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Analysis on Trends of Machine Learning-as-a-Service

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Abstract

Demand is increasing rapidly in recent years than supply to machine learning professionals. To alleviate this gap, user-friendly machine learning software that can be used by non-specialists has emerged, which is Machine Learning-as-a-Service(MLaaS). MLaaS provides services that enable businesses to easily leverage ML capabilities without expertise.

In this paper, we will compare and analyze features, interfaces, supporting programming language, ML framework, and Machine Learning services of MLaaS, to help companies easily use ML service.

Keywords: *AI, Machine Learning, Machine Learning-as-a-Service, MLaaS*

1. Introduction

An unprecedented increase in cloud-based products, including SaaS and IaaS, has introduced Machine Learning-as-a-Service(MLaaS) in the marketplace. The cloud provides a suitable ML platform because it can store large volumes of data easily, has low deployment costs, and has high computing performance. The MLaaS provider uses its own data center to handle calculations and prevent customers from running their own servers or installing their own software[1].

MLaaS provides access to ML tools, which do not require tools or installation because they leverage directly from the cloud. In this paper, we review MLaaS needs and MLaaS providers, and compare various characteristics of MLaaS providers.

2. Machine Learning-as-a-Service

The Machine Learning-as-a-Service(MLaaS) provides tools for data visualization, face recognition, natural language processing, image recognition, predictive analysis and in-depth learning as part of cloud computing services[2].

MLaaS is an automated and semi-automated cloud platforms that cover most infrastructure issues such as data pre-processing, model training, and model evaluation, with further prediction. Prediction results can be bridged with your internal IT infrastructure through REST APIs. MLaaS services that allow for fast model training and deployment with little to no data science expertise[3].

For MLaaS, the provider handles the actual calculations in its own datacenter, and customers do not need

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to install their own software or run their own servers. At first, we provide a free ML service for developers, so we can evaluate the usefulness of the platform.

Most popular machine learning solutions have MLaaS platform services. MLaaS provides lower accessibility than high-performance ML infrastructures.

The MLaaS provider provides development tools that simplify the process of including ML in an application while making it possible to use a proven ML technology solution through a quick and easy machine learning model.

MLaaS supports the deployment and computational performance and high scalability of the ML model as a Web service.

It supports integration with various cloud services from the same provider and enables ML without expertise.

MLaaS continues to provide a cost-effective system for participating in the analysis needed to succeed in a rapidly changing environment.

3. Machine Learning-as-a-Service Providers

3.1 Microsoft Azure Machine Learning Studio

Microsoft Azure Machine Learning Studio(ML Studio) is a powerful yet simple browser-based, visual drag-and-drop authoring environment where no coding is necessary[4].

ML Studio provides scalable machine learning of all sizes. Ideal for both AI beginners and experts, it provides out-of-the-box algorithms and more flexible tools. ML Studio provides a browser-based work environment that uses a visual drag-and-drop mechanism for ease of operation. It is a serverless, code-free intuitive experimentation, deploys web sevices in minutes. It has a wide variety of algorithms with about 100 ways developers can use them.

The Cortana Intelligence Gallery is a community based collection of ML solutions used by data scientists.

Figure 1 shows a screenshot of Microsoft Azure ML Studio.

