Python Data Analytics

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Open Source Analytics, IBM
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Agenda

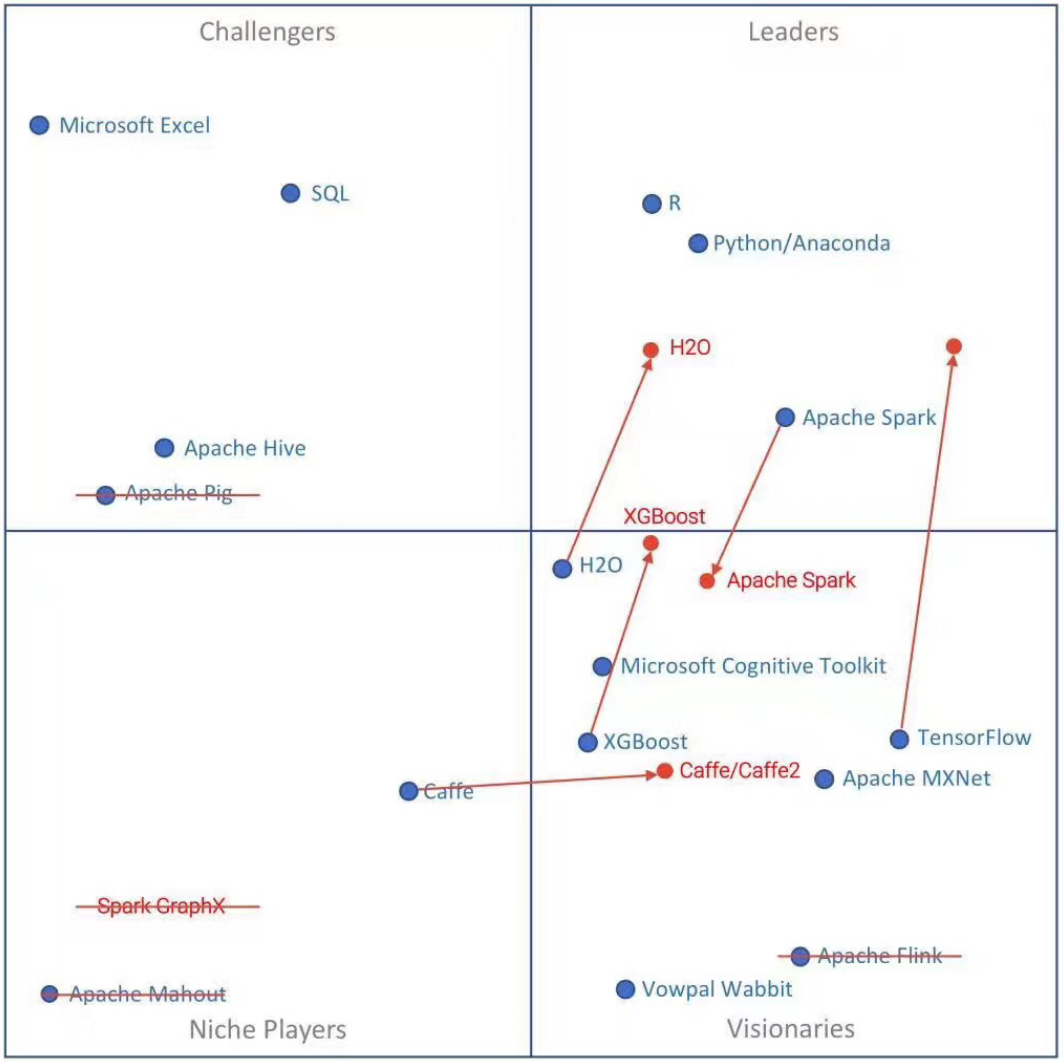
- Introduction
- Data Analysis with Pandas
- Data Visualization with Matplotlib
- Machine Learning with Scikit-learn
- Bonus: Power AI Vision

About me

- Open Source
- Big Data Analytics
- Data Science and Machine Learning
- High Performance Computing

"We have lots of information technology. We just don't have any information."

Data Analytics Magic Quadrant (2018)



What is the most popular programming language nowadays?

