common
EUROPE LUXEMBOURG
Modernisation des Applications IBM i & Open Source
(webinaire)
Jeudi 25 mars – 14h00 – 17h00

Smarter IBM i Applications Made Easy with AI

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for Business

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Agenda

Introduction to AI & Machine Learning

Solutions on IBM i
Free Open Source, AutoML, API's, POWER9 and POWER10

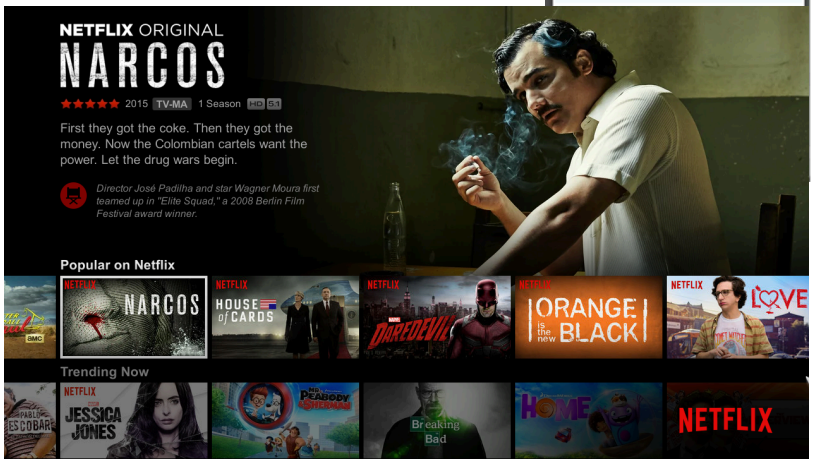
How to get started?
Online Demos, code & materials

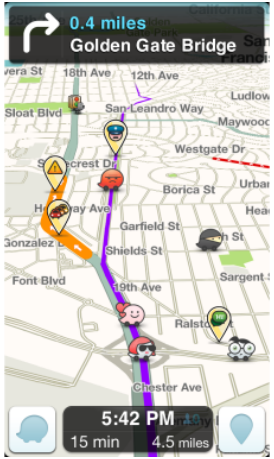
for Business

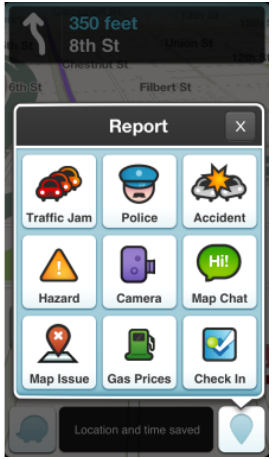
AI & Machine Learning ?

Machine learning is everywhere – influencing nearly everything we do

Netflix provides personalized movie recommendations





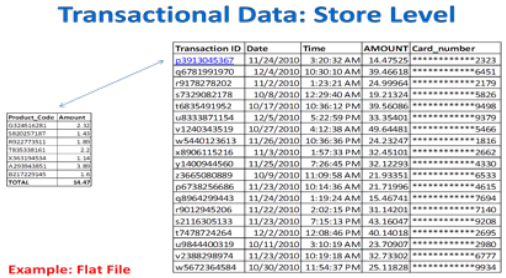


Waze provides a personalized driving experience for its users

The future is now … on IBM i

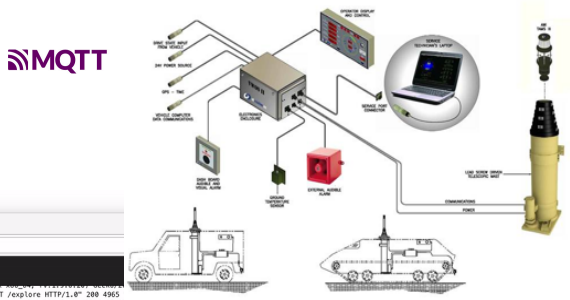
Images

Transactional

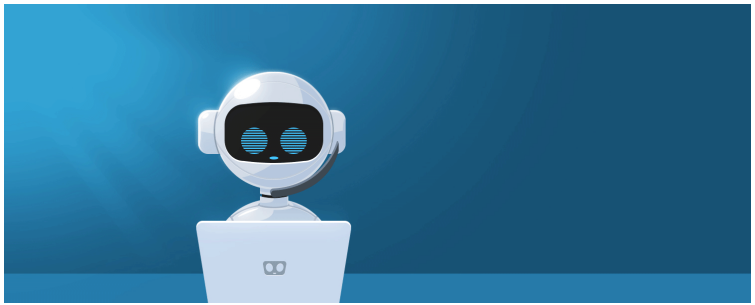


Machine Learning and AI are everywhere

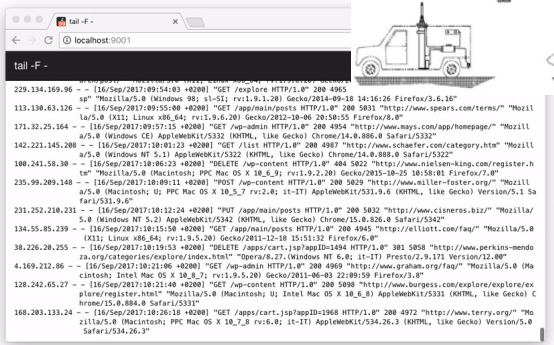
Sensors



Conversation

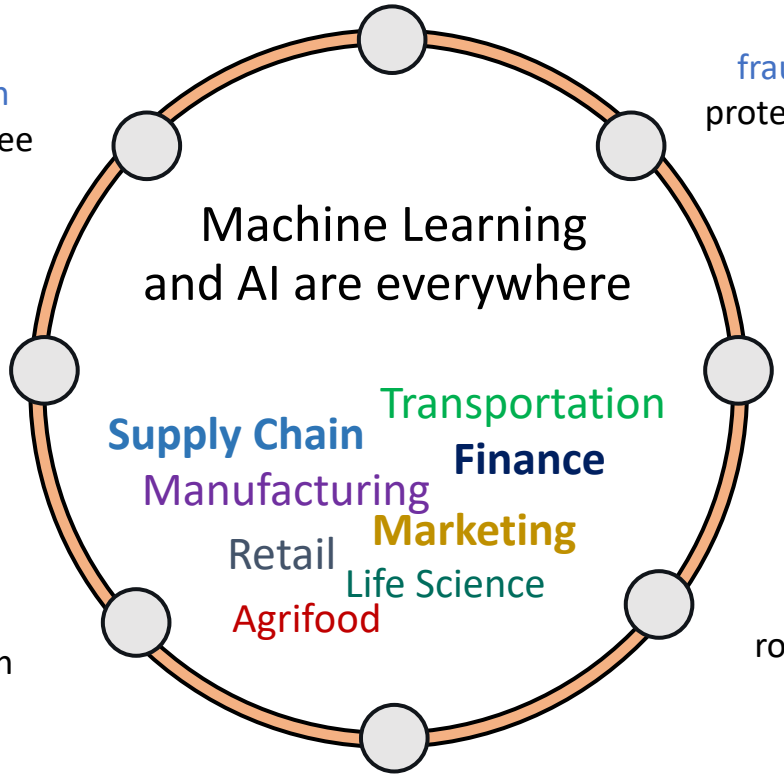


Log



for Business

The future is now … on IBM i



supply chain
operational efficiency

fraud detection
protects your credit

recommendations
help you shop faster

chat bots
route calls quicker

retail
sentiment analysis,
customer churn prediction

machine vision
visual recognition

predictive maintenance
detect anomalies

speech recognition
lets you go hands-free

Why augmenting my apps with AI ?

Decision Optimization

Event / Pattern detection (images, structured data), Classification, customer segmentation. Decision Optimization: do more with less, make better decisions, better address my customers , etc. From a simple (but smart) dashboard to complex fraud detection

Augmentation/ Automation

- Repetitive tasks and time-consuming analysis based on images, cases with constrained access… Ex: A doctor could spend hundreds of hours per week to read new studies & publications
- Enhance user experience by exposing new user interfaces - image, voice, text, Ex: Chabot (Natural Language Processing)

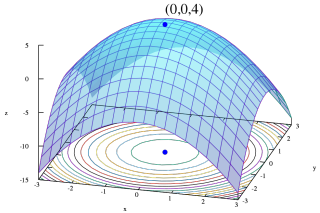
AI is necessary when dealing with complex situations, where rules can’t easily be coded with if-then-else.

Why augmenting my apps with AI ?

UX / Personalization

Business Processes Optimization

Do more with less



Gain competitive edge & Grow your Revenue

Why augmenting IBM i apps with AI ?

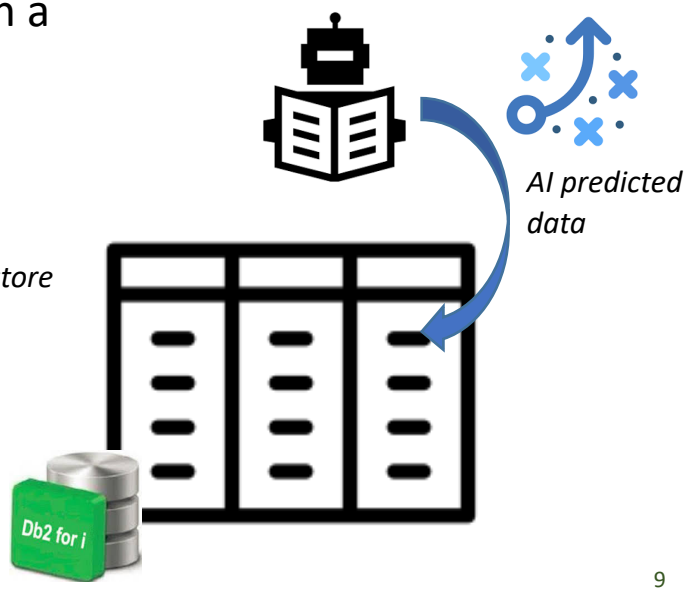
- Close relationship between AI , and “core business” data and applications. AI requires Data. *Data is the new Oil*

- IBM i : Platform of choice for hosting critical apps and data

→locate AI models and mission-critical applications on a reliable & secure system.

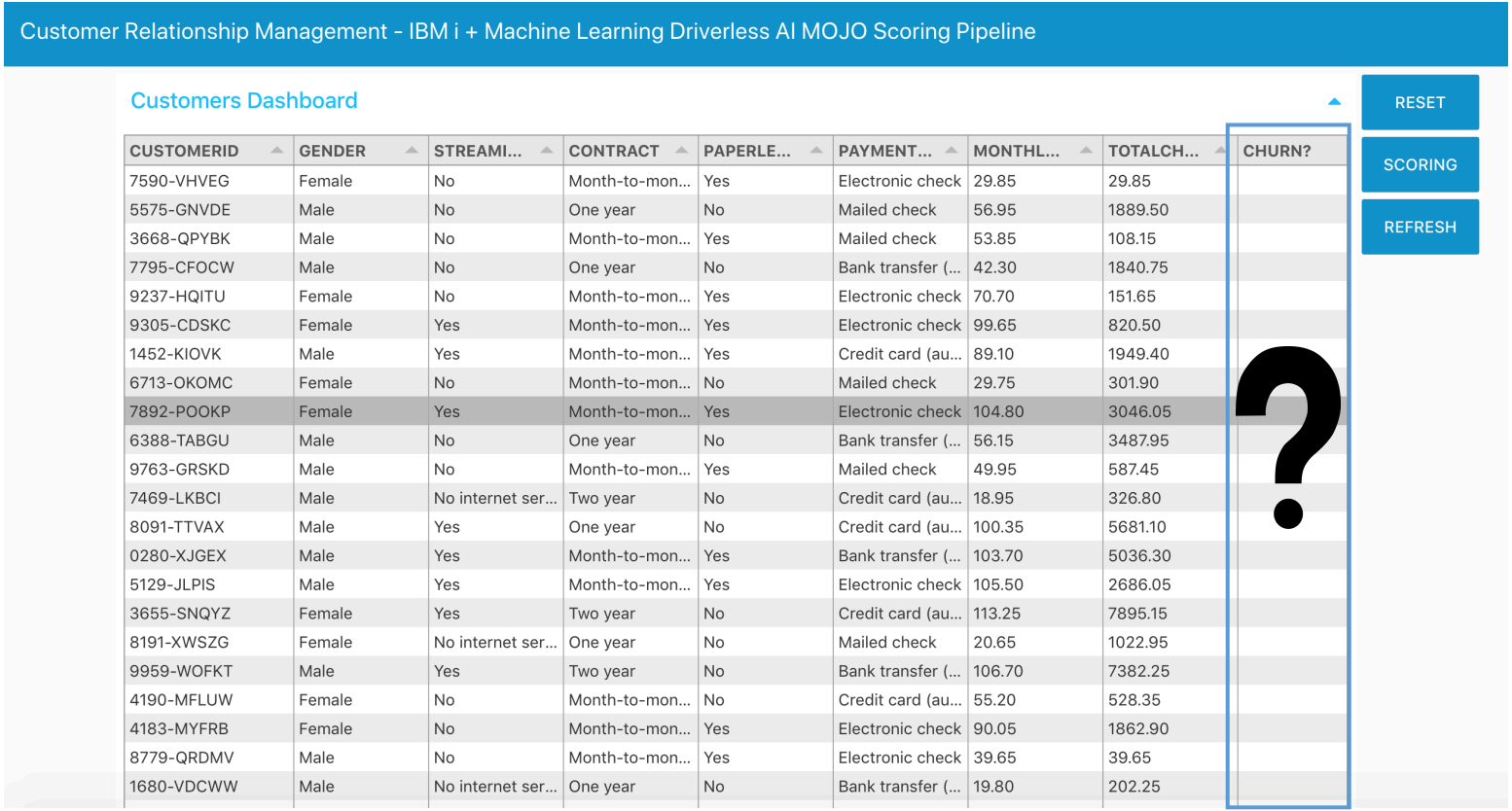
- IBM i & AI cases and customer stories

  → Turnover Optimization - *The good product at the good store*
  → Fraud Detection – *transactional data at work*
  → Predictive Maintenance – *based on IoT data*
  → Harvest Prediction - *per land parcel in Tons*
  → Customer Churn prediction – *augmented CRM*
  → Chatbot – *helpdesk, customer support*