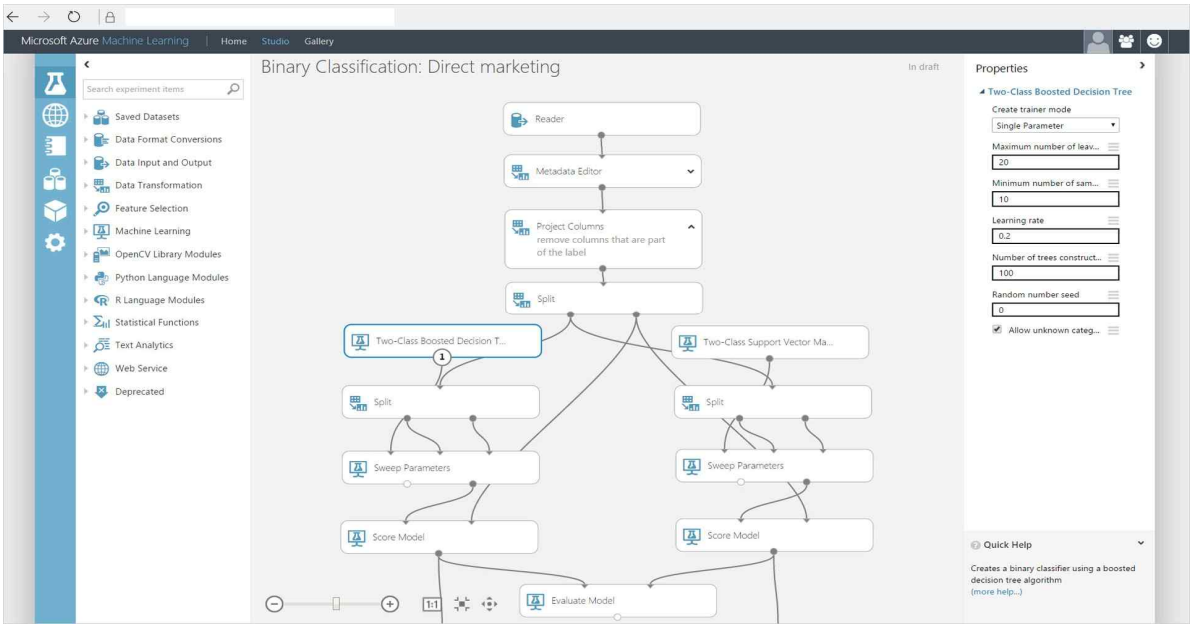

Figure 1. Microsoft Azure ML Studio

3.2 AWS Machine Learning

Amazon Machine Learning is a service that allows users to create ML models without learning complex algorithms[5]. When you create models with visualization tools and wizards, a simple API generates predictions for your application without code generation or infrastructure management.

Amazon Machine Learning has a high level of automation that can load data from multiple sources, including Amazon RDS, Amazon Redshift, and CSV files.

To simplify machine learning for developers and data scientists, AWS now offers Amazon SageMaker, a fully-managed service with sophisticated development, training, and hosting features that lets developers focus on the data science of building, training, and tuning machine learning models without having to worry about infrastructure or system management[6].

3.3 IBM Watson Machine Learning

Watson Machine Learning (Watson ML) is a general service provider that runs on IBM's Bluemix[2]. Watson ML provides a visual modeling tool that helps users quickly identify patterns, gain insights, and make decisions more quickly.

Figure 2 shows a screenshot of IBM Watson Studio.