Introducing Python

Introducing Python

*"Python is **powerful**... and fast**;** plays well with others; runs everywhere; is **friendly** & easy to learn; is **Open**."*

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

matplotlib

Version 3.1.1

scikit learn

IP[y]:

jupyter

https://www.python.org/

Data Analysis

pandas

$$y_{it} = \beta' x_{it} + \mu_i + \epsilon_{it}$$

- A fast and efficient **DataFrame** object for data manipulation
- **Reading and writing data** : CSV and text files, Microsoft Excel, SQL databases, and the fast HDF5 format
- **Data alignment** and handling of **missing data**
- **Reshaping** and pivoting of data sets
- **Slicing**, **indexing**, and **subsetting** of large data sets
- **Group by**, **merging and joining** of data sets;
- Python with *pandas* is in use in a wide variety of **academic and commercial** domains, including Finance, Neuroscience, Economics, Statistics, Advertising, Web Analytics, and more.

https://pandas.pydata.org/

Data Visualization

- Python 2D plotting library which produces **publication quality** figures
- **Interactive environments** with Python shell, IPython, Jupyter notebook, and web application servers
- Generate plots, histograms, bar charts, scatter plots, etc., with just **a few lines of code**
- **Simple plotting** pyplot module provides a MATLAB-like interface
- **Full control** of line styles, font properties, axes properties

https://matplotlib.org/

Machine Learning

- Most popular machine learning library in Python
- Built on NumPy, SciPy, and matplotlib
- **Classification:** Identifying to which **category** an object belongs to such as spam detection, image recognition
- **Regression:** Predicting a **continuous-valued attribute** associated with an object such as energy consupmption, stock price
- **Clustering:** Automatic **grouping** of similar objects into sets such as customer segmentation and grouping experiment outcome
- **Dimensionality reduction:** Reducing the number of random variables to consider such as visualization, increased efficiency

https://scikit-learn.org/stable/

Lab Setup

Download & Install Anaconda

https://www.anaconda.com/distribution/

Jupyter Notebook

```
In [1]: import this

The Zen of Python, by Tim Peters

Beautiful is better than ugly.
Explicit is better than implicit.
Simple is better than complex.
Complex is better than complicated.
Flat is better than nested.
Sparse is better than dense.
Readability counts.
Special cases aren't special enough to break the rules.
Although practicality beats purity.
Errors should never pass silently.
Unless explicitly silenced.
In the face of ambiguity, refuse the temptation to guess.
There should be one-- and preferably only one --obvious way to do it.
Although that way may not be obvious at first unless you're Dutch.
Now is better than never.
Although never is often better than *right* now.
If the implementation is hard to explain, it's a bad idea.
If the implementation is easy to explain, it may be a good idea.
Namespaces are one honking great idea -- let's do more of those!
```

jupyter RBS-Workshop-Lab 1- Car Price (autosaved)

File Edit View Insert Cell Kernel Widgets Help

Run Markdown

Importing Libraries

```
In [1]: import pandas as pd
        import numpy as np
        import matplotlib.pyplot as plt
        import seaborn as sns
```

