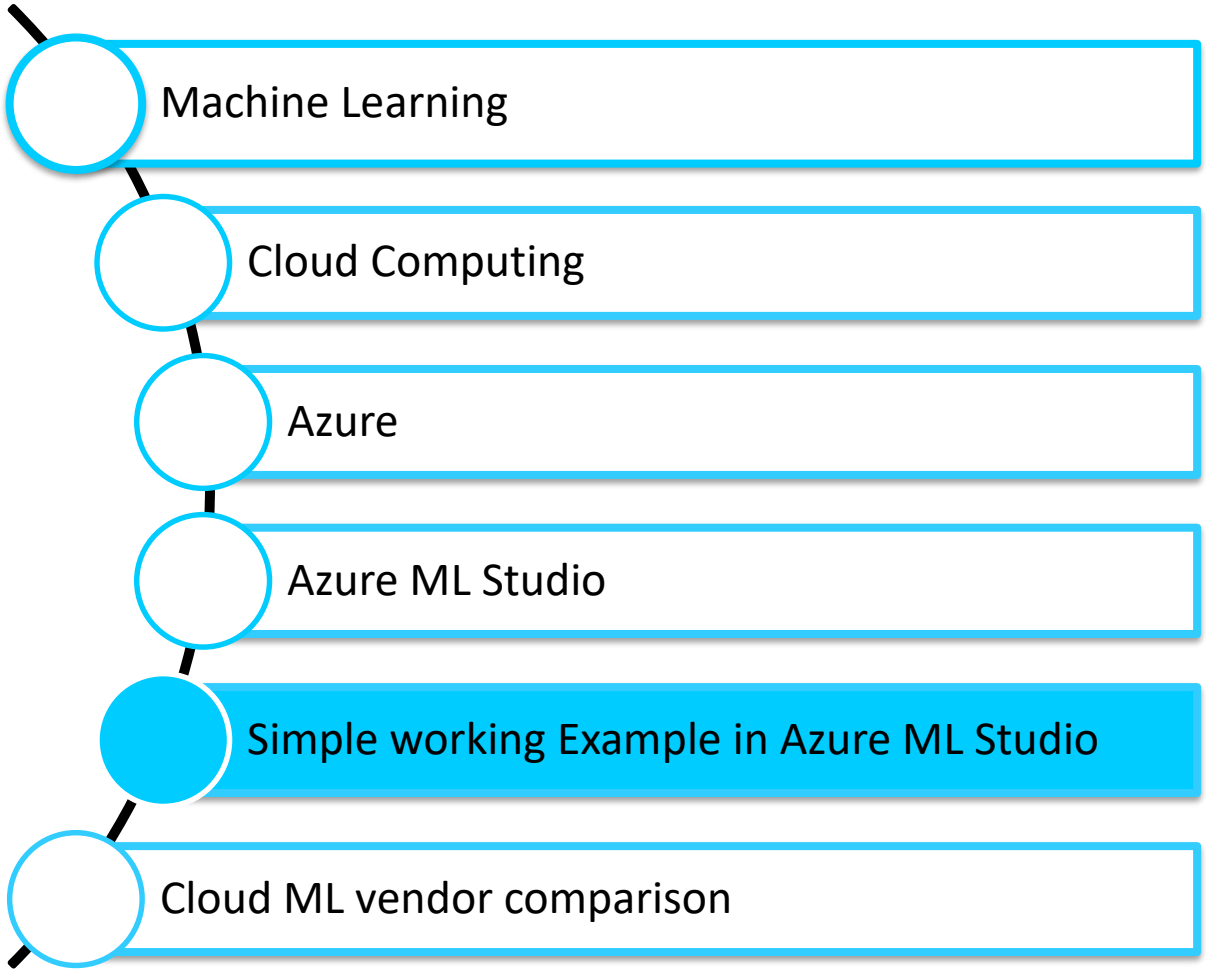


Build - main features

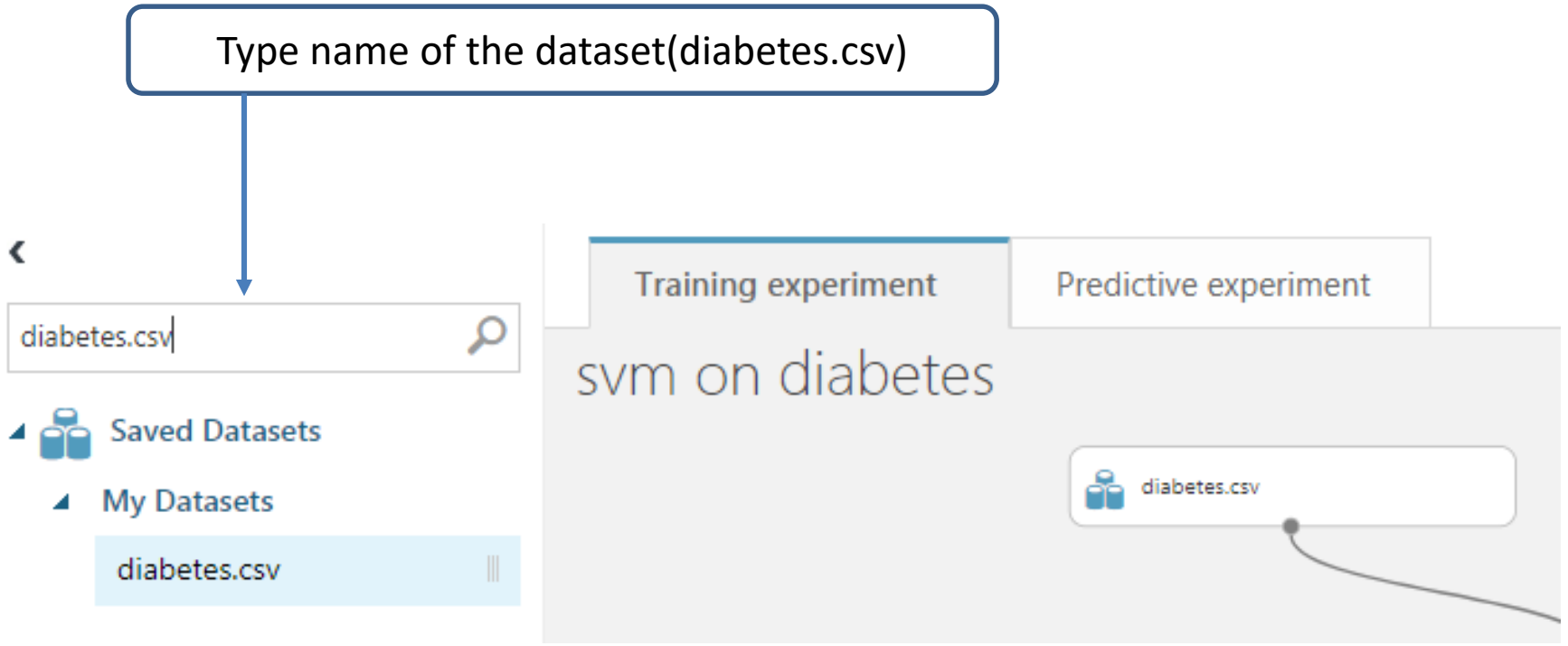


Quick Recap

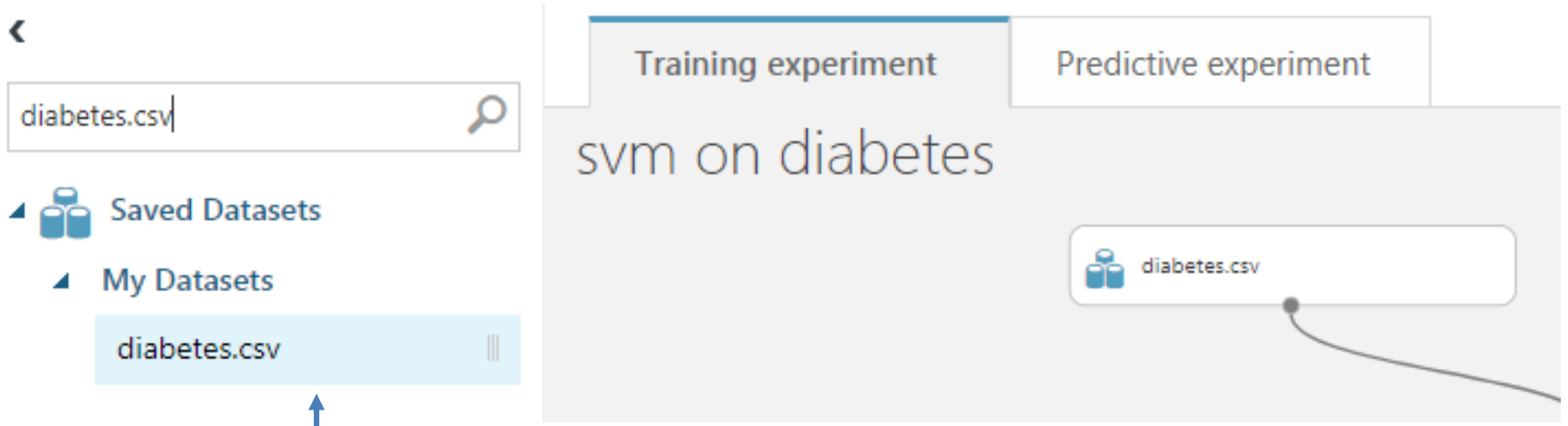
- Getting Stated With Azure ML Studio(Login/ Signup)
- Components of Azure ML Studio(Project , Experiments , Web Services, Datasets, Notebook, Trained Models)
- How Azure ML Studio Works


Machine Learning
Cloud Computing
Azure
Azure ML Studio
Simple working Example in Azure ML Studio
Cloud ML vendor comparison