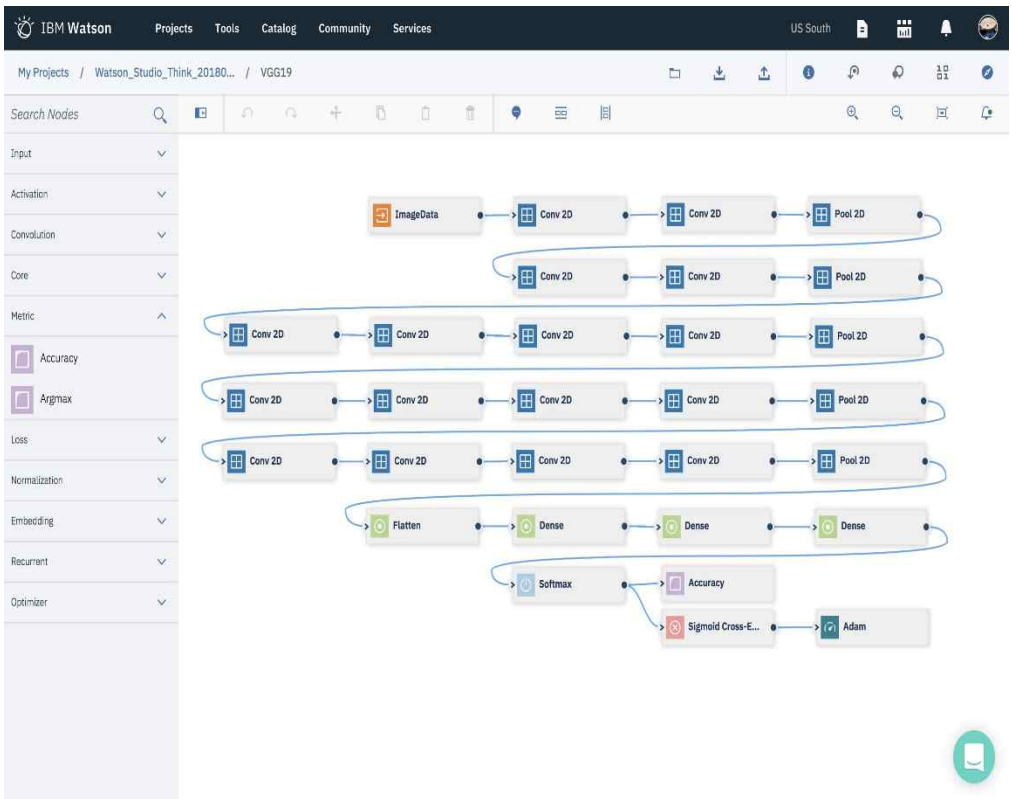

Figure 2. IBM Watson Studio

IBM Watson Studio provides tools for data scientists, application developers and subject matter experts to collaboratively and easily work with data to build and train models at scale[8]. It gives you the flexibility to

build models where your data resides and deploy anywhere in a hybrid environment so you can operationalize data science faster. Watson Studio provides visually program for deep learning with an intuitive drag-and-drop, no-code interface in Neural Network Modeler.

3.4 Google Cloud Machine Learning Engine

Google's Cloud AI services include the Machine Learning Engine, which provides natural language processing and API services for voice, natural language processing, translation, video and image recognition[9].

Google's Cloud Machine Learning Engine provides users with an easy alternative to build ML models for all types or sizes of data.

3.5 BigML

BigML can cross-provider access in MLaaS to import data from any platform, regardless of AWS, MS Azure, Google Storage, Google Drive, Dropbox, etc. BigML's focus on machine learning means that it has more features available that are integrated into its web UI[10].

BigML provides a large gallery of free data sets and models, useful clustering algorithms and visualization, and transform detection.

Figure 3 shows a screenshot of BigML Dashboard.