Introduction

Data Acquisition

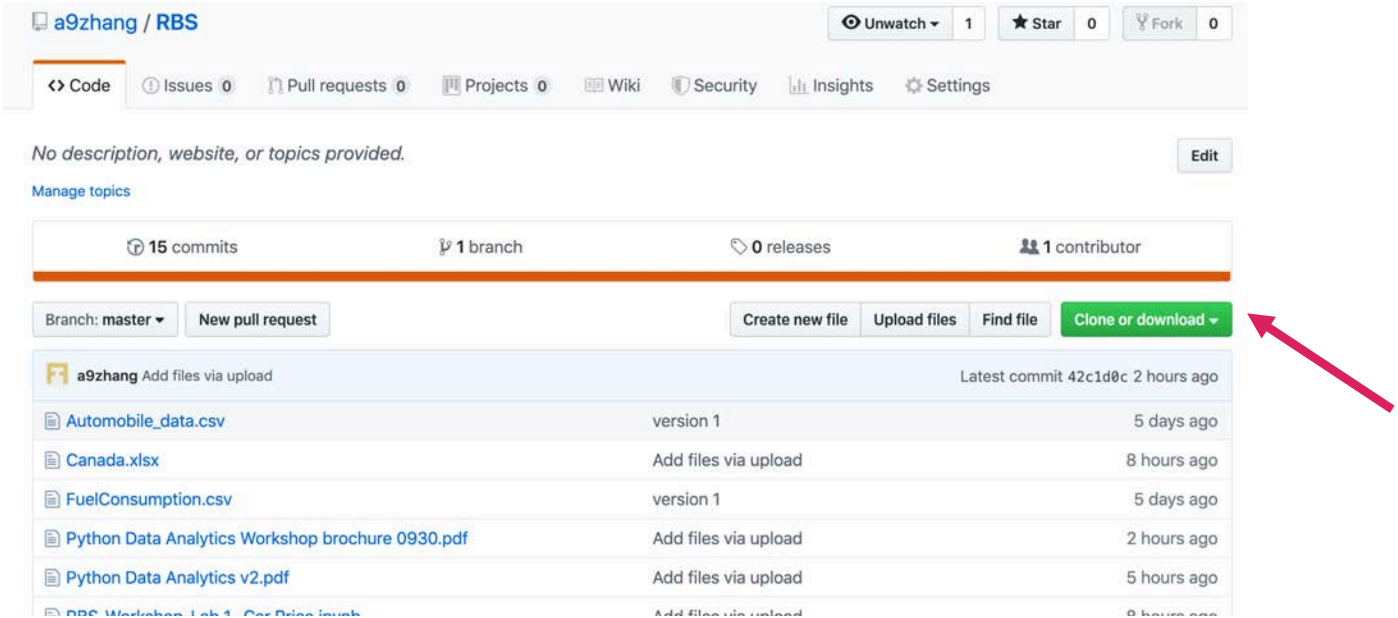
```
In [2]: path = 'https://s3-api.us-geo.objectstorage.softlayer.net/cf-courses-data
        df_1 = pd.read_csv(path)
        df_1.head()
```

Out[2]:

	symboling	normalized-losses	make	aspiration	num-of-doors	body-style	drive-wheels	engine-location	wheel-base	leng