Let's Start with a Simple Model In Azure ML Studio: Data import

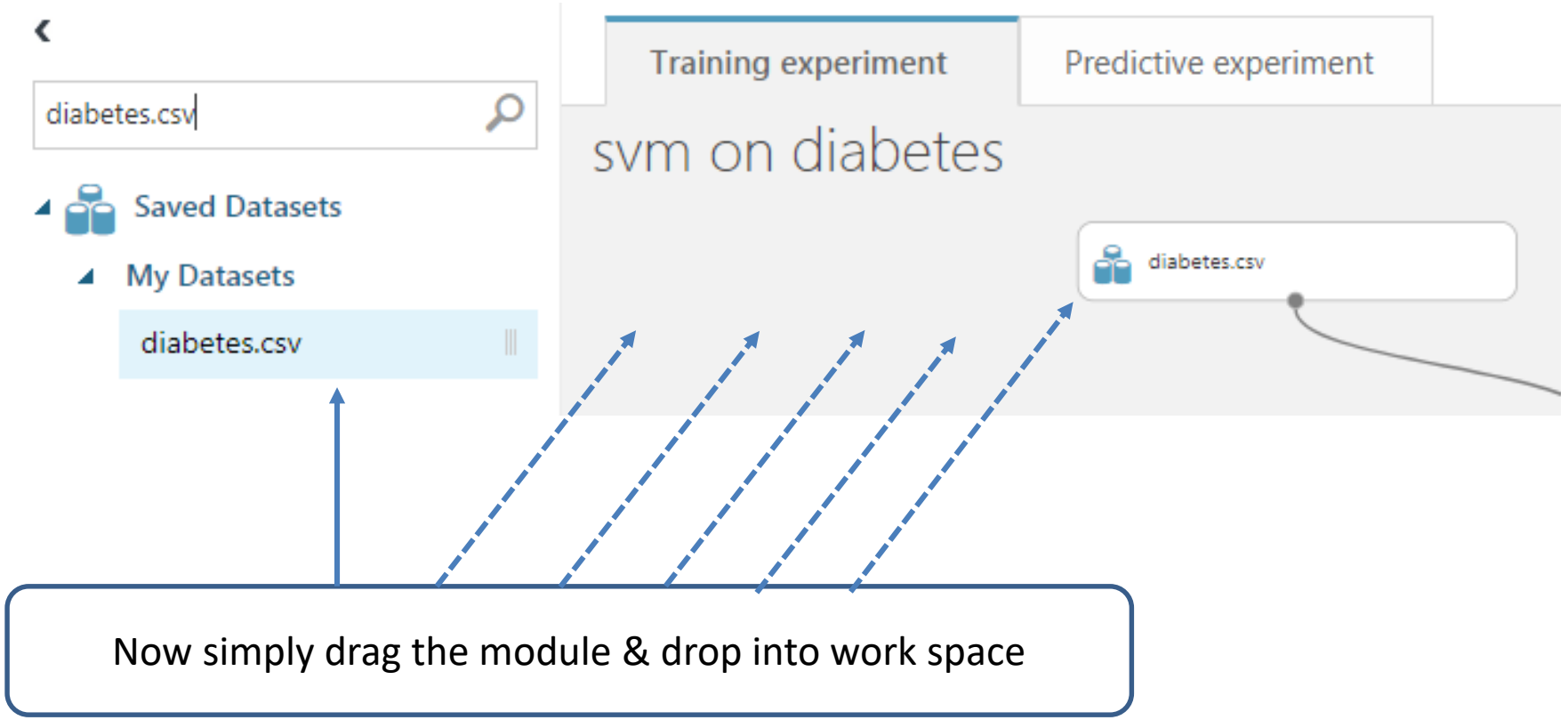


Data import

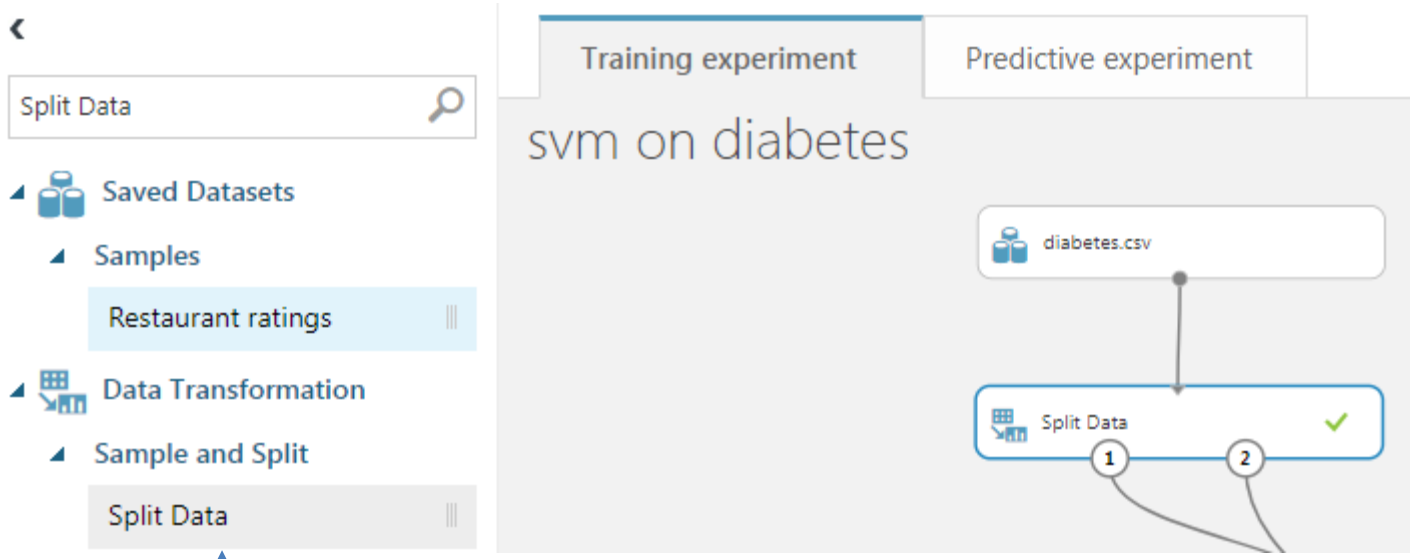


If the dataset is stored in Azure cloud will pop up here

Data import: Drag & Drop

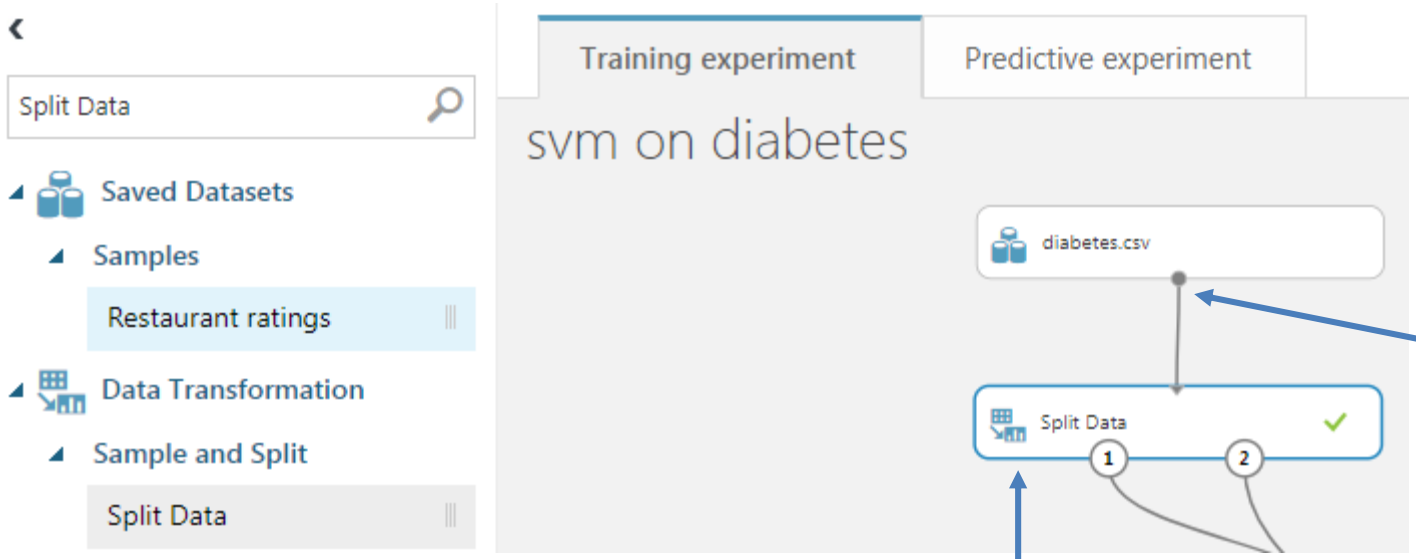