Example: Customer Churn

CRM & Customer Churn scenario

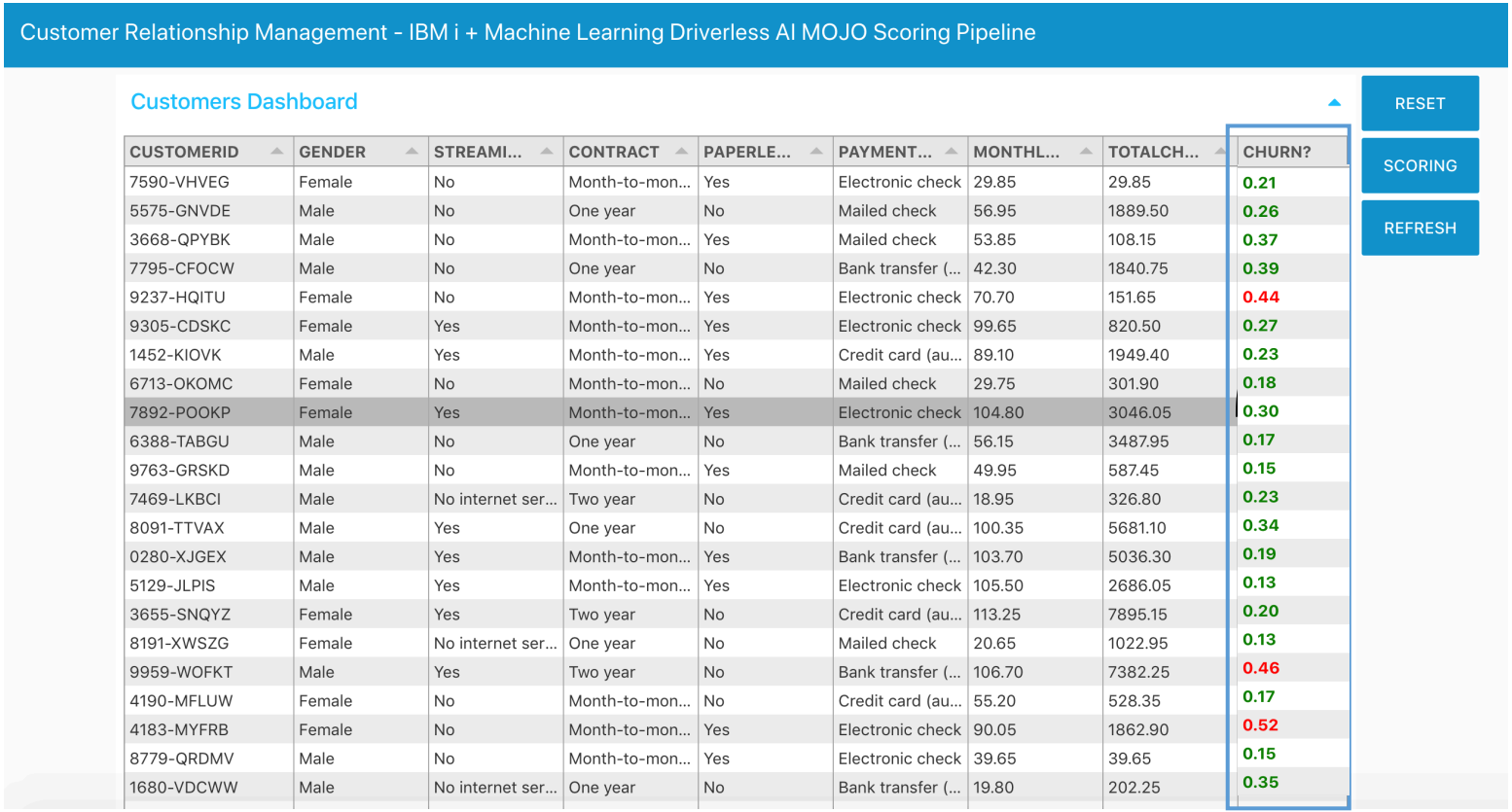


Initial CRM

No Customer Churn risk estimate per customer

Example: Customer Churn

CRM & Customer Churn scenario



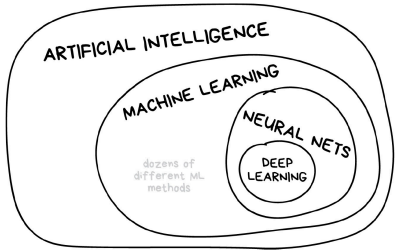
CUSTOMERID	GENDER	STREAMI...	CONTRACT	PAPERLE...	PAYMENT...	MONTHL...	TOTALCH...	CHURN?
7590-VHVEG	Female	No	Month-to-mon...	Yes	Electronic check	29.85	29.85	0.21
5575-GNVDE	Male	No	One year	No	Mailed check	56.95	1889.50	0.26
3668-QPYBK	Male	No	Month-to-mon...	Yes	Mailed check	53.85	108.15	0.37
7795-CFOCW	Male	No	One year	No	Bank transfer (...	42.30	1840.75	0.39
9237-HQITU	Female	No	Month-to-mon...	Yes	Electronic check	70.70	151.65	0.44
9305-CDSKC	Female	Yes	Month-to-mon...	Yes	Electronic check	99.65	820.50	0.27
1452-KIOVK	Male	Yes	Month-to-mon...	Yes	Credit card (au...	89.10	1949.40	0.23
6713-OKOMC	Female	No	Month-to-mon...	No	Mailed check	29.75	301.90	0.18
7892-POOKP	Female	Yes	Month-to-mon...	Yes	Electronic check	104.80	3046.05	0.30
6388-TABGU	Male	No	One year	No	Bank transfer (...	56.15	3487.95	0.17
9763-GRSKD	Male	No	Month-to-mon...	Yes	Mailed check	49.95	587.45	0.15
7469-LKBCI	Male	No internet ser...	Two year	No	Credit card (au...	18.95	326.80	0.23
8091-TTVAX	Male	Yes	One year	No	Credit card (au...	100.35	5681.10	0.34
0280-XJGEX	Male	Yes	Month-to-mon...	Yes	Bank transfer (...	103.70	5036.30	0.19
5129-JLPIS	Male	Yes	Month-to-mon...	Yes	Electronic check	105.50	2686.05	0.13
3655-SNQYZ	Female	Yes	Two year	No	Credit card (au...	113.25	7895.15	0.20
8191-XWSZG	Female	No internet ser...	One year	No	Mailed check	20.65	1022.95	0.13
9959-WOFKT	Male	Yes	Two year	No	Bank transfer (...	106.70	7382.25	0.46
4190-MFLUW	Female	No	Month-to-mon...	No	Credit card (au...	55.20	528.35	0.17
4183-MYFRB	Female	No	Month-to-mon...	Yes	Electronic check	90.05	1862.90	0.52
8779-QRDMV	Male	No	Month-to-mon...	Yes	Electronic check	39.65	39.65	0.15
1680-VDCWW	Male	No internet ser...	One year	No	Bank transfer (...	19.80	202.25	0.35

Augmented CRM with AI

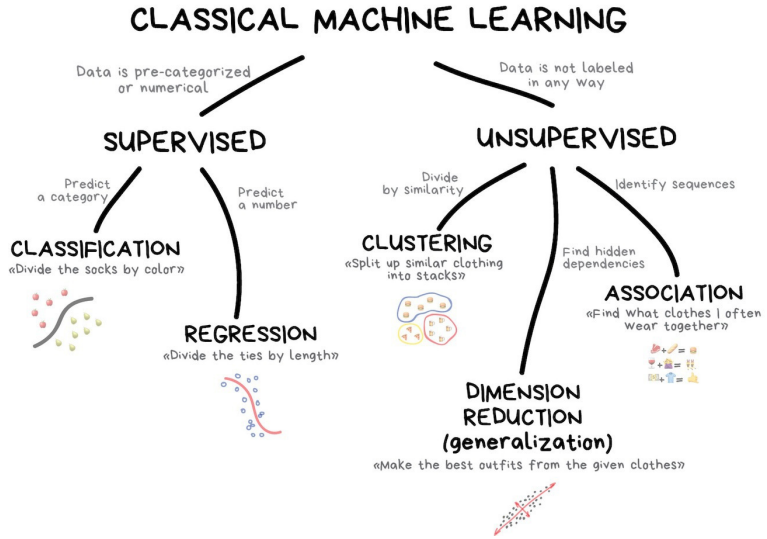
including Customer Churn risk estimate

Machine Learning 101

Machine Learning



- Born in the 1950's , ML relies on computing power, mathematics libraries and Data
- Learns from data, no explicit programming
- Establishes causation relationships in the data by 'observing' a phenomenon
- Data knowledge & expertise are necessary



Machine Learning

Mathematical Function

$f(x)$

- Credit card transaction
- Loan application
- MRI image
- House data

- Fraudulent vs. legitimate
- Approve vs. reject
- Tumor benign vs. malignant
- House appraisal value

- Representing pattern by a mathematical function
- Machine learning is just a bunch of math

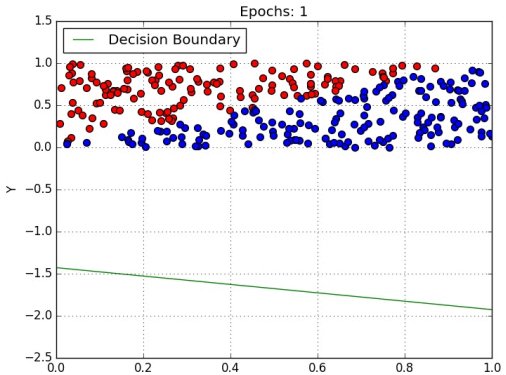
Machine Learning

Loan Application Example

Feature	Feature	Feature	Feature	Label (values to predict in the future)
Loan Requested	Income	Own House	Outstanding Debt	Decision
$20,000	$100,000	Y	0	Approve
$50,000	$70,000	N	$20,000	Reject
$5,000	$150,000	Y	$10,000	Approve
…	…	…	…	…

$$\begin{matrix} x_1 \\ x_2 \\ x_3 \\ \dots \\ x_n \end{matrix} \begin{bmatrix} x_{11} & x_{12} & x_{13} & x_{14} \\ x_{21} & x_{22} & x_{23} & x_{24} \\ x_{31} & x_{32} & x_{33} & x_{34} \\ \dots & \dots & \dots & \dots \\ x_{n1} & x_{n2} & x_{n3} & x_{n4} \end{bmatrix} \qquad \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \dots \\ y_n \end{bmatrix}$$

X Y

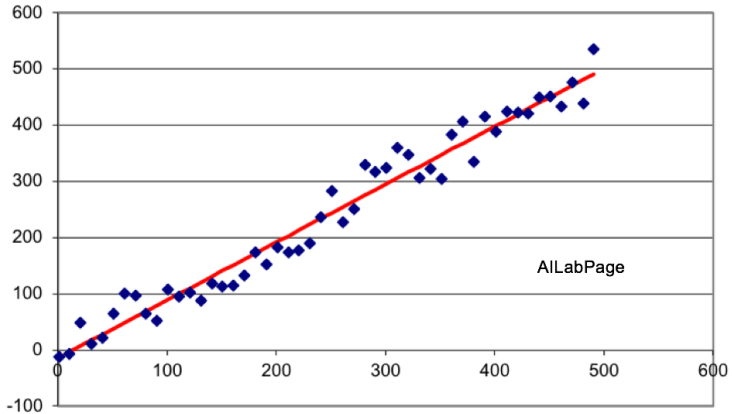


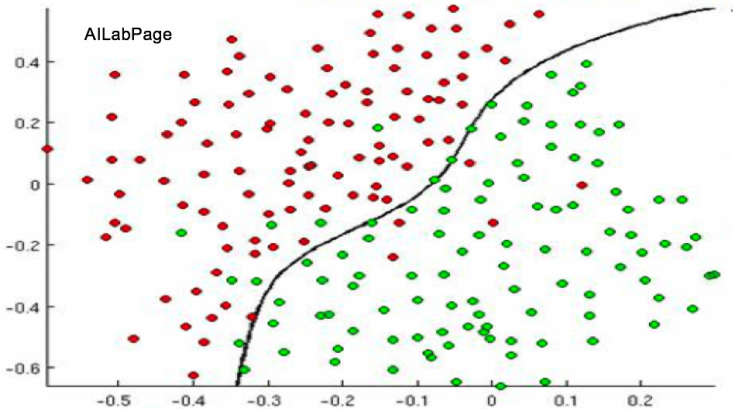
AI Model training (Classification)

→ **Learn from your data without explicitly coding the rules & relationships between X (features) and the decision Y**

→ **Once trained, the optimal parameters (here, A and B matrices) are fixed and materialize the model (function f).**

Machine Learning





Regression

The system attempts to predict a value for an input based on past data.

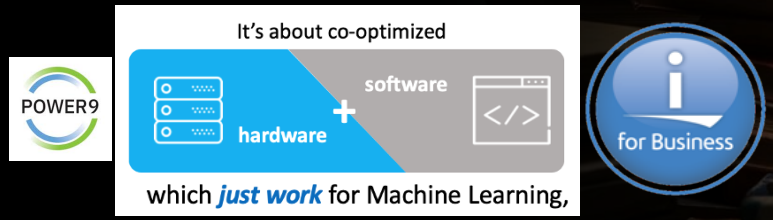
Example – 1. Temperature for tomorrow

Classification

In classification, predictions are made by classifying them into different categories.