Download and Import Notebooks

https://github.com/a9zhang/RBS



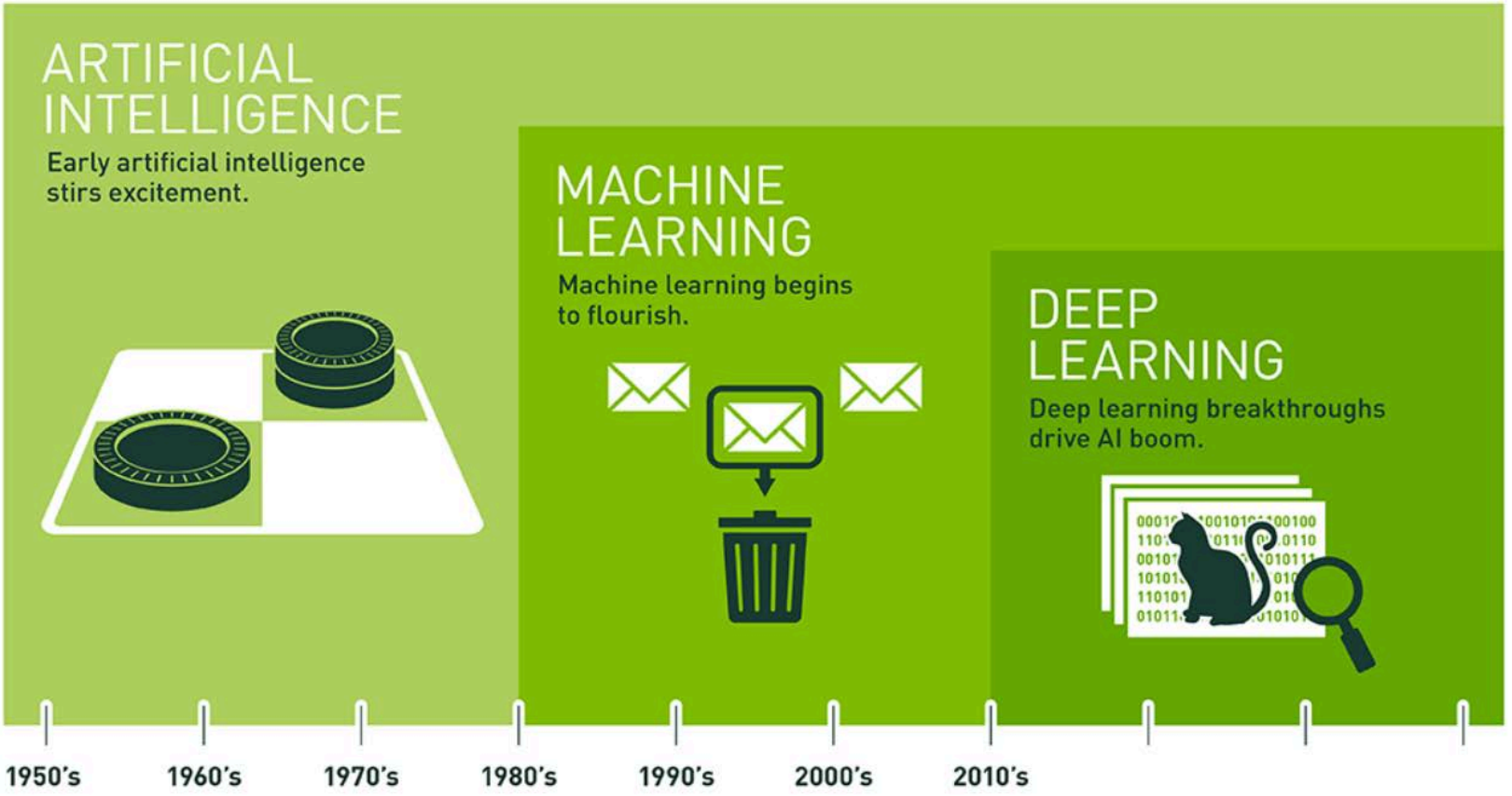
Lab Exercises

Lab Exercises (2 ~ 3 hours)

- **Lab 1: Data Analysis with Pandas**
- **Lab 2: Data Visualization with Matplotlib**
- **Lab3: Machine Learning with Scikit-learn**

Bonus

Machine Learning, Deep Learning and AI



Since an early flush of optimism in the 1950s, smaller subsets of artificial intelligence – first machine learning, then deep learning, a subset of machine learning – have created ever larger disruptions.