Data Transformation: Split Data



Type Split Data in the search box get the module pop up here

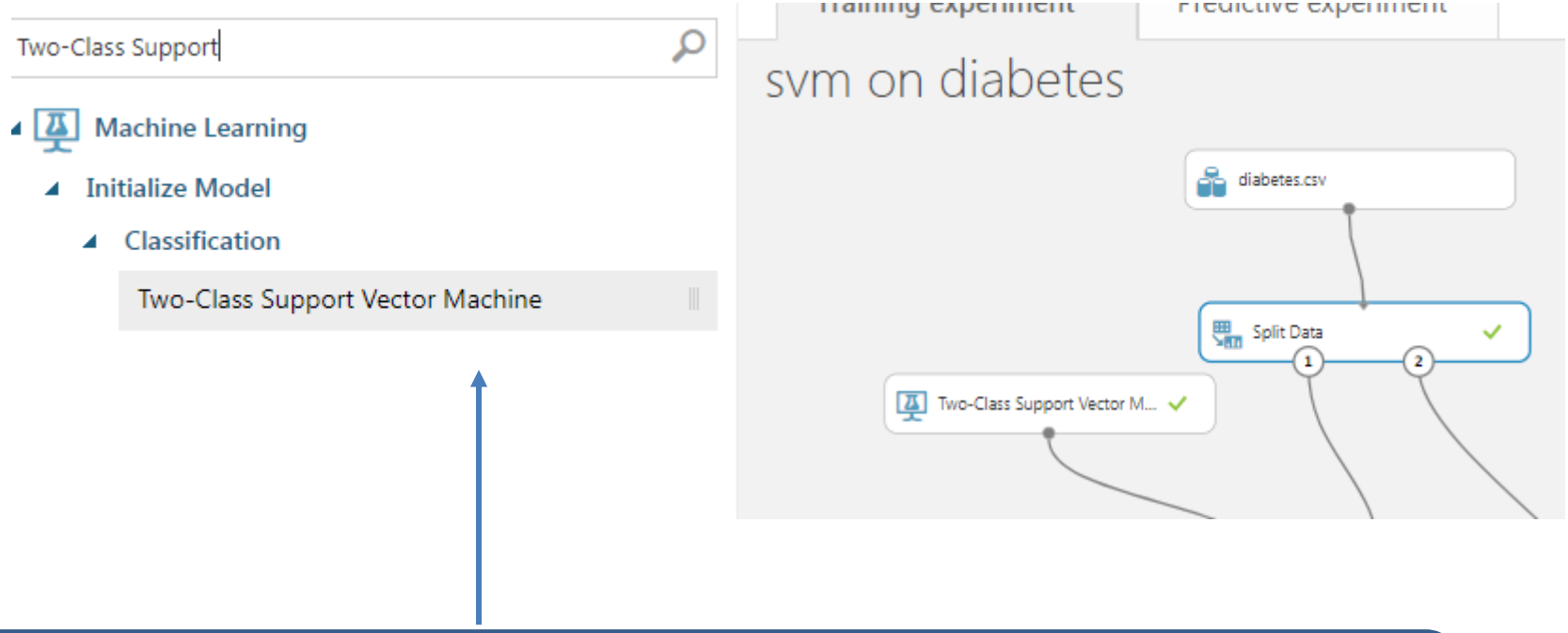
Data Transformation: Split Data



This is output port of diabetes.csv module & can be connected with other modules like Split Data.