Example – 1. Type of cancer 2. Cancer Y/N

AI Solutions on IBM i



AI Tooling trends

1. Ready to Use – simple customization

Possible model re-training with your own data. (specialization)

Ex: Integration w/ Watson API (Chatbot , Image Processing, Text Processing etc.)

2. Auto ML

Bespoke accelerated modeling. Chargeable Licensed products

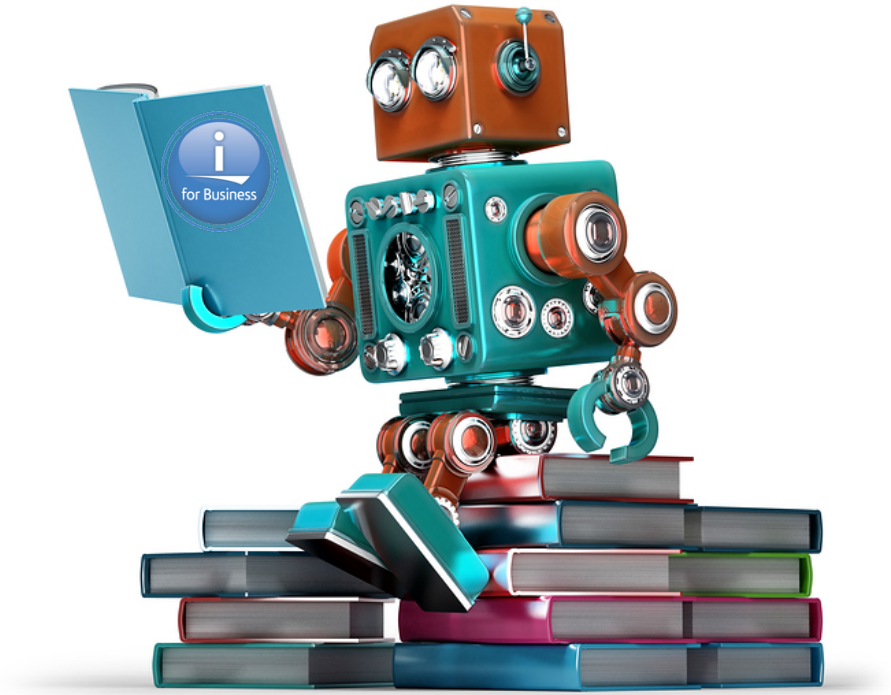
- H2O Driverless AI, SAS Viya, …
- Cloud Pak for Data: IBM Watson Studio & AutoAI / CLPEX Optimization Studio

3. AI Libraries

Bespoke models, total control, free or licensed products.

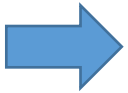
- ML/DL : **Scikit learn, R**, Rstudio, H2O-3 , PyTorch, TensorFlow, Caffe , **Chainer** …
- Apache Spark, Nvidia CUDA, KubeFlow, IBM Snap ML, Appliances (Nvidia, IBM AC922…), OpenCE, etc.

Relax…All you need is available on IBM i !



AI Applications on IBM i

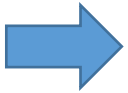
Dashboard (Web Query…) with additional insight ,
Augmented ERP, CRM, or Core business applications, etc.



1. Ready to Use – simple customization

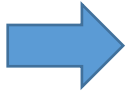
Ex: Watson Conversation/Translation REST API integrated with ILE/PASE/Db2

Training in the Cloud (IBM Cloud PaaS or Private with Cloud Pak for Data)



2. AI Libraries & tools in PASE

PASE Libraries : **Scikit learn, R**, **NLTK** , etc.



3. Assisted ML : Auto ML

Ex: AutoML models running (inference) in PASE (Scikit learn auto-sklearn etc)

H2O Driverless AI Scoring Pipeline running in PASE (Java, Python) / Db2 Java UDF

Inference: PASE ←→ ILE Integration

Training in PASE or offloaded on Linux/other Clouds.

IBM Solutions : AI/ML/DL

AutoML
Multi-Cloud (Private/Public)

AutoML "Data Scientist in a Box"
Training on Linux , Scoring on AIX/IBM i !

Free Open Source on IBM i /AIX

Data Engineer

Structured Data
Tabular data: IoT/Logs/Database
Acceleration & **AutoML** with Driverless AI

WML
All use cases
Program your models w/ Open source
& **Accelerated** HW . Scale w/o limit

Vision/Acoustic
Retail/Inspection
/Security, Quality...

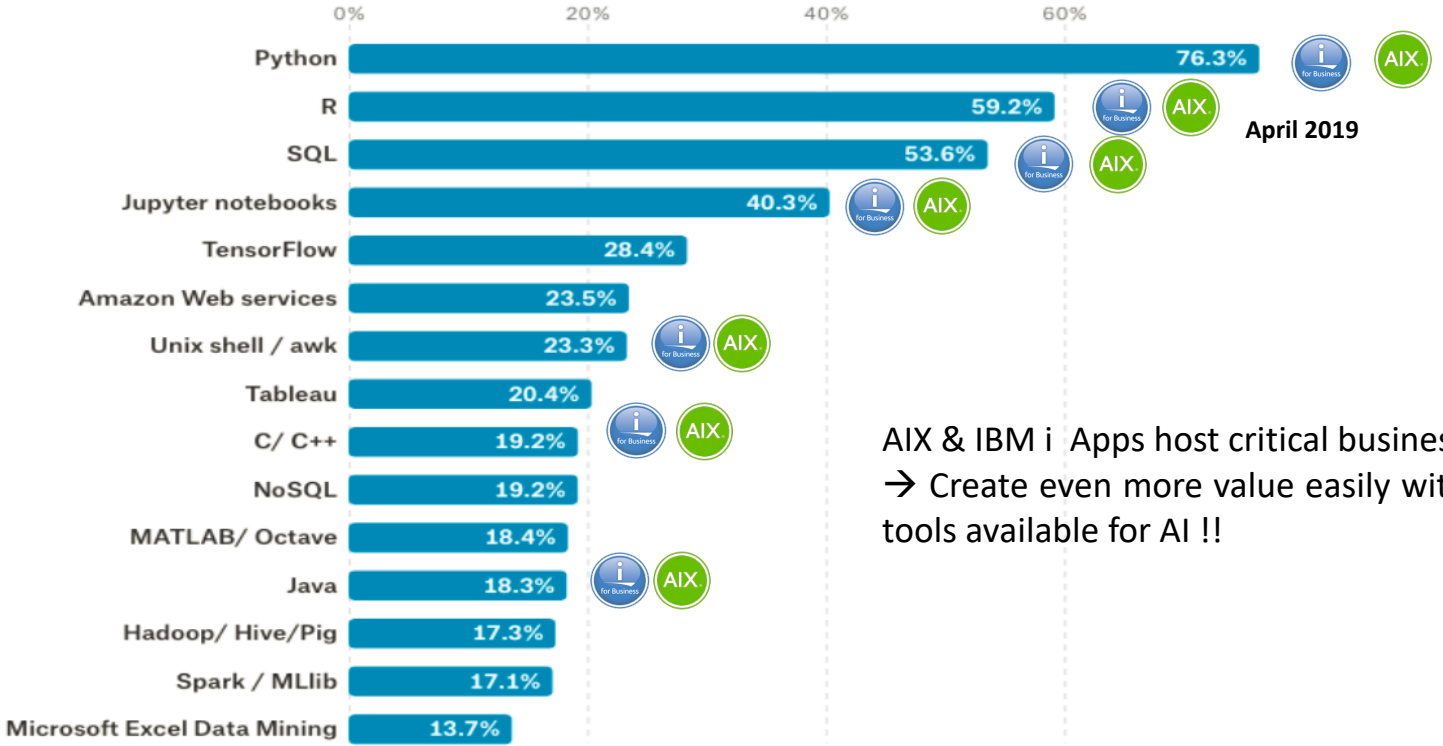
WML
All use cases
AI Cockpit
AutoML

	Open Source Libraries AIX / IBM i	H2O.ai Driverless AI	Open-CE	WML-A	Visual Insights	WML Studio
Description	ML on IBM i /AIX No GPU, runs on CPUs Traditional datasets, Relevant for Model **Inference** (production) Enrichable with Watson Services	Auto Machine learning Simplified deployment,, automatic pipelines, model "explainability", end to end automation **Inference:**	Free, Easy to install High Performance DL LMS (Large Model) DDL (Distributed) TensorFlow PYTORCH Chainer	Enterprise Solution for Deep Learning – Advanced Features : DDL 4+ Nodes... HPC Job Scheduler	Ready to use Deep Learning with Video tools Train/Infer/Edge	Collaborative ML/DL WML dev & deployment AutoAI Use WMLCE if installed Can Use WML-A plugin
Support	**Avaialable from IBM**	**H2O L 1-3**	**Available from IBM**	**IBM L 1-3 Included**	**IBM L1-3 Included**	**Available from IBM**
Environments Server Technologies	**AIX , IBM i, Linux**	**x86, IC/AC922, LC9xx**	**x86/AC922/ IC922**	**x86/AC922/ IC922**	**x86/AC922/ IC922**	**x86/AC922/ IC922**

AI technologies available on IBM i

What tools do you use for AI & Analytics projects ?

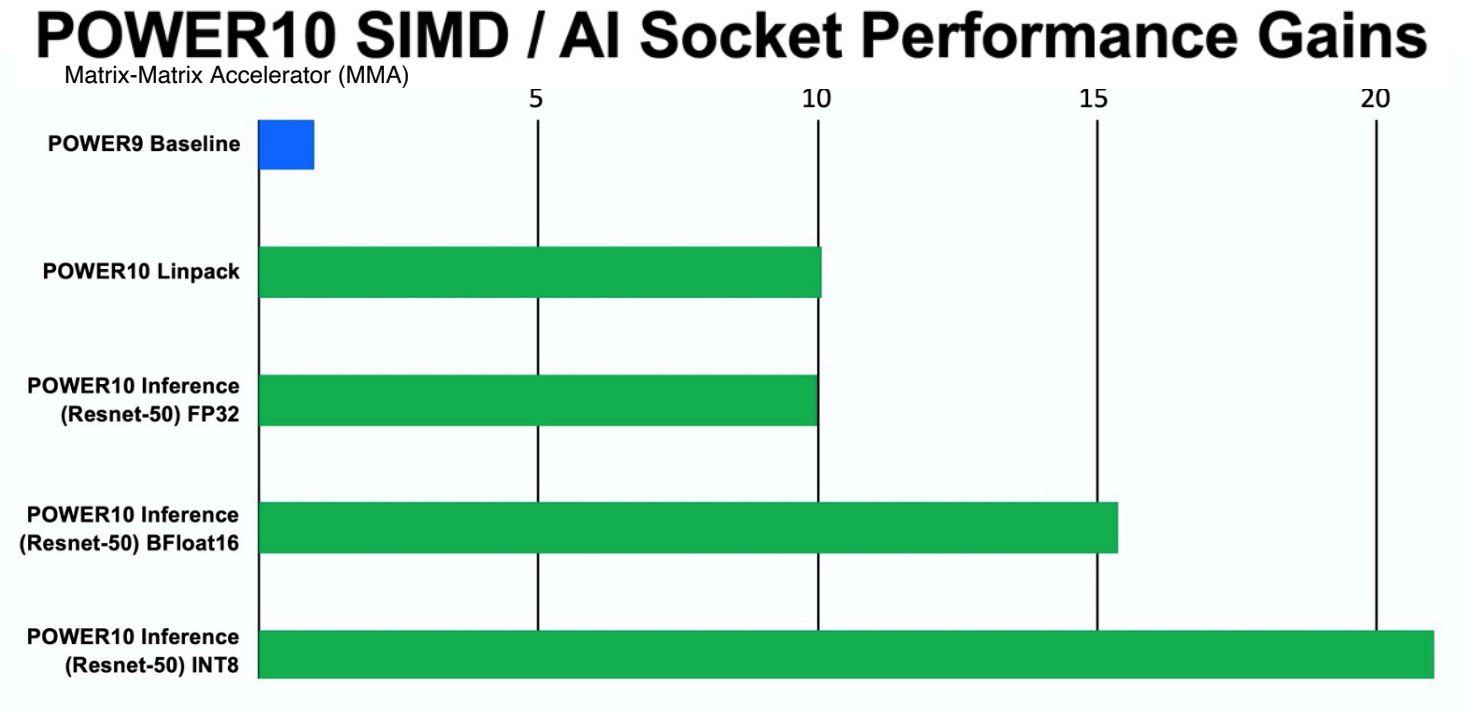
AI - Kaggle Survey results 2017



AIX & IBM i Apps host critical business data

→ Create even more value easily with Open Source tools available for AI !!

Analytics, AI & IBM Systems: What's next after POWER9?



→ AI Infusion into Enterprise Databases (Oracle, SAP, DB2)

→ AutoAI & Advanced Analytics : H2O, SAS Viya, IBM Cloud Pak for Data

AI Applications on IBM i

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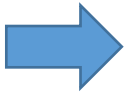
Augmented ERP, CRM, or Core business applications, etc.