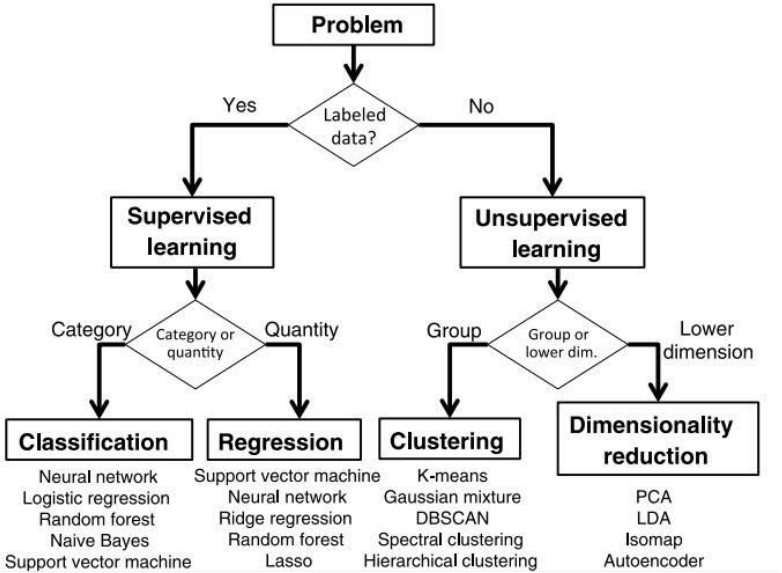
Machine Learning vs Deep Learning

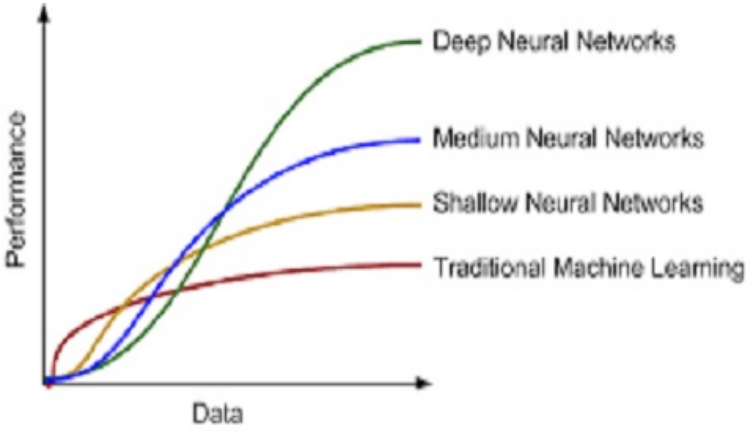
Machine Learning

- Traditional ML requires manual feature extraction/engineering
- Feature extraction for unstructured data is very difficult

Deep Learning

- Deep learning can automatically learn features in data
- Deep learning is largely a "black box" technique, updating learned weights at each layer





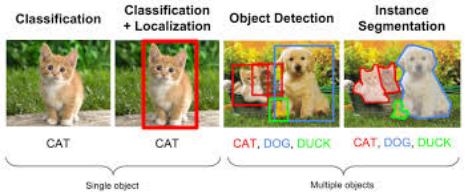
Popular Machine Learning Services

NLP

- Natural Language Processing Services
- Entity Extraction
- Key Phrase Extraction
- Sentiment Analysis
- Syntax Analysis
- Topic Modeling
- Multiple Language Support
- Parts of Speech

Visual Recognition

- Object Detection
- Scene Detection
- Facial Recognition
- Flag In-appropiate Content
- Facial Analysis
- Celebrity Recognition
- Logo Detection
- Text Recognition
- Web Detection
- Landmark Detection
- Dominant Color Detection
- Thumbnail Generation

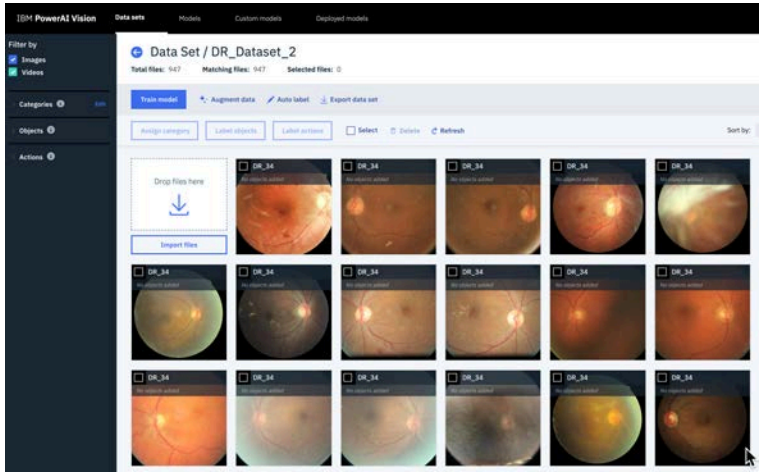


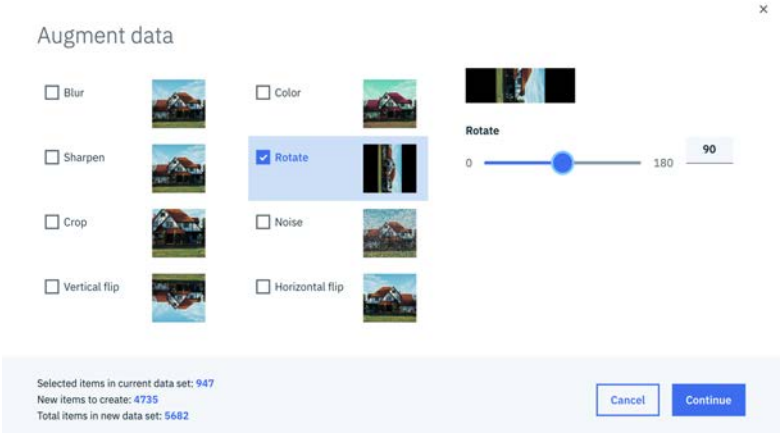
Speech

- SSML
- Multiple Language
- Format
- Automatic Speech Recognition (ASR)
- Noisy Accuracy