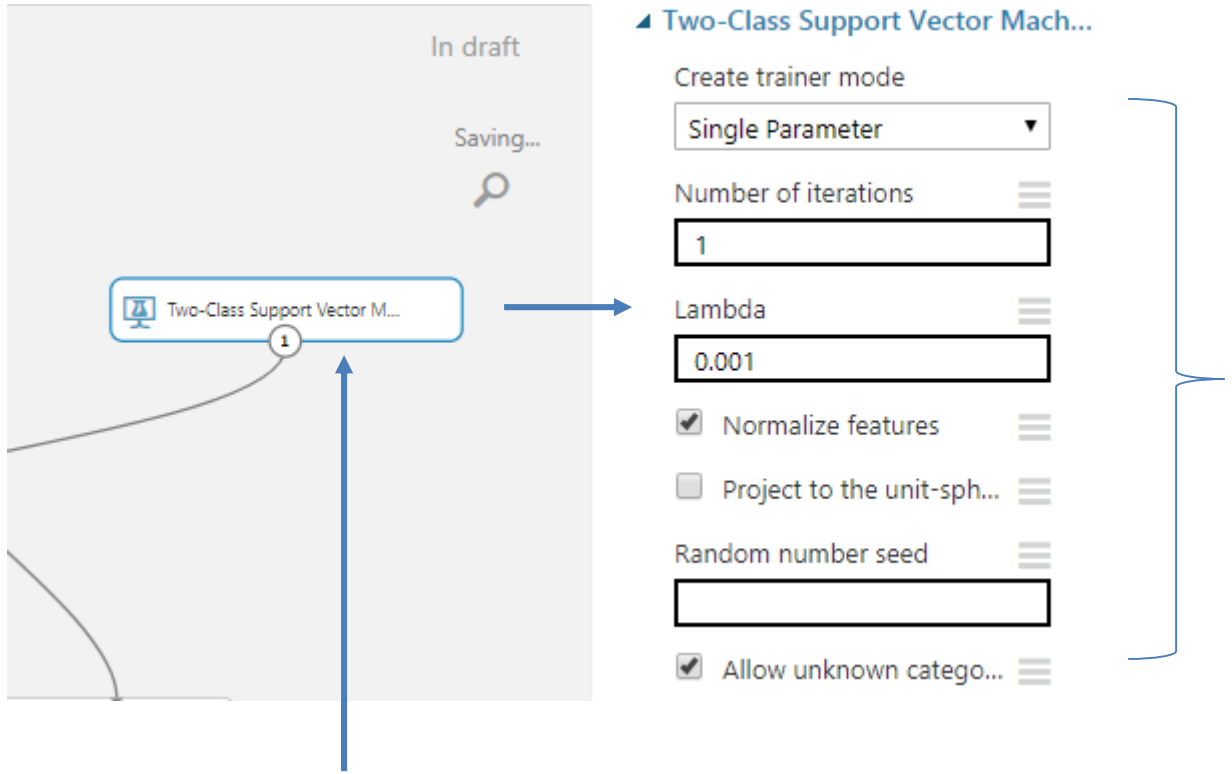
Split diabetes data into train set & test set

Algorithm: Two-Class Support Vector Machine



Two-Class Support Vector Machine classifier pops up after typing in the search box.
This is the algorithm we'll use to model our data

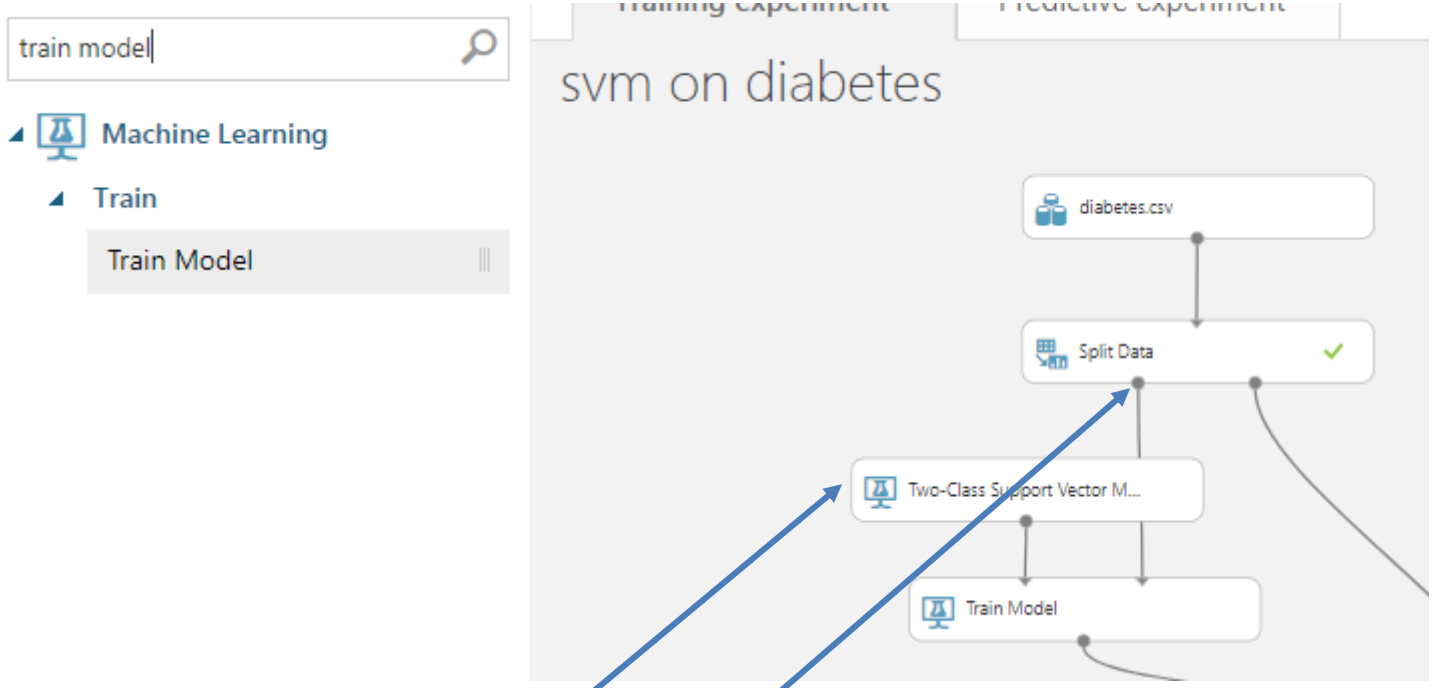
Algorithm: Two-Class Support Vector Machine