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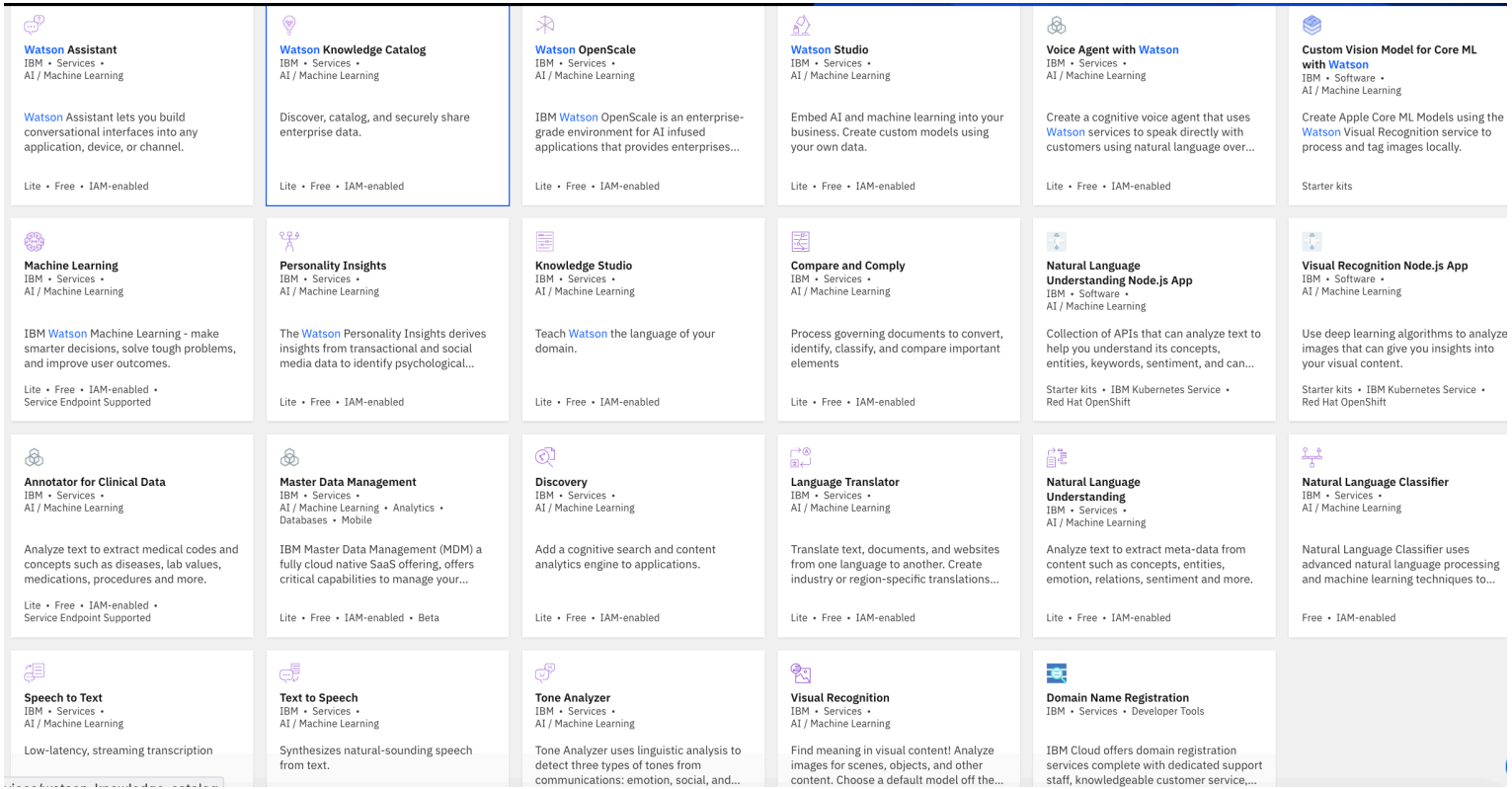
Training in PASE or offloaded on Linux/other Clouds.

1_ AI Model consumption – IBM Watson API Example

- NLP, translation, tonality
- Documents (annotations..)
- images
- Voice

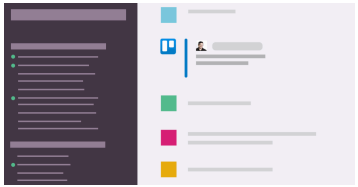
Integration via REST API or via Db2 for I data connector

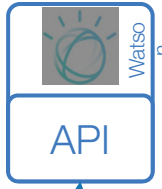
Available on any Cloud (AWS, IBM, Azure, On Premise…)

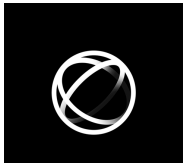


1_ AI Model consumption – IBM Watson API Example

Chabot (Assistant) on IBM i

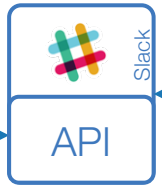




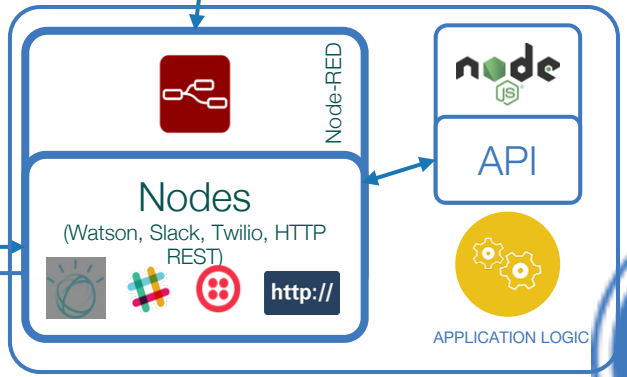


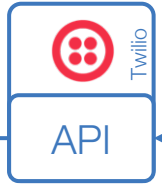
CONVERSATION

[understands natural-language and responds in human-like conversation]



Slack [Communicate with user]



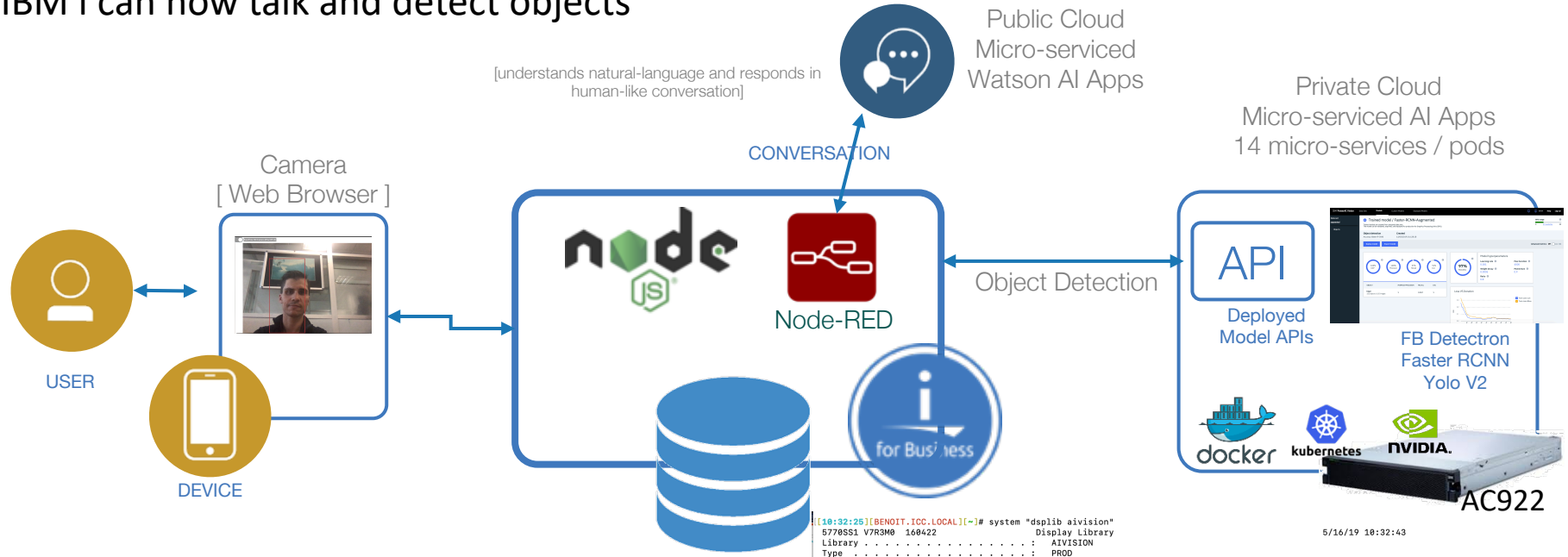


[Text Authentication Code]

- ✓ **Scenarios: support Helpdesk, etc.**
- ✓ **Watson understands your need (intents) & triggers Actions that can interract with your ERP or CRM or any applications**

1_ AI Model consumption – IBM Watson API Example

IBM i can now talk and detect objects

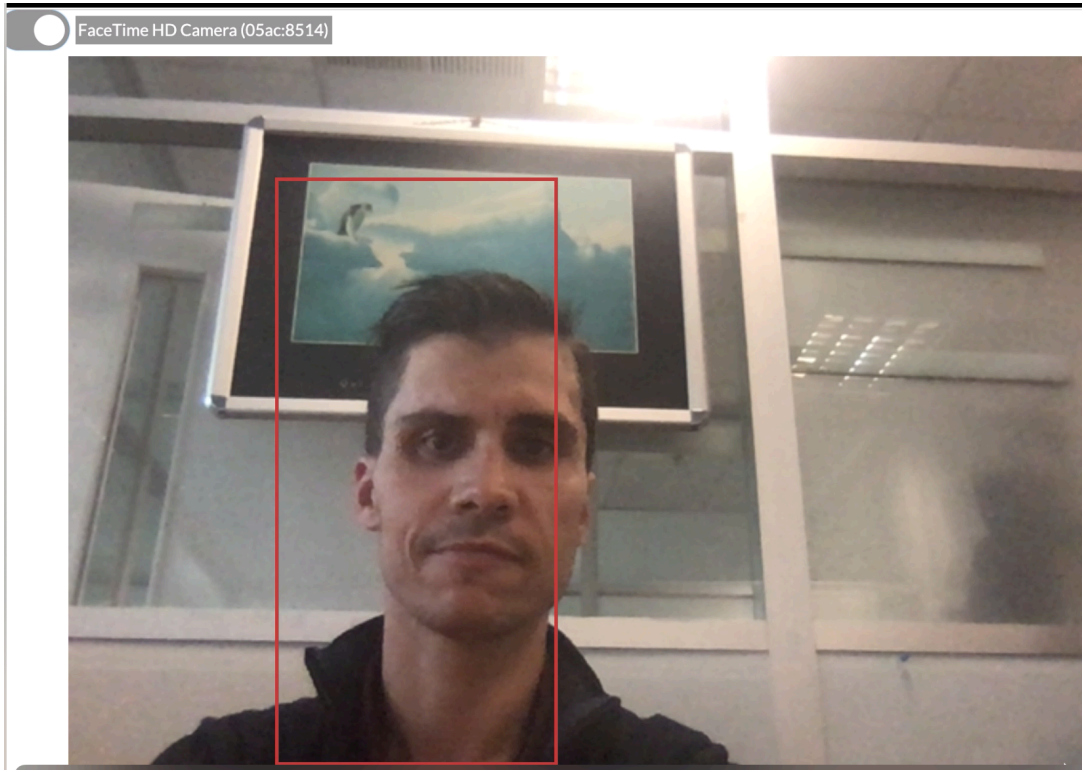


ID	DETECTEDLABEL	CONFIDENCE	YMAX	XMAX	XMIN	YMIN	A
165	head	0.995372474193573	119.0	111.0	73.0	36.0	en
164	head	0.9906670451164246	119.0	122.0	84.0	62.0	en
163	head	0.9786785244941711	119.0	157.0	123.0	60.0	en
162	head	0.998145580291748	119.0	101.0	53.0	54.0	en
161	head	0.9998226761817932	119.0	95.0	52.0	53.0	en
160	head	0.9996845722198486	119.0	104.0	61.0	53.0	en
159	head	0.9455117583274841	119.0	124.0	83.0	57.0	en
158	head	0.735583484172821	119.0	126.0	87.0	74.0	en
157	head	0.9001550674438477	119.0	119.0	84.0	63.0	en
156	head	0.6558237075805664	119.0	37.0	0.0	52.0	en
155	head	0.9980860948562622	119.0	45.0	3.0	39.0	en
154	head	0.9998077750205994	119.0	103.0	60.0	50.0	en

```
[10:32:25][BENOIT.ICC.LOCAL][~]# system "dsplib aivision"
 5770SS1 V7R3M0  160422                Display Library                5/16/19 10:32:43
 Library . . . . . . . . . . . . . . . :   AIVISION
 Type  . . . . . . . . . . . . . . . . :   PROD
 Number of objects . . . . . . . . . . :        25
 Library ASP number  . . . . . . . . . :         1
 Library ASP device  . . . . . . . . . :   *SYSBAS
 Library ASP group . . . . . . . . . . :   *SYSBAS
 Create authority  . . . . . . . . . . :   *EXCLUDE
 Text description  . . . . . . . . . . :   COLLECTION - created by SQL
   Object      Type      Attribute            Size  Description
   QSQJRN0001  *JRNRCV                     1118208  COLLECTION - created by SQL
   QSQJRN0002  *JRNRCV                     1118208  COLLECTION - created by SQL
   QSQJRN0003  *JRNRCV                     1118208  COLLECTION - created by SQL
   QSQJRN0004  *JRNRCV                     1118208  COLLECTION - created by SQL
   QSQJRN      *JRN                          12288  COLLECTION - created by SQL
   DETECTIONS  *FILE     PF                290816
   SYSCHKCST   *FILE     LF                 45056  SQL catalog view
   SYSCOLUMNS  *FILE     LF                135168  SQL catalog view
   SYSCST      *FILE     LF                 86016  SQL catalog view
   SYSCSTCOL   *FILE     LF                 57344  SQL catalog view
   SYSCSTDEP   *FILE     LF                 57344  SQL catalog view
   SYSFIELDS   *FILE     LF                 86016  SQL catalog view
   SYSINDEXES  *FILE     LF                126976  SQL catalog view
   SYSKEYCST   *FILE     LF                 69632  SQL catalog view
   SYSKEYS     *FILE     LF                 86016  SQL catalog view
   SYSPACKAGE  *FILE     LF                 98304  SQL catalog view
   SYSREFCST   *FILE     LF                 77824  SQL catalog view
```

Computer Vision on IBM i

IBM i can now talk and detect objects



Visual Recognition Demo on IBM i + PowerAI Vision

for Business

node JS

PowerAI Vision

Do try this at home! https://github.com/bmarolleau/paiv-ibmi

(need to be adapted if IBM Visual Insights is not used ☺)

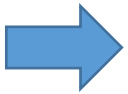
AI Applications on IBM i

Dashboard (Web Query…) with additional insight ,
Augmented ERP, CRM, or Core business applications, etc.