[Machine Learning (ML) Services from Various Cloud ML Service Providers]

Diabetic Retinopathy Detection using IBM Power AI Vision





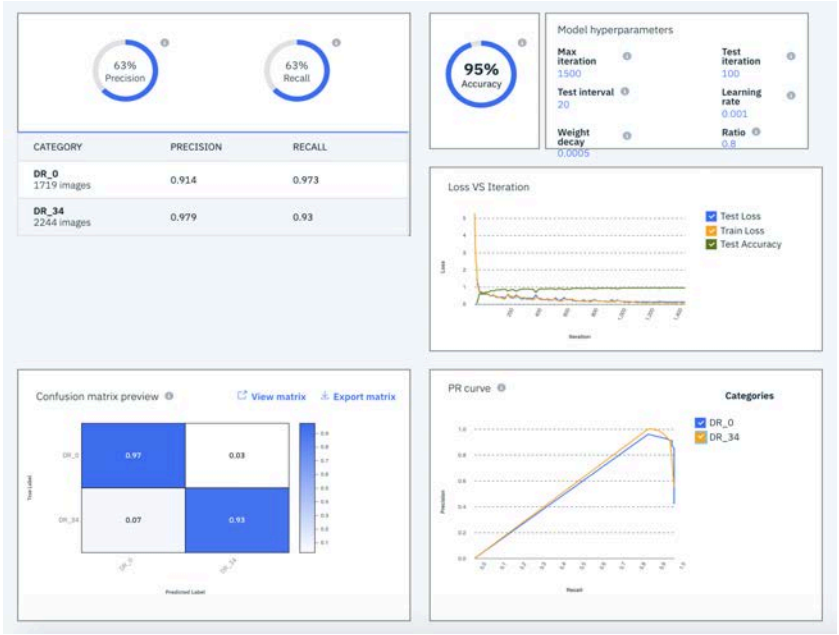
35,000 + images of various classes

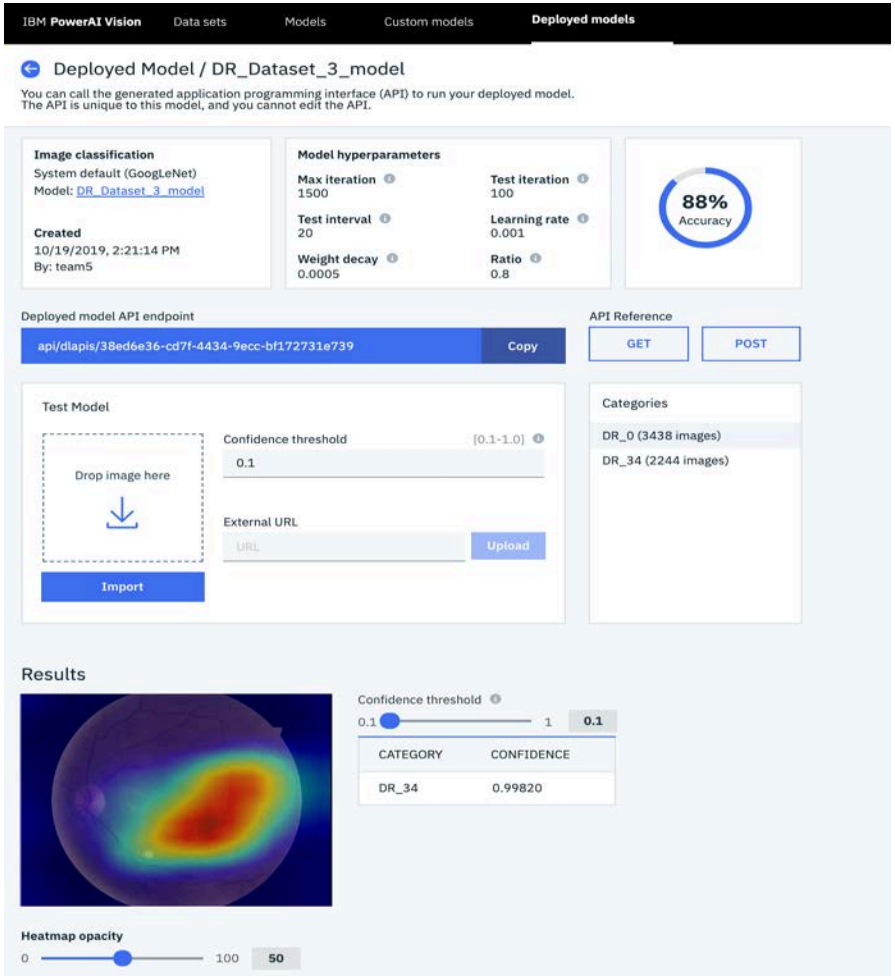
0 - No DR
1 - Mild
2 - Moderate
3 - Severe
4 - Proliferative DR

Data Augmentation – create more data

Resize, Crop, Rotate, Flip, Translation…

Diabetic Retinopathy Detection using Power AI Vision

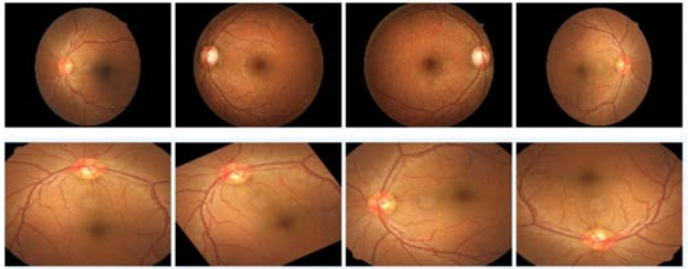




Train machine learning model with high accuracy without coding

Detect new images – DR vs No_DR images with a trained model

Diabetic Retinopathy Detection using Python



Python and Open Source

- **Exploratory Data Analysis**
- **Crop and Resize Images on cloud**
- **Rotate and Mirror Images**
- **Neural Network Architecture**

Metric	Value
Accuracy (Train)	82%
Accuracy (Test)	80%
Precision	88%
Recall	77%

Takeaways

1. It’s never too late to learn a programming language
2. You don’t need to be a coder, but you should understand how coder works
3. Data analytics is not only about data analysis, it is about business decision
4. The future of business intelligence is machine intelligence
5. Business need both data scientists and data analysts to work together
6. Build your first impressive data visualization and machine learning app

Bar Chart Racing in Python ~In roughly less than 50 lines of code

Questions ?

Backup Slides

Why are enterprises struggling to capture the value of AI?

Data

- Data resides in silos & difficult to access
- Unstructured and external data wasn't considered

Governance

- If the data isn't secure, self-service isn't a reality
- Challenge understanding data lineage and getting to a system of truth

Skills

- Data Science skills are in low supply and high demand
- Nurturing new data professionals is challenging

Tools & Infrastructure

- Need an environment that enables a "fail fast" approach
- Discrete tools present barriers to productivity

Watson Studio

Supporting the end-to-end AI workflow

Connect and discover content from multiple data sources in the cloud or on premises. Bring **structured** and **unstructured** data to one toolkit.

Find data (structured, unstructured) and AI assets (e.g., ML/DL models, notebooks, Watson Data Kits) in the **Knowledge Catalog** with intelligent search and giving the right access to the right users.

Clean and prepare your data with **Data Refinery**, a tool to create data preparation pipelines visually.
Use popular open source libraries to prepare unstructured data.

Democratize the creation of ML and DL models. Design your AI models **programmatically** or **visually** with the most popular **open source** and IBM ML/DL frameworks or leverage transfer learning on **pre-trained** models using **Watson tools** to adapt to your business domain. Train at scale on **GPUs** and **distributed** compute

Deploy your models easily and have them **scale automatically** for online, batch or streaming use cases

Monitor the performance of the models in production and trigger automatic retraining and redeployment of models. Build **Enterprise Trust** with Bias Detection, Mitigation Model **Robustness** and Testing Service Model **Security**.

Watson Studio

Comprehensive set of tools for the end-to-end AI workflow

- Create, collaborate, deploy, and monitor
- Best of breed open source & IBM tools
- Code (R, Python or Scala) and no-code/visual modeling tools

- Most popular open source frameworks
- IBM best-in-class frameworks

- Fully managed service
- Container-based resource management
- Elastic pay as you go CPU/GPU power