Model's Parameter

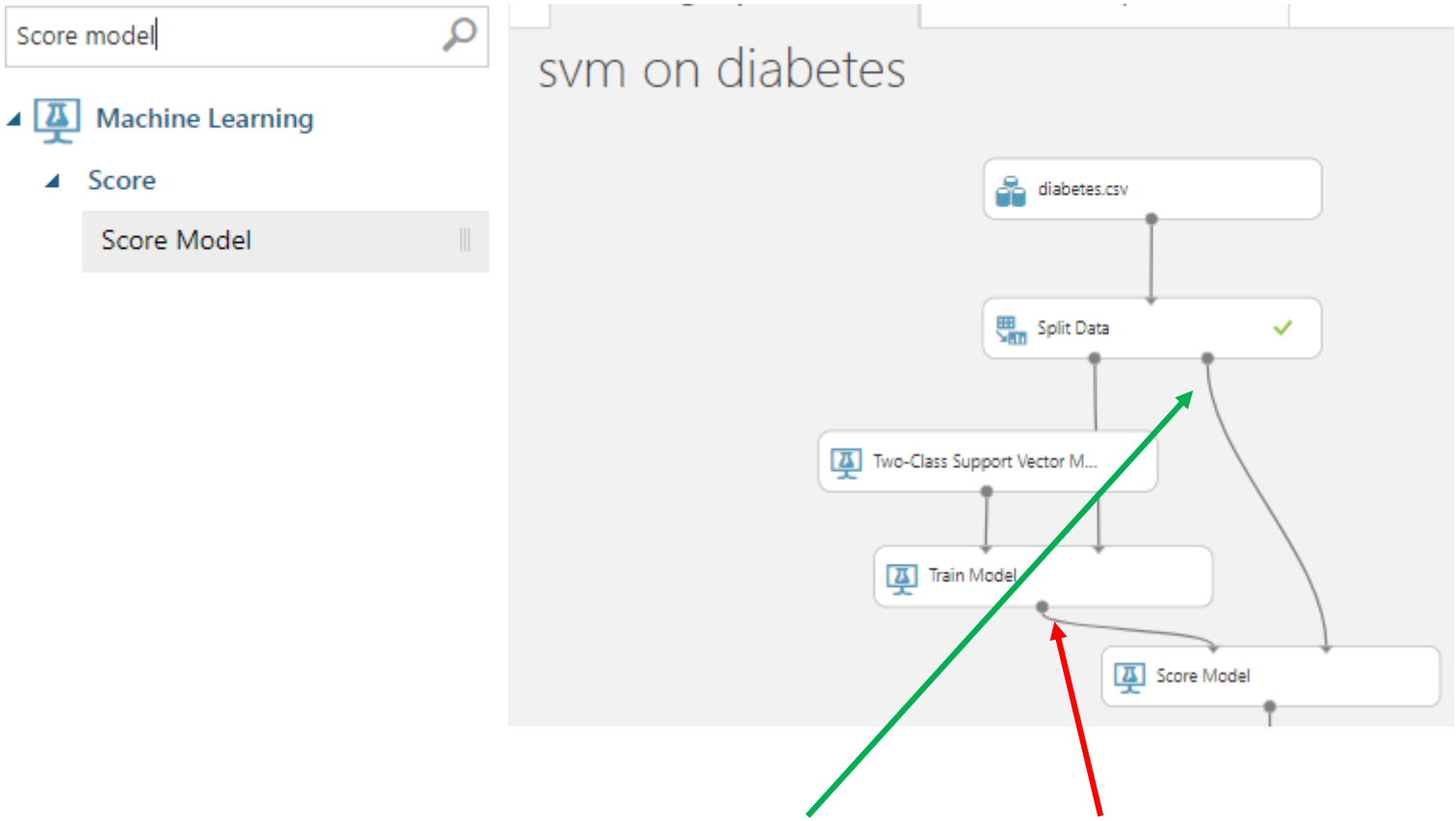
Clicking on module opens up a window beside.

Train Model



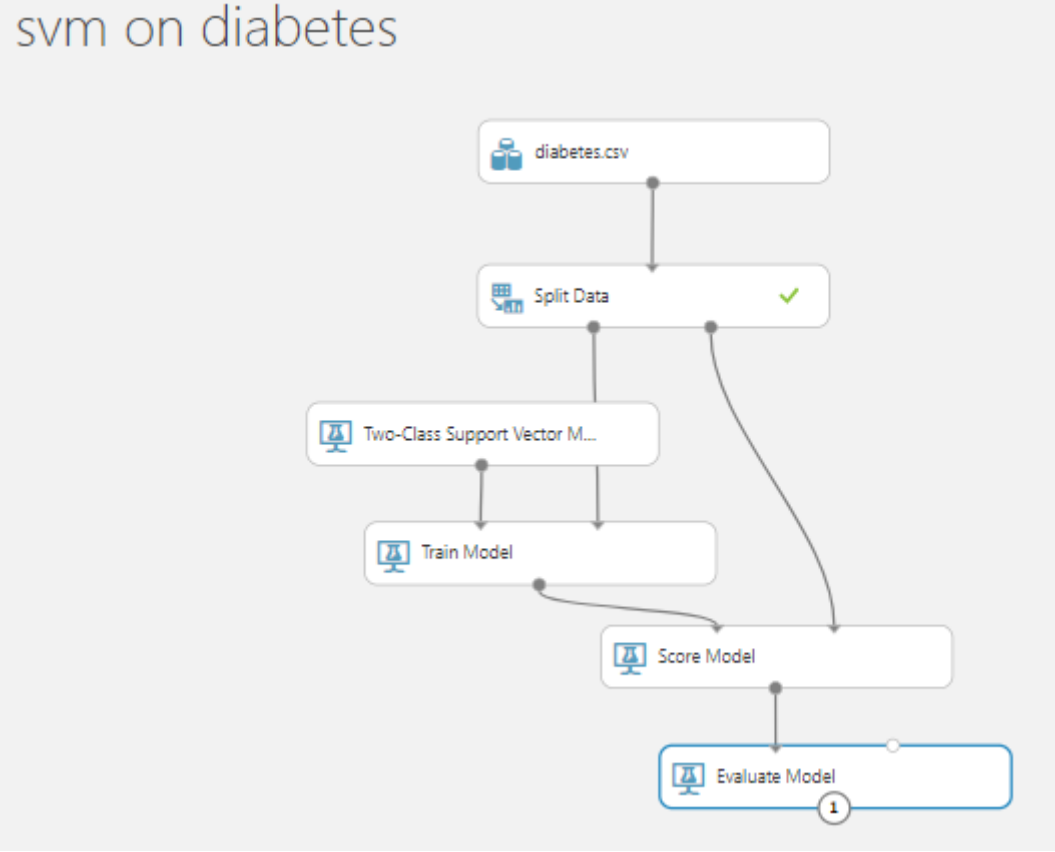
Train model with the Classifier & 70% of training data