1. Ready to Use – simple customization

Ex: Watson Conversation/Translation REST API integrated with ILE/PASE/Db2

Training in the Cloud (IBM Cloud PaaS or Private with Cloud Pak for Data)



2. AI Libraries & tools in PASE

PASE Libraries : **Scikit learn, R**, **NLTK** , etc.

3. Assisted ML : Auto ML

Ex: AutoML models running (inference) in PASE (Scikit learn auto-sklearn etc)

H2O Driverless AI Scoring Pipeline running in PASE (Java, Python) / Db2 Java UDF

Inference: PASE ←→ ILE Integration

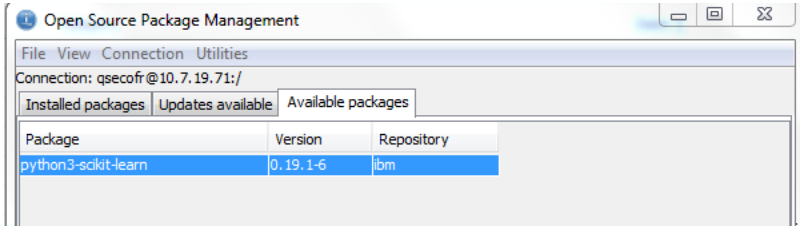
Training in PASE or offloaded on Linux/other Clouds.

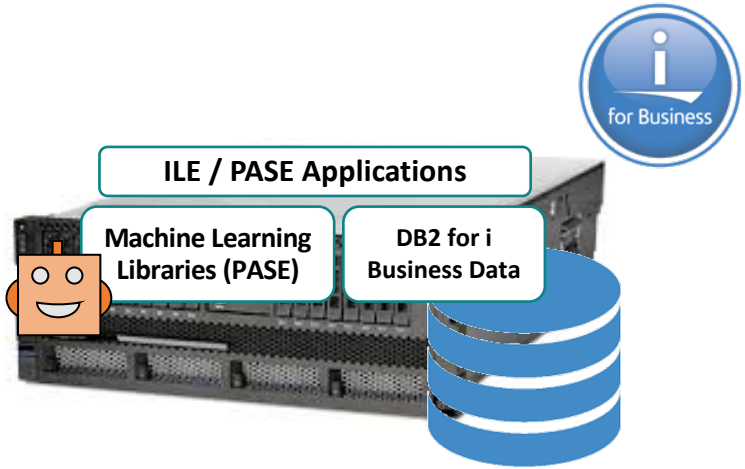
2_ Free Open Source on IBM i

Librairies & languages on AIX & IBM i

Data & Scientific Packages Available

- Numpy, Pandas : Data Processing
- **Scipy, Scikit-Learn**
- IPython : interactive Python
- NLTK : Natural Language Processing
- Matplotlib, Jupyter : Data Visualization
- R Language (Interpreter, Runtime)
- More to come? ☺





- ➔ Useful in all phases of a ML project on AIX/IBM i
- ➔ Data Visualization/ Preparation
- ➔ Model creation , training, inference as well
- ➔ **GPU Acceleration often needed for large datasets (price / performance) → IC922 / AC922 + WML-CE**

Free Open Source on IBM i

scikit-learn

Classification

Identifying to which category an object belongs to.

Applications: Spam detection, Image recognition.
Algorithms: SVM, nearest neighbors, random forest, …

— Examples

Regression

Predicting a continuous-valued attribute associated with an object.

Applications: Drug response, Stock prices.
Algorithms: SVR, ridge regression, Lasso, …

— Examples

Clustering

Automatic grouping of similar objects into sets.

Applications: Customer segmentation, Grouping experiment outcomes
Algorithms: k-Means, spectral clustering, mean-shift, …

— Examples

Dimensionality reduction

Reducing the number of random variables to consider.

Applications: Visualization, Increased efficiency
Algorithms: PCA, feature selection, non-negative matrix factorization.

— Examples

Model selection

Comparing, validating and choosing parameters and models.

Goal: Improved accuracy via parameter tuning
Modules: grid search, cross validation, metrics.

— Examples

Preprocessing

Feature extraction and normalization.

Application: Transforming input data such as text for use with machine learning algorithms.
Modules: preprocessing, feature extraction.

— Examples

https://scikit-learn.org

Free Open Source on IBM i

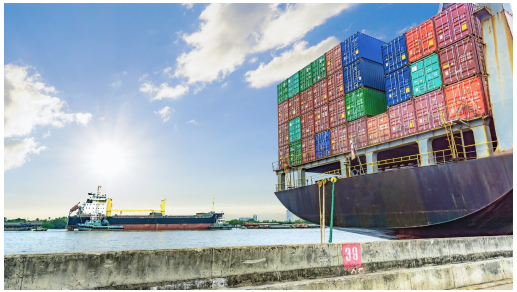
- Packages to install – 1.2 GB

Yum Install (*ALLOBJ)

Package (RPM)	Description
Tcl	TCL language support
Tk	TK package for GUI support of TCL
Python3	Python 3 support
Python3-devel	Python3 development package
python3-ibm_db	DBAPI support backage for IBM i
Pyton3-numpy	Numpy package
Python3-scipy	Scipy package
Python3-scikit-learn	Scikit-learn package
Libzmq	Zero-MQ library

Package Python (user)

Package Python (PIP)	Description
juypterlab	Includes jupyter (Julia/Python/R IDE)
joblib	Model and large objects persistence on Filesystem



Free Open Source on IBM i

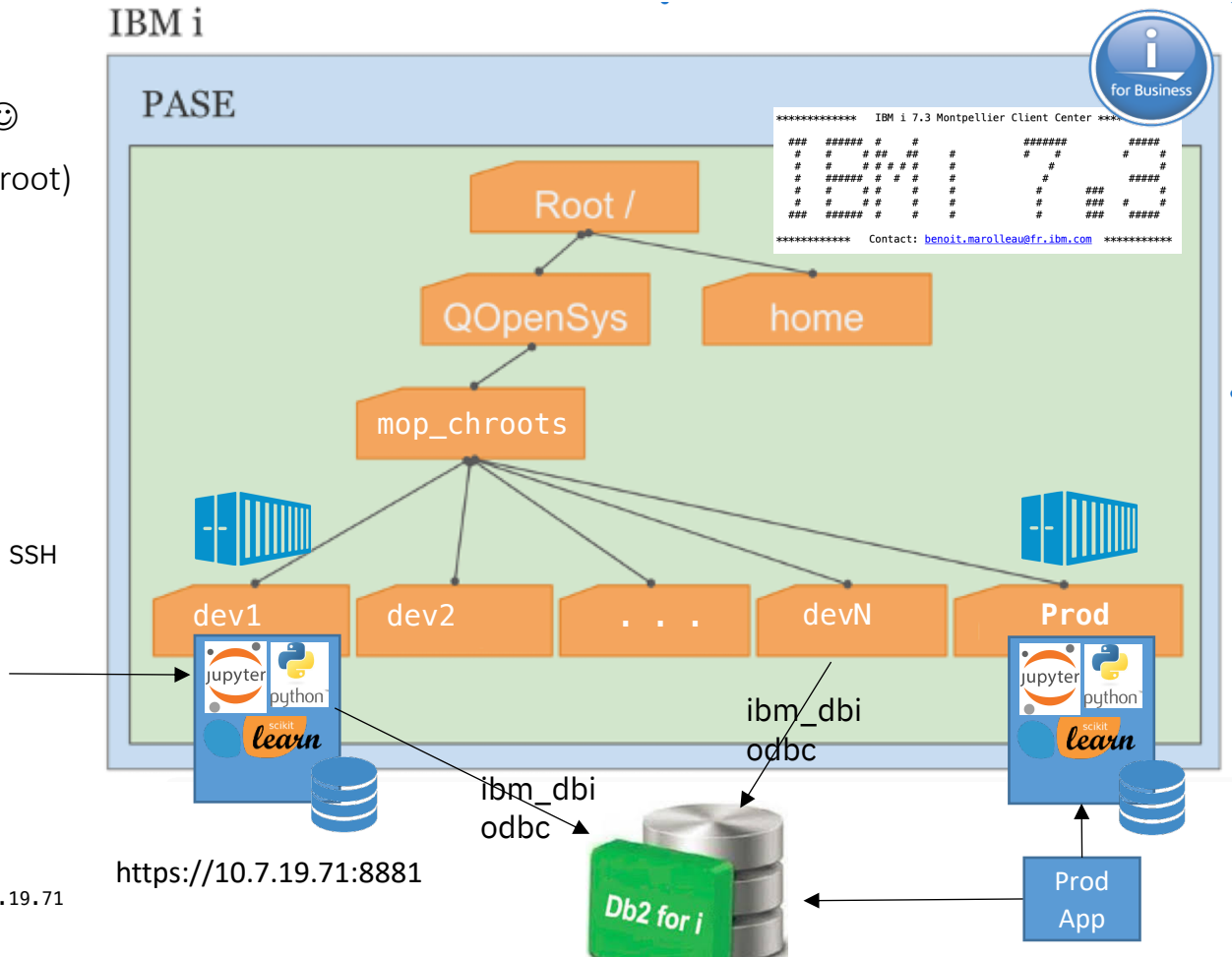
DevOps setup for AI

- Chroot jails (Isolation in PASE/IFS) ☺
- n Data Scientists = n sand boxes (chroot)
- Dev + Ops Environments
- 1.2GB per **Scikit-learn** environment
- Rest of the system (/) isolated

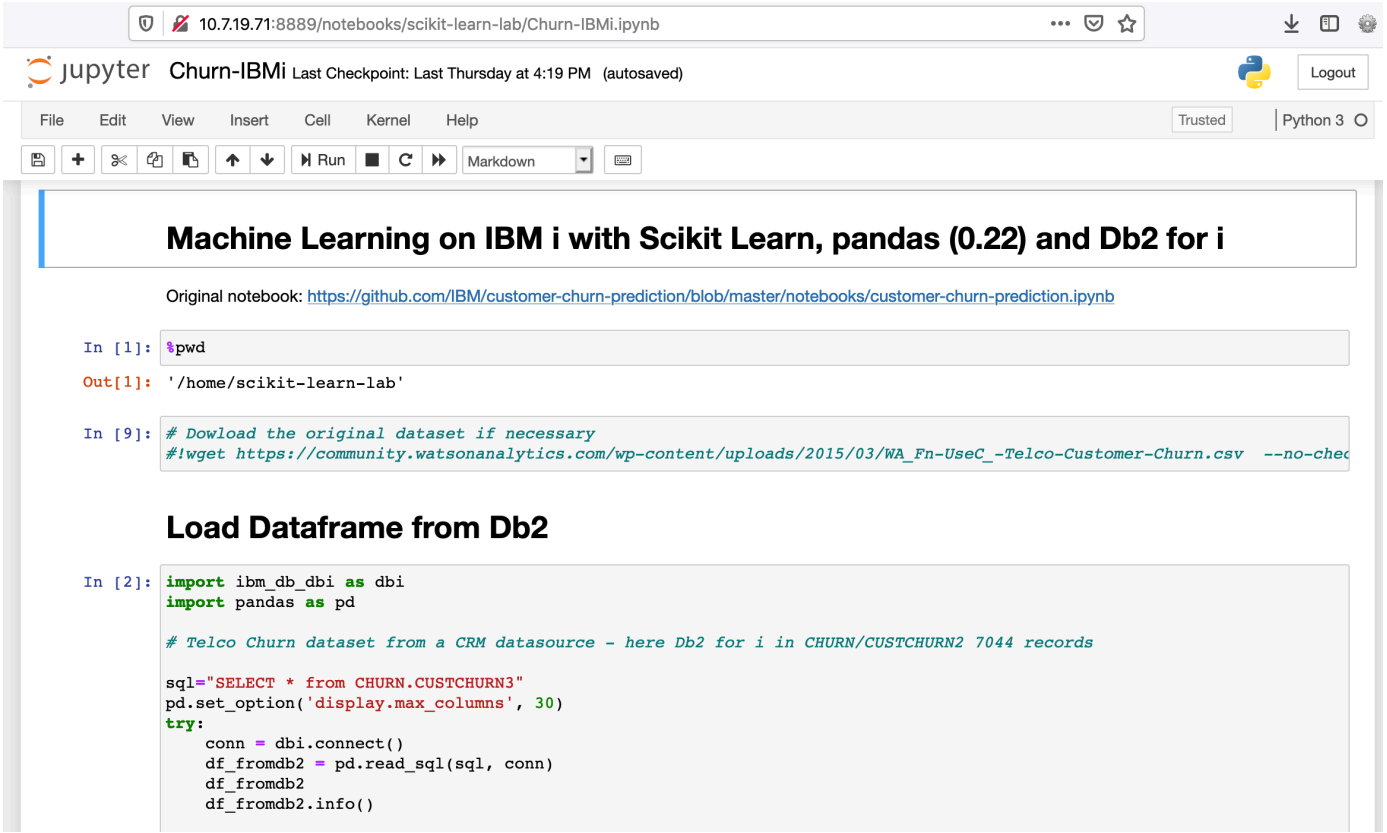
```
yum install
--installroot /QOpenSys/mop_chroots/dev1
tcl
tk
python3
python3-devel
python3-ibm_db
python3-numpy
python3-scipy
python3-scikit-learn
python3-pyzmq
libzmq
python3-pip
python3-pandas
openssl
bash

ssh dev1@BENOIT.ICC.LOCAL
bash-4.4$ pip3 install jupyterlab
bash-4.4$ pip3 install joblib

bash-4.4$ jupyter notebook --port 8881 --ip 10.7.19.71
```