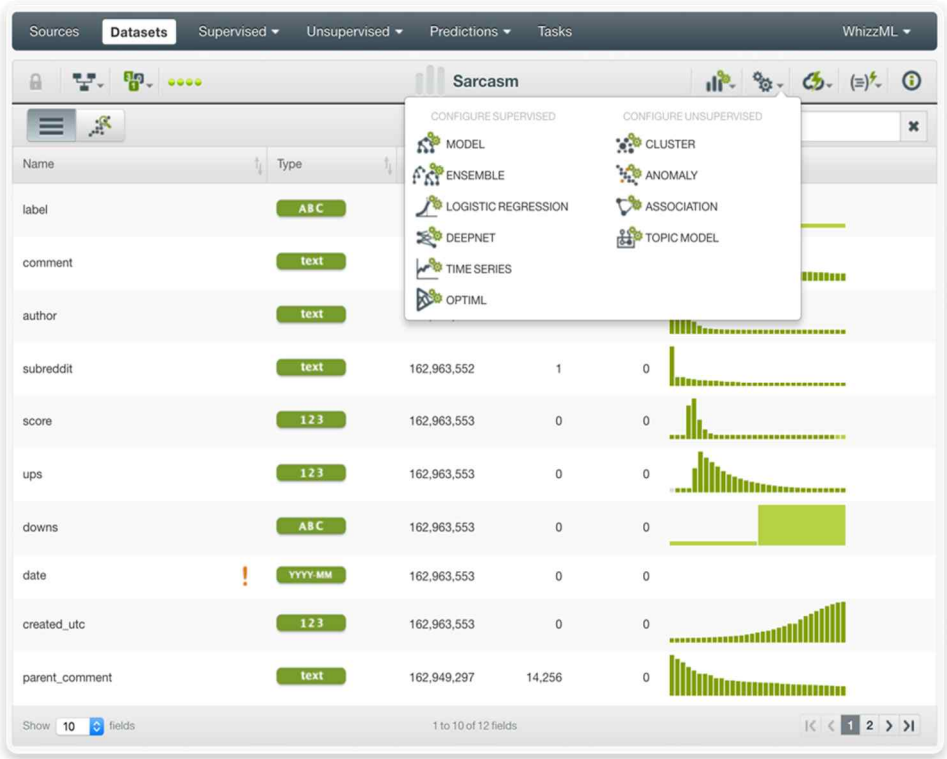

Figure 3. BigML Dashboard

4. MLaaS's Summary Features

In this section we will compare the various attributes of the MLaaS platforms provided by Amazon, Microsoft, IBM, Google, and BigML.

Table 1 shows the comparison of the features and interfaces of MLaaS platforms. Most MLaaS platforms are giving away a certain amount of storage for free for a period of time to highlight their strengths. It also makes it easy to use MLaaS services through a variety of interfaces.

Table 1. MLaaS's Features and Interfaces

Solution Name	Feature	Interface
Microsoft Azure ML Studio	Free workspace(10GB) Free access Predictive web service	ML Studio
AWS Machine Learning	Amazon DynamoDB 25GB Amazon S3 5GB 2 months free trial	SageMaker
IBM Watson Machine Learning	30 day free trial	Watson Studio
Google Cloud ML Engine	Cross-provider access	gcloud (command-line tool)
BigML	Unlimited tasks for datasets up to 16MB for free	Dashboard (point-and-click web interface)

Table 2 shows the programming languages and ML frameworks supported by MLaaS platforms. Most MLaaS platforms support python, and some MLaaS platforms support the REST API, which allows you to use the Web UI. It also shows that it supports various ML frameworks.

Table 2. MLaaS's Programming Languages and ML Frameworks

Solution Name	Programming Language	ML Framework
Microsoft Azure ML Studio	R, Python	Scikit-learn, TensorFlow, Pytorch, other Python-based frameworks
AWS Machine Learning	Python	TensorFlow, PyTorch, Apache MXNet
IBM Watson Machine Learning	R, Python, Scala	Tensorflow, Keras, PyTorch, Caffe
Google Cloud ML Engine	REST API, Python	Scikit-learn, XGBoost, Keras, TensorFlow
BigML	REST API, Python, Node.js, Ruby, Java, Swift	

Table 3 shows that the MLaaS platforms support various Machine Learning Services. It can be seen that it supports various deep-running services and application services.

Table 3. MLaaS's Machine Learning Services

Solution Name	Machine Learning Service
Microsoft Azure ML Studio	Automated machine learning and hyper-parameter tuning,

	Choose any framework or algorithm, Support for popular IDEs, Version control and reproducibility, Model management, Hybrid deployment, Distributed deep learning, Train and deploy with ease
AWS Machine Learning	Forecasting, Image and Video Analysis, Advanced Text Analytics, Document Analysis, Voice, Conversational Agents, Translation, Transcription
IBM Watson Machine Learning	Experiment Assistant, Open and flexible, Elastic GPU compute, Hyperparameter optimization, Neural Network Modeler
Google Cloud ML Engine	Automated resource provisioning, HyperTune, Predictive Analytics
BigML	Classification, Regression, Cluster Analysis, Anomaly Detection, Association Discovery

5. Conclusion

In this paper, we reviewed MLaaS needs and MLaaS providers, and compared various characteristics of MLaaS providers.

MLaaS allows companies without artificial intelligence development capabilities to create and apply artificial intelligence to services. MLaaS will be the cornerstone of AI adoption as it allows companies to leverage ML capabilities easily.

An unprecedented increase in cloud-based products has introduced MLaaS in the marketplace. The cloud provides a suitable ML platform because it can store large volumes of data easily, has low deployment costs, and has high computing performance. The MLaaS provider uses its own data center to handle calculations and prevent customers from running their own servers or installing their own software.

MLaaS provides access to ML tools, which do not require tools or installation because they leverage directly from the cloud.

As the market for AI services grows rapidly and the need for MLaaS solutions grows, I think the review will help us develop MLaaS solutions in the future.

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