Prediction: Score Model



Score model module enables us to predict 30% data with trained model

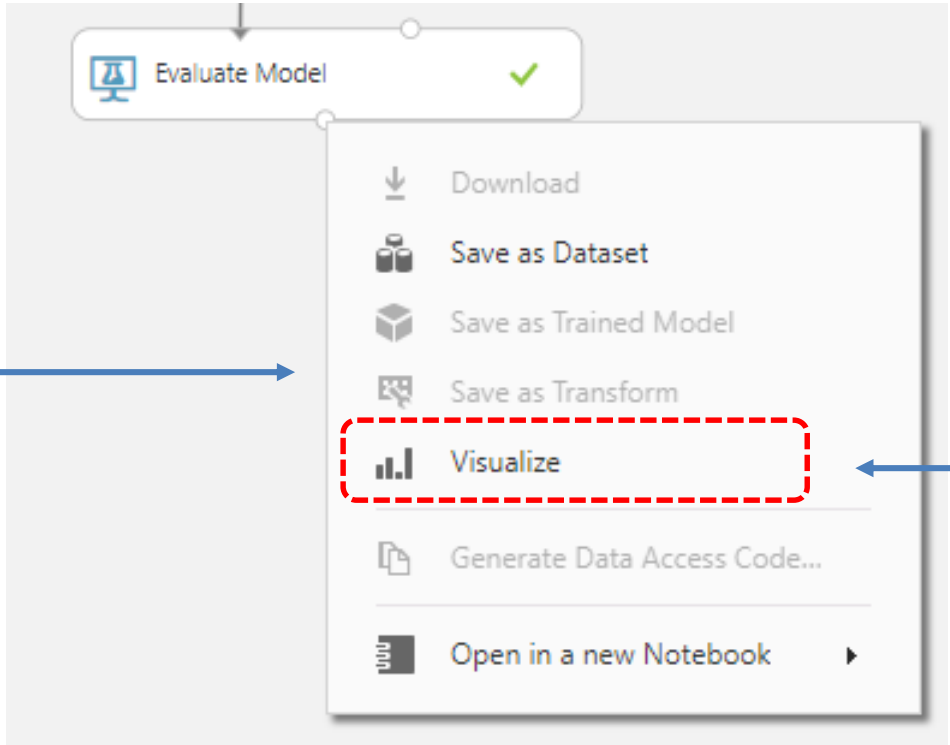
Measure model's performance: Evaluate model



Evaluate model enables to find the performance of the classifier on unseen or test data

Measure model's performance: Evaluate model

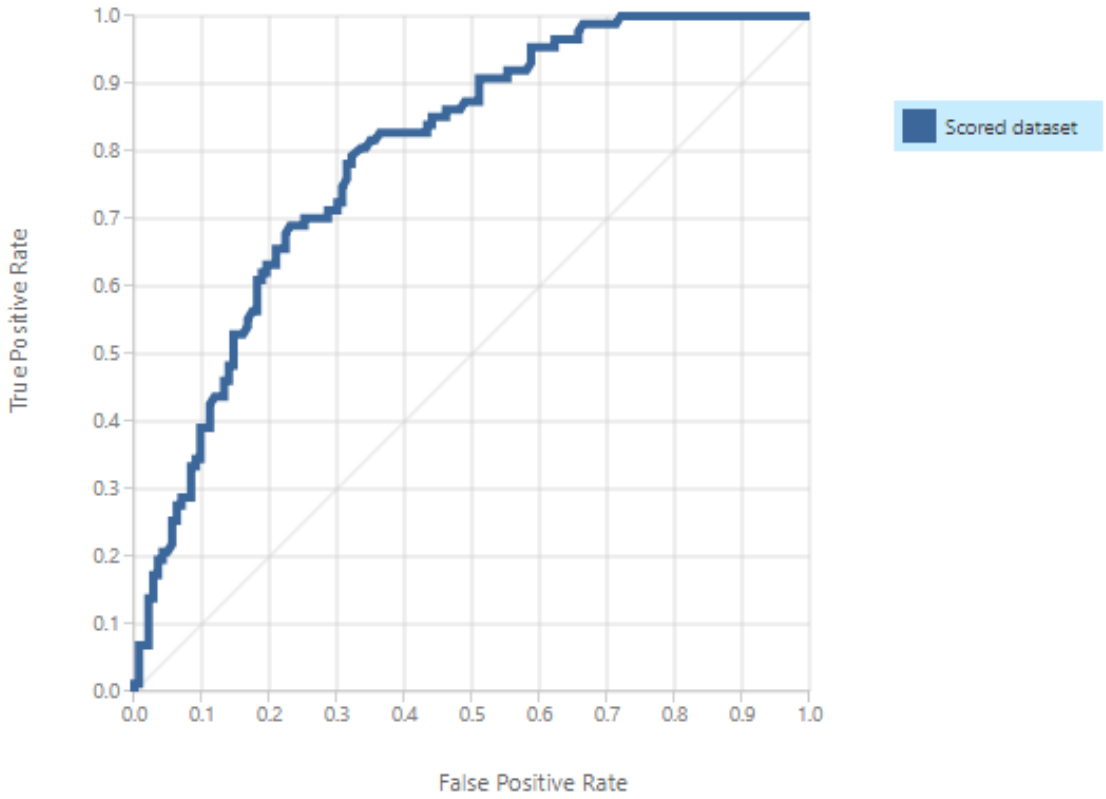
Clicking on output port enables this window to pop up.