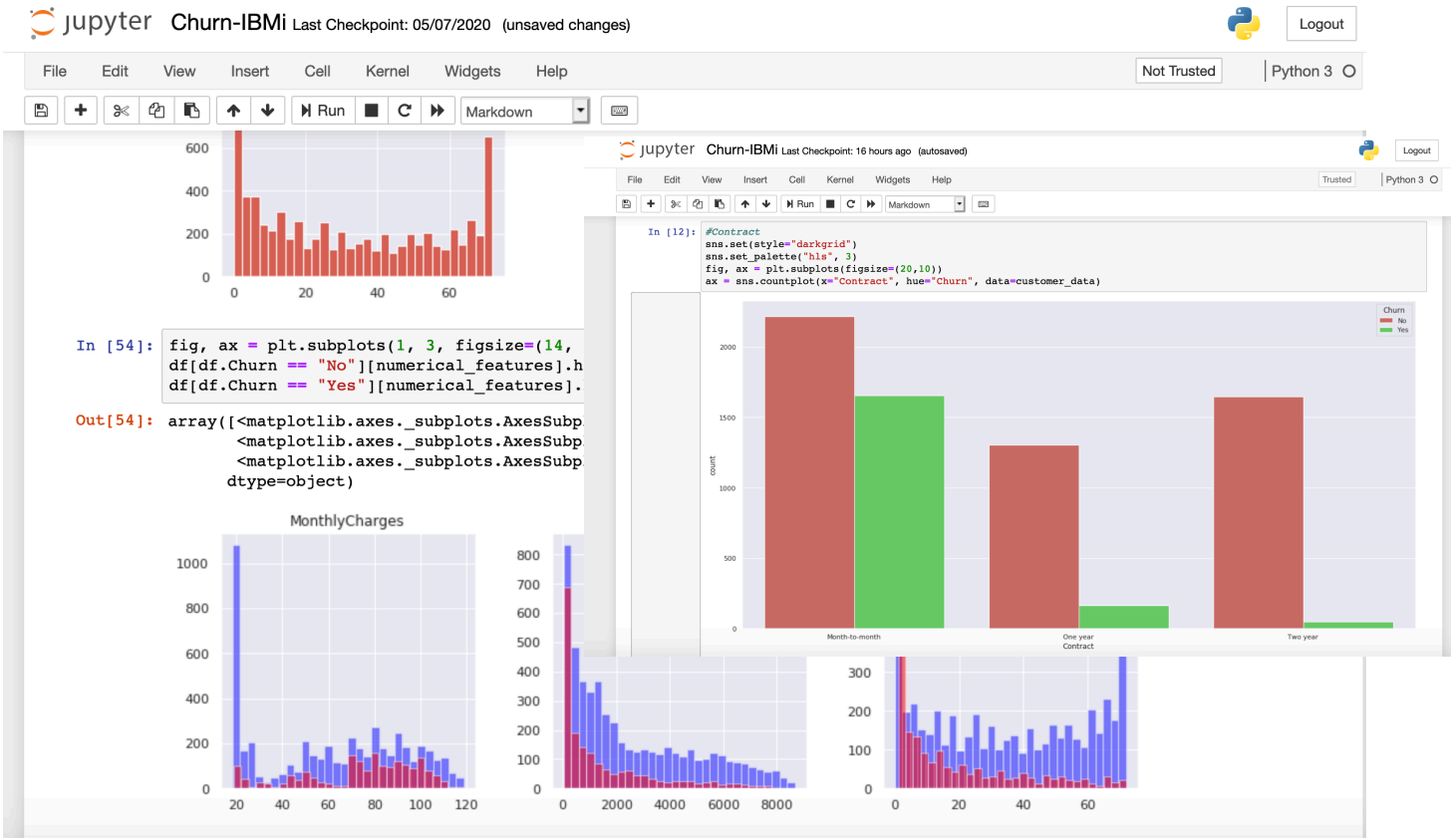


Free Open Source on IBM i
Model Training with data from Db2 for i



Free Open Source on IBM i

Analytics Dashboard, Data preparation



Free Open Source on IBM i

Model integration with your applications (GO LIVE)

1. Model Training/Validation (on IBM i or not)
2. Model transfer & loading to IBM i (IFS/JFS)
3. Scoring (Inference) on IBM i (PASE)
4. Integration of the model in your app

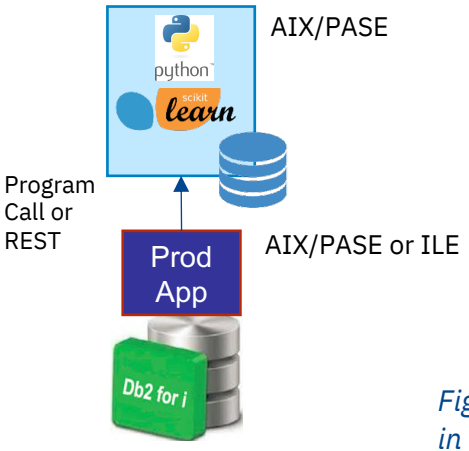


Fig. 20 client Scoring in PASE (Python3)

Using production data

jupyter Churn-IBMi Last Checkpoint: 3 hours ago (unsaved changes)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted Python 3

Run Code

Load trained model

Python Application can use the created model

In [40]:
```
from joblib import load
clf_svc = load('SVC_Model_CHURN_IBMi_V1.joblib')
```

Test the Model - Model Inference on IBM i

In [43]:
```
#XInfer=pd.DataFrame(X_train_scaled, columns=X_train.columns).head(20).values
#print(clf_svc.predict(XInfer))
#[0 0 0 1 0 1 0 0 0 0 0 0 1 0 1 0 1 0 0 0 0]

#X_train_scaled.shape
#(4718, 25)

X_test_scaled.shape
#(2325, 25)
print("Testing model on IBM i")
print("Test Dataset:")
#print(X_test_scaled)

XInfer=pd.DataFrame(X_test_scaled, columns=X_train.columns).head(20).values
print("IBM i Scikit Learn Scoring on 20 new Customers ")
print(clf_svc.predict(XInfer))
#[1 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 1]
```

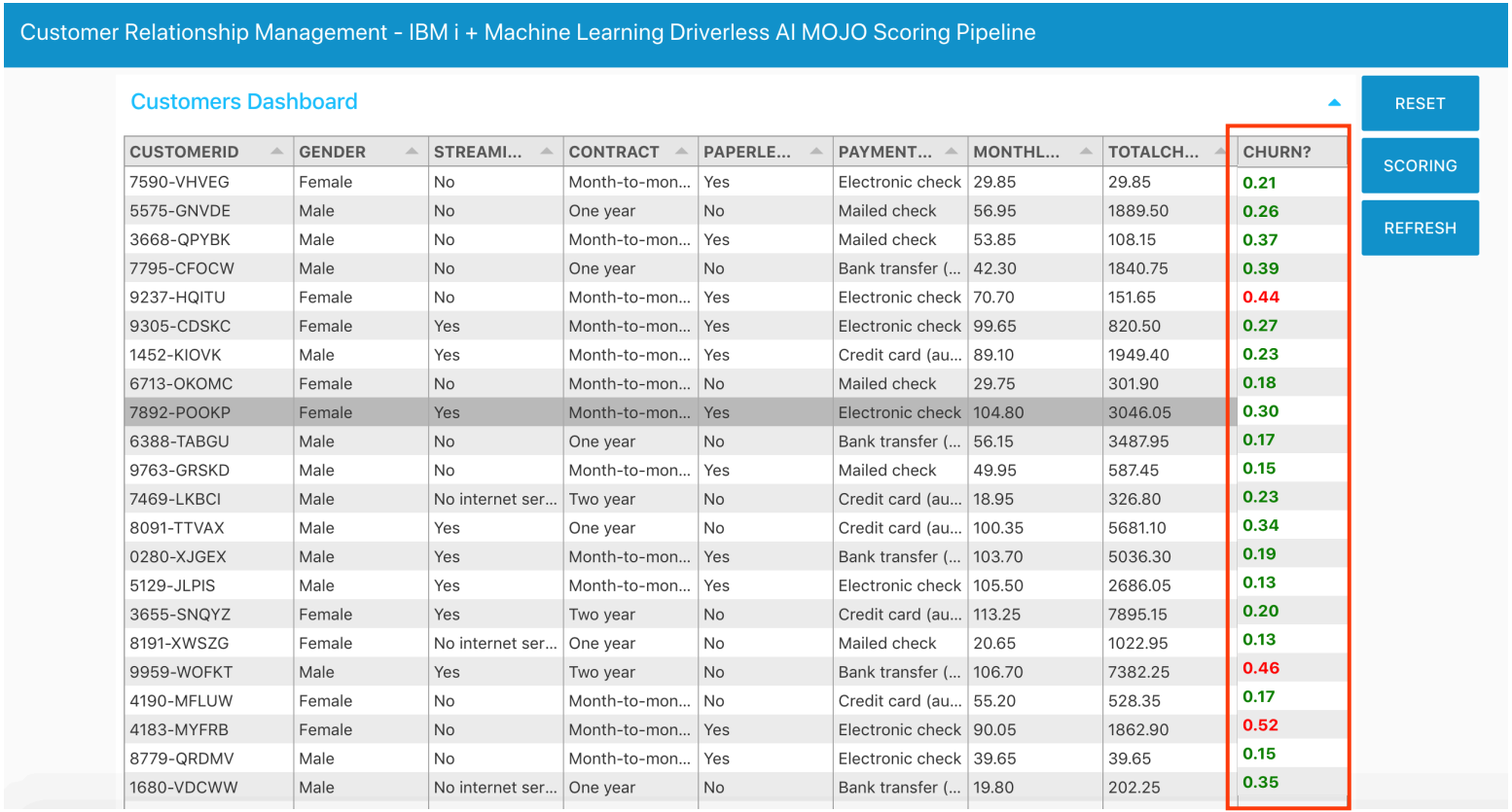
```
Testing model on IBM i
Test Dataset:
IBM i Scikit Learn Scoring on 20 new Customers
[1 0 0 1 0 0 0 0 0 0 0 0 0 0 1 0 1 1 1 0 1]
```

In [42]:
```
print(clf_svc.predict_proba(XInfer))
```

```
[[0.27807305 0.72192695]
 [0.84525602 0.15474398]
 [0.8468064  0.1531936 ]
 [0.31472176 0.68527824]
 [0.8481302  0.1518698 ]
 [0.86909208 0.13090792]
 [0.84684585 0.15315415]
 [0.84687523 0.15312477]
```

Free Open Source on IBM i : Smarter apps made easy

CRM & Customer Churn scenario



CUSTOMERID	GENDER	STREAMI...	CONTRACT	PAPERLE...	PAYMENT...	MONTHL...	TOTALCH...	CHURN?
7590-VHVEG	Female	No	Month-to-mon...	Yes	Electronic check	29.85	29.85	0.21
5575-GNVDE	Male	No	One year	No	Mailed check	56.95	1889.50	0.26
3668-QPYBK	Male	No	Month-to-mon...	Yes	Mailed check	53.85	108.15	0.37
7795-CFOCW	Male	No	One year	No	Bank transfer (...	42.30	1840.75	0.39
9237-HQITU	Female	No	Month-to-mon...	Yes	Electronic check	70.70	151.65	0.44
9305-CDSKC	Female	Yes	Month-to-mon...	Yes	Electronic check	99.65	820.50	0.27
1452-KIOVK	Male	Yes	Month-to-mon...	Yes	Credit card (au...	89.10	1949.40	0.23
6713-OKOMC	Female	No	Month-to-mon...	No	Mailed check	29.75	301.90	0.18
7892-POOKP	Female	Yes	Month-to-mon...	Yes	Electronic check	104.80	3046.05	0.30
6388-TABGU	Male	No	One year	No	Bank transfer (...	56.15	3487.95	0.17
9763-GRSKD	Male	No	Month-to-mon...	Yes	Mailed check	49.95	587.45	0.15
7469-LKBCI	Male	No internet ser...	Two year	No	Credit card (au...	18.95	326.80	0.23
8091-TTVAX	Male	Yes	One year	No	Credit card (au...	100.35	5681.10	0.34
0280-XJGEX	Male	Yes	Month-to-mon...	Yes	Bank transfer (...	103.70	5036.30	0.19
5129-JLPIS	Male	Yes	Month-to-mon...	Yes	Electronic check	105.50	2686.05	0.13
3655-SNQYZ	Female	Yes	Two year	No	Credit card (au...	113.25	7895.15	0.20
8191-XWSZG	Female	No internet ser...	One year	No	Mailed check	20.65	1022.95	0.13
9959-WOFKT	Male	Yes	Two year	No	Bank transfer (...	106.70	7382.25	0.46
4190-MFLUW	Female	No	Month-to-mon...	No	Credit card (au...	55.20	528.35	0.17
4183-MYFRB	Female	No	Month-to-mon...	Yes	Electronic check	90.05	1862.90	0.52
8779-QRDMV	Male	No	Month-to-mon...	Yes	Electronic check	39.65	39.65	0.15
1680-VDCWW	Male	No internet ser...	One year	No	Bank transfer (...	19.80	202.25	0.35

Augmented CRM with AI

including Customer Churn risk estimate

AI Applications on IBM i

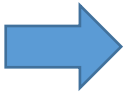
Dashboard (Web Query…) with additional insight ,
Augmented ERP, CRM, or Core business applications, etc.

1. Ready to Use – simple customization

Ex: Watson Conversation/Translation REST API integrated with ILE/PASE/Db2
Training in the Cloud (IBM Cloud PaaS or Private with Cloud Pak for Data)

2. AI Libraries & tools in PASE

PASE Libraries : **Scikit learn, R**, **NLTK** , etc.



3. Assisted ML : Auto ML

Ex: AutoML models running (inference) in PASE (Scikit learn auto-sklearn etc)
H2O Driverless AI Scoring Pipeline running in PASE (Java, Python) / Db2 Java UDF
Inference: PASE ←→ ILE Integration
Training in PASE or offloaded on Linux/other Clouds.

3_ Auto ML

Example with H2O Driverless AI

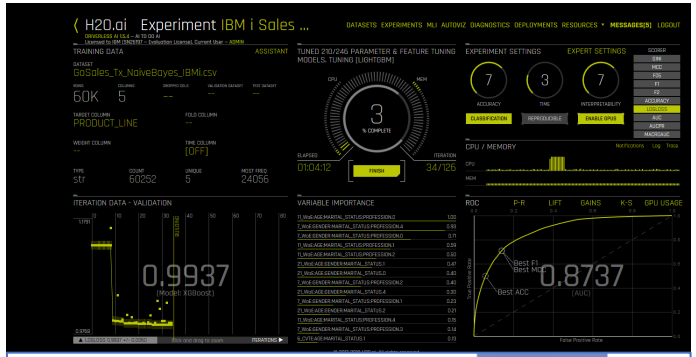
YouTube
http://ibm.biz/PowerVUG

Une Solution simple et abordable :

- → "Expert Data Scientist in a Box"
- → Months down to Hours
- → Explainability & Transparency

2 **Import & Visualize Data**
Create & Test Models

1 **Extract CRM data**



Optimized for Power9 Servers

Model Export

3

python Java

Recommendation Engine
Scoring Pipeline

4 **Augment IBM i Applications**
Model Inference

5 **Monitor Models & Iterate**

Business Database

Customer Relationship Management - IBM i + Machine Learning Driverless AI MOJO Scoring Pipeline

RESET | SCORING | REFRESH

Customer Dashboard

CUSTOM...	GENDER	STREAMI...	CONTRACT	PAPERLE...	PAYMENT...	MONTHL...	TOTALCH...	CHURN?
0002-ORFBO	Female	Yes	One year	Yes	Mailed check	65.60	593.30	0.21
0003-MKNFE	Male	No	Month-to-mon...	No	Mailed check	59.90	542.40	0.26
0004-TLHLJ	Male	No	Month-to-mon...	Yes	Electronic check	73.90	280.85	0.37
0011-IGKFF	Male	Yes	Month-to-mon...	Yes	Electronic check	98.00	1237.85	0.39
0013-EXCHZ	Female	Yes	Month-to-mon...	Yes	Mailed check	83.90	267.40	0.44
0013-MHZWF	Female	Yes	Month-to-mon...	Yes	Credit card (au...	69.40	571.45	0.27
0013-SMEOE	Female	Yes	Two year	Yes	Bank transfer (...	109.70	7904.25	0.23

Business Application

Smarter IBM i apps made easy with Driverless AI

Dataset creation from Db2 for i

Untitled* - Run SQL Scripts - 10.7.19.71(O01dd6f4)

File Edit View Run VisualExplain Monitor Options Connection Tools Help

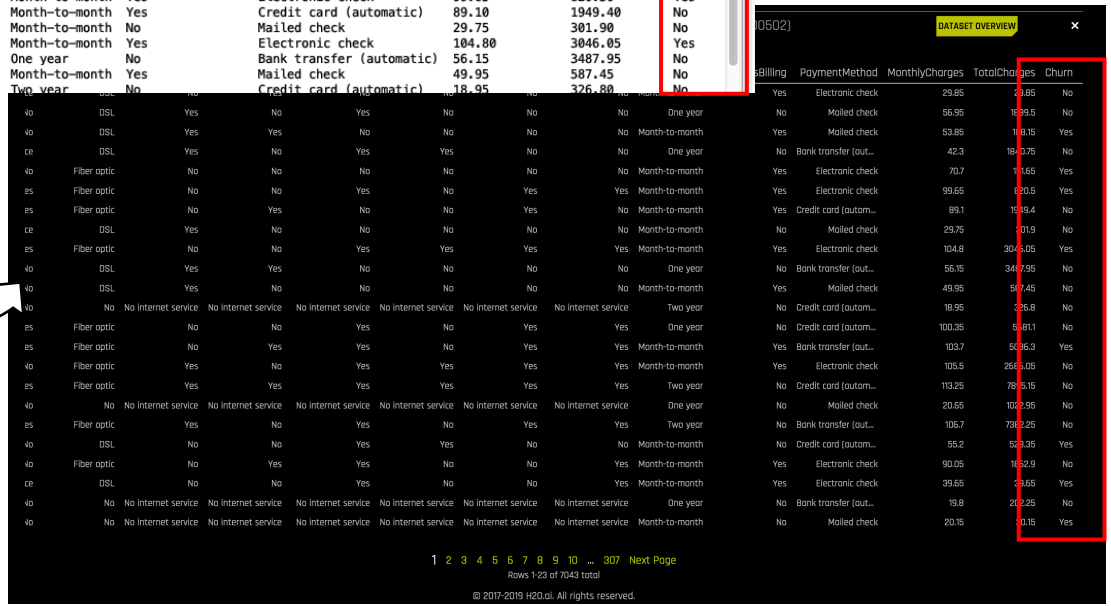
```
1 select * from churn.custchurn3
```

ACKUP	DEVICEPROTECTION	TECHSUPPORT	STREAMINGTV	STREAMINGMOVIES	CONTRACT	PAPERLESSBILLING	PAYMENTMETHOD	MONTHLYCHARGES	TOTALCHARGES	CHURN
	No	No	No	No	Month-to-month	Yes	Electronic check	29.85	29.85	No
	Yes	No	No	No	One year	No	Mailed check	56.95	1889.50	No
	No	No	No	No	Month-to-month	Yes	Mailed check	53.85	108.15	Yes
	Yes	Yes	No	No	One year	No	Bank transfer (automatic)	42.30	1840.75	No
	No	No	No	No	Month-to-month	Yes	Electronic check	70.70	151.65	Yes
	Yes	No	Yes	Yes	Month-to-month	Yes	Electronic check	99.65	820.50	Yes
	No	No	Yes	No	Month-to-month	Yes	Credit card (automatic)	89.10	1949.40	No
	No	No	No	No	Month-to-month	No	Mailed check	29.75	301.90	No
	Yes	Yes	Yes	Yes	Month-to-month	Yes	Electronic check	104.80	3046.05	Yes
		No	No	No	One year	No	Bank transfer (automatic)	56.15	3487.95	No
		No	No	No	Month-to-month	Yes	Mailed check	49.95	587.45	No
	rice	No internet service	No internet service	No internet service	Two year		Credit card (automatic)	18.95	326.80	No

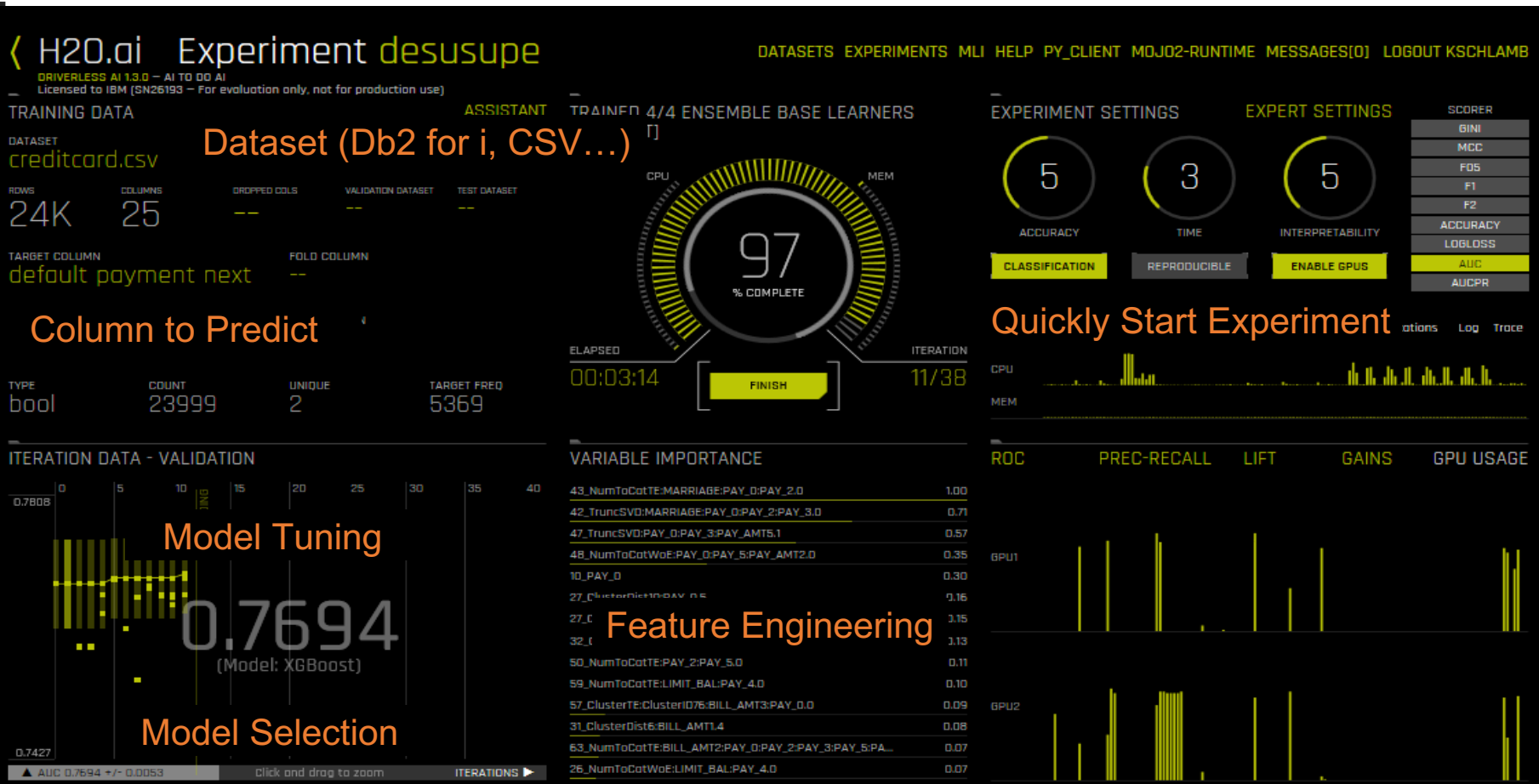
Extraction
or JDBC
Data Connector

H2O.ai

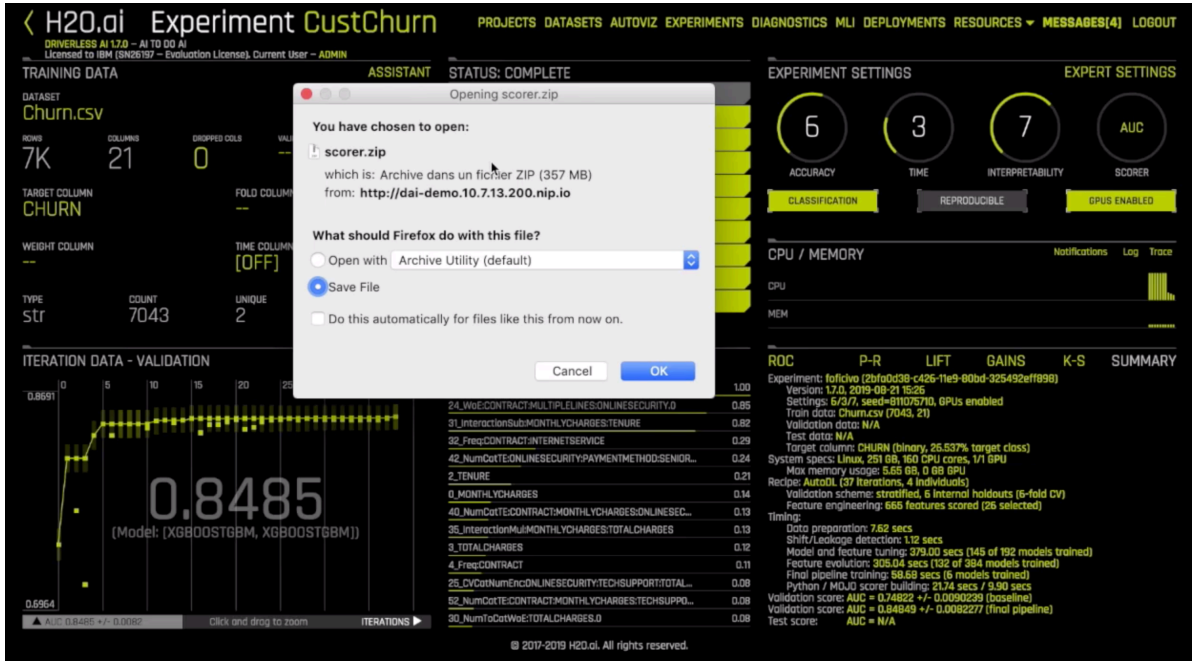
Prepared
Training
Dataset



The Driverless AI Experience – Dataset from IBM i



Export Scoring Pipeline



Scoring Pipeline export

Automatic Scoring Pipelines

Export ultra-low latency Python or Java Automatic Scoring Pipelines that include feature transformations and models.

Here, the Java/ Python Scoring Pipeline “scorer.zip” to be deployed on the inference system

Inference on the Edge , datacenter, Cloud … on any device.

Export the Java/Python Scoring Pipeline (model) and run it on IBM i !

3_ Auto ML: Demo: Augmented CRM with AI

Client Scoring for evaluating the churn risk / probability
base on historical data

https://www.youtube.com/watch?v=QemqAzpyJPc&feature=youtu.be

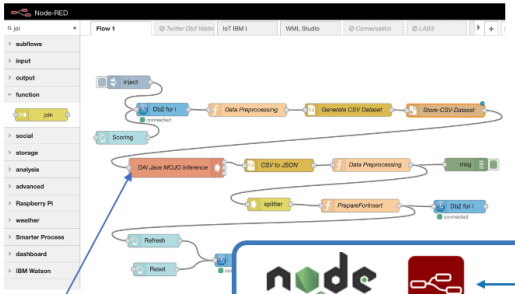


Fig. Node-RED Prototyping - CRM dashboard

Java MOJO Scoring Pipeline
Invoked from the Node.js app

Fig. **Boosted CRM Application**
w/ integration of a real time scoring
Pipeline (Java MOJO)
ILE ←→ PASE Integration

Scoring Model Precision : 84%

Manually, with basic ML knowledge : 0.79%
Driverless AI : Feature Engineering like a Kaggle grandmaster.

Time to market : reduce it from months to days

Auto ML solutions with Hardware acceleration allow you to create high quality models, comparable to a ww ML grandmaster, very quickly , with only a good knowledge on ML.

With Driverless AI, The shaped model (Scoring Pipeline) can be executed on AIX or IBM i close to the core business applications and database.

H2O Driverless AI on AC922 Client Reference in Financial Services

Improving Profitability of Core Financial Services

- Data extracted from **IBM Db2 for i**
- Improved **years** of expert feature engineering
- **Increased accuracy** of existing credit risk scoring in **less time**
- **2x propensity to buy** for new bank products
- Accelerated by IBM Power Systems AC922

"By using Driverless AI on IBM Power Systems AC922, we have been able to build out ML/AI solutions in **less time**, with **improved quality** and **accuracy**."

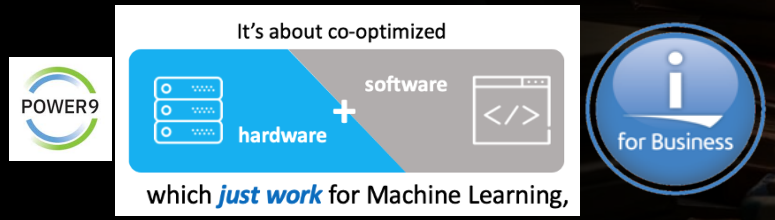
"We were also able to **double the propensity** for our banking customers **to accept an offer** of credit products, such as credit cards… We plan to use the platform for more use cases in the future."

"This awesome result is because Driverless AI uses **the expertise of "Kaggle Grand Masters in a Box."**

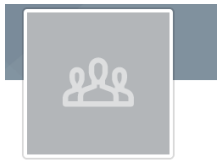
Vison Banco - IBM Customer Case Study

Ruben Diaz
Data Scientist, Visión Banco
https://www.linkedin.com/pulse/journey-towards-driverless-ai-ruben-diaz/

How to get Started ?



How to get started?



[How to Start With Machine Learning on IBM i (by Gan Zhang, IBM - Nov 2019)]

Accessing the rest of your IBM i from Python (Kevin Adler)
[ibm_dbi driver presentation]

Join the #IBMiOSS Linkedin [Group]

Check out the IBM i OSS Examples - Github [Repository]

YiPS [http://yips.idevcloud.com/wiki/]

[Bitbucket IBM i Open Source]

[My blog ☺] (K8s , App modernization , ML , H2O, Watson, Node-RED, IBM i)

Videos 2020 (AIX/IBM i in IBM Cloud , Terraform) [My Youtube Channel]

How to get started?

Data Analysis with Python

Data Visualization with R

Data Visualization using Python

https://cognitiveclass.ai/courses/data-analysis-python

https://www.coursera.org/specializations/data-science-python

How to get started? Demos

→ 'Scikit-learn on IBM i' Demonstration on Youtube

https://youtu.be/Uw_ePb8Hz3o?t=1296 YouTube

→ Do it Yourself: Install yum packages and git clone

- https://github.com/bmarolleau/firstdemo-scikitlearn-ibmi/
- **Free Auto-ML ?** Auto-sklearn from Scikit-learn
- Need support or a live demo ? **Contact me!**

→ IBM i & AutoML: H2O Driverless AI

https://www.youtube.com/watch?v=QemqAzpyJPc&feature=youtu.be YouTube

common
EUROPE LUXEMBOURG
Modernisation des Applications IBM i & Open Source
(webinaire)
Jeudi 25 mars – 14h00 – 17h00

Smarter IBM i Applications made easy with AI

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IBM Garage for Systems - Montpellier, France
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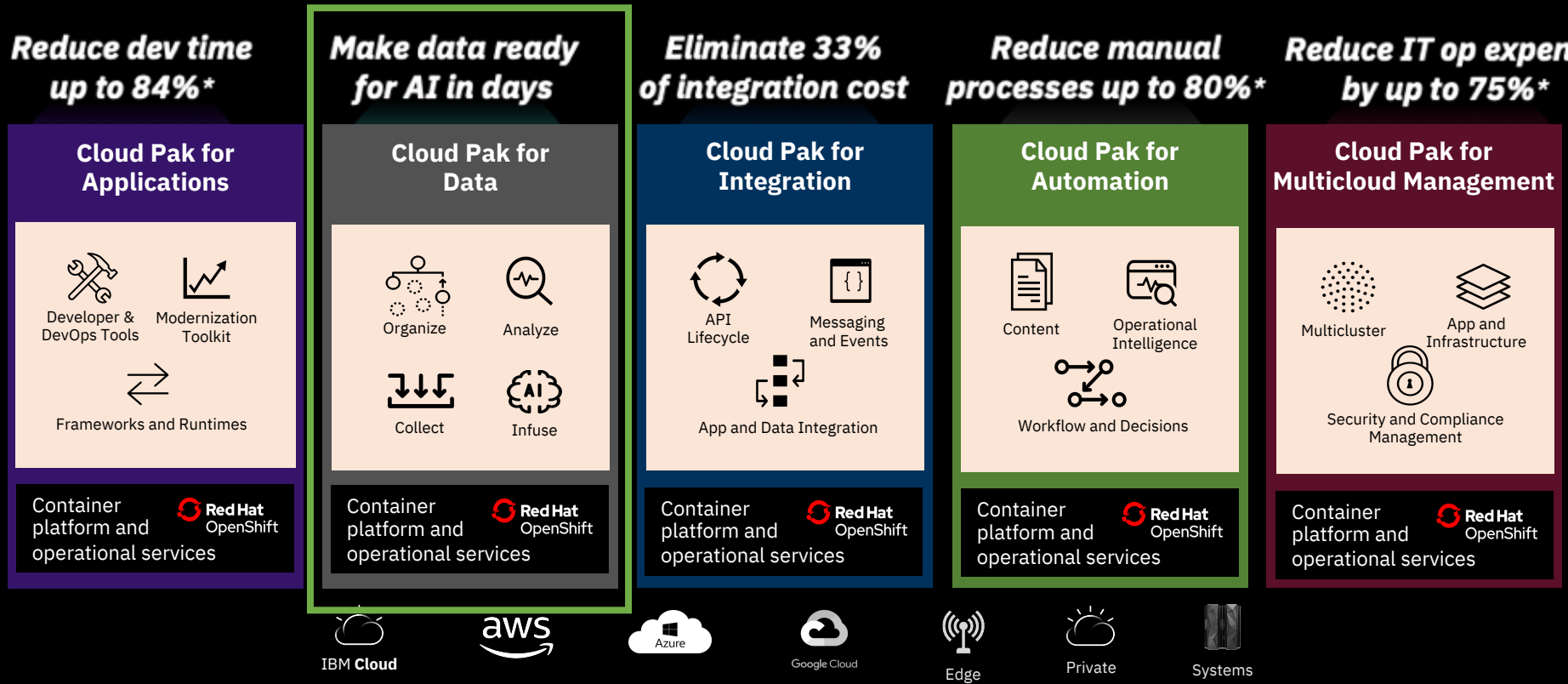
#IBMi #IBMiOSS Fan

for Business

Cloud Paks – Pre-integrated for cloud use cases

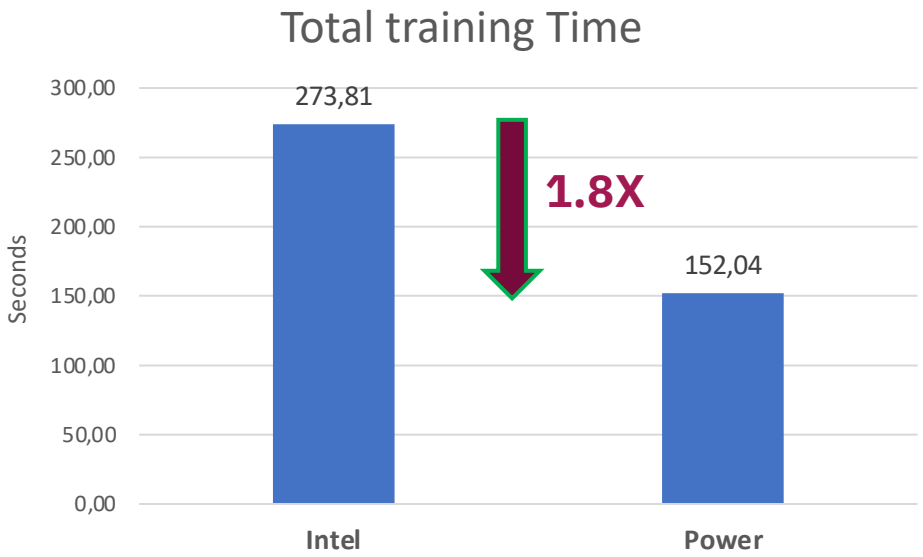
Today, IBM offers clients the first five Cloud Paks…



IBM **Cloud**

LightGBM Algorithm is Faster on Power

H2O Driverless AI uses LightGBM as one of its main ML Algorithms



Advantages of LightGBM

1. Faster training speed and higher efficiency
2. Lower memory usage
3. Better accuracy than any other boosting algorithm
4. Compatibility with Large Datasets
5. Parallel learning supported.

LightGBM on Power (CUDA) is 1.8X faster than x86 (OpenCL)

Machine Learning

Use training data to derive f(x) so that

Minimize (Actual - f(x))

or mathematically

$$\min \quad 1/n \sum_{i=1}^{n} (y_i - f(x_i))^2$$

	Feature	Feature	Feature	Feature	Label (=f(X))	
	Loan Requested	Income	Own House	Outstanding Debt	Decision	
Vector X Input	$20,000	$100,000	Y	0	Approve	Output
	$50,000	$70,000	N	$20,000	Reject	
	$5,000	$150,000	Y	$10,000	Approve	
	...	...	...	...	...	

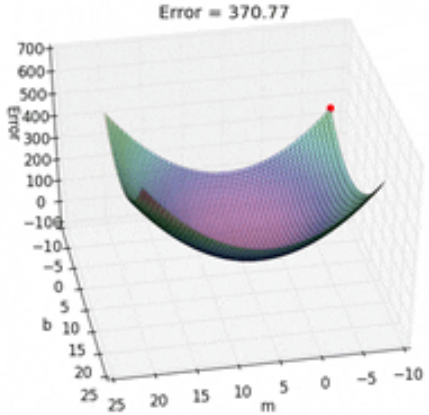
$$\begin{matrix} x_1 \\ x_2 \\ x_3 \\ \dots \\ x_n \end{matrix} \begin{bmatrix} x_{11} & x_{12} & x_{13} & x_{14} \\ x_{21} & x_{22} & x_{23} & x_{24} \\ x_{31} & x_{32} & x_{33} & x_{34} \\ \dots & \dots & \dots & \dots \\ x_{n1} & x_{n2} & x_{n3} & x_{n4} \end{bmatrix} \quad \begin{bmatrix} y_1 \\ y_2 \\ y_3 \\ \dots \\ y_n \end{bmatrix}$$

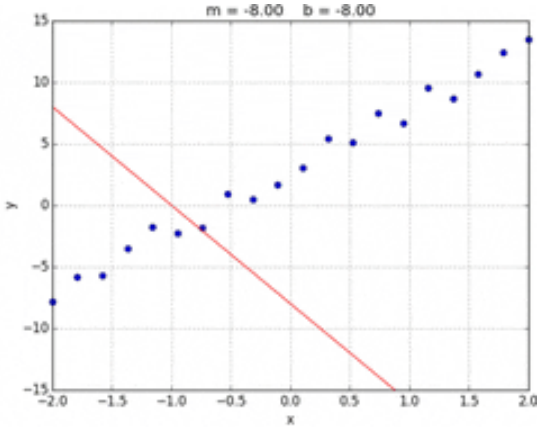
- Learning phase : minimize the distance between the current result f(x) and the actual result (supervised learning)
- Volume & Data quality are crucial (Training Dataset). Knowledge of the observed phenomenon, business.
- Each algorithm has **parameters** , adjusted (learned) according to the obtained errors during training.
- The choice of the algorithm is also key, as well as **hyperparameters** initialization.
- At the end of the training , the parameter values are fixed
- The execution of the validated, tested model on new examples is called **inference**
- Accelerators - GPU (or FPGA) – are useful in the Training Phase, sometimes in Inference : thousands of cores, good at matrix and vector calculation (tensors) can divide a training time by 50

→ Solutions exist to assist in all these phases (Relax ☺)

Machine Learning

Error Function
to minimize (almost) at each iteration.

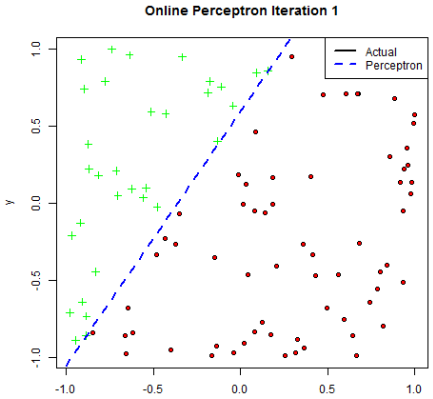




Regression

The