Clicking on this opens up evaluation report window

Classification Report

ROC-AUC Curve



Confusion Matrix

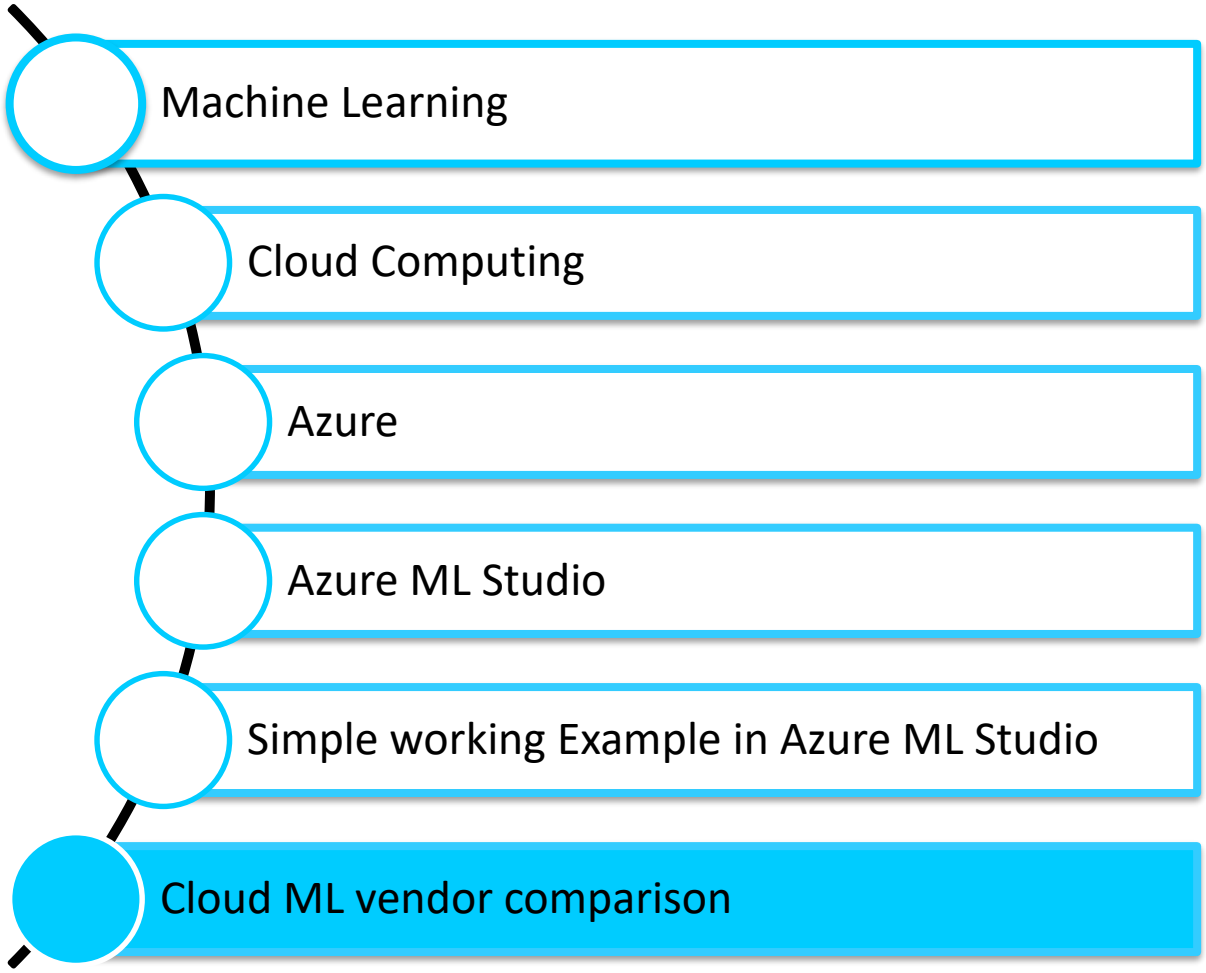
True Positive	False Negative	Accuracy	Precision	Threshold	AUC
38	49	0.704	0.667	0.5	0.794

False Positive	True Negative	Recall	F1 Score
19	124	0.437	0.528

Positive Label	Negative Label
1	0

Summary

I. Machine Learning
II. Cloud Computing
III. ML in Cloud
IV. Azure ML Studio
V. Machine Learning in ML Studio
VI. Differences among different Cloud platforms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5.Cloud Machine Learning Vendor Comparison

	Google cloud ML	Microsoft Azure ML	Amazon ML	IBM Watson ML
Overview	Gives users access to state-of –art algos. Used b Google in search & other industry leading applications . Users can also build their own model	Offers long list of predefined algorithms that users can apply to their data, less automated than other options	Largely automated platform that applies ML algos to data stored in Amazon Web services platform	Most focused on getting models into production through REST API connectors
Interface	Command Line interface using gcloud ml-engine to control TensorFlow process	1. Azure ML studio drag & drop environment 2. Packages for R & Python coding	1.Amazon ML console 2.Amazon Command Line Interface	1. SPSS can be used as a front end 2. API connectors enable users to build models in 3rd party data science applications
Algorithm & Modeling method	1. Video analysis 2. Text Analysis 3. Speech Recognition 4. Translation 5. Image Analysis	1. Boosted Decision Tree 2. Bayesian Recommendation system 3. Decision jungle 4. Deep Neural Network 5. Regression ,classification(binary ,multiclass) 6. Clustering	1. Regression 2. Binary Classification 3. Multi class classification	Users can build their own algorithms in any language through REST API connector. Links Apcahe Spark's Mlib Library are planned via IBM Data Science Experience workbench platform.
Data Location Requirement	Data must be stored & models must be staged in Google storage	Sample data are in Azure ML studio as well as data can be imported from other sources	Data must be in Amazon web service before use in Machine Learning	Data must be stored & models must be staged in IBM Bluemix

Thanks!

Any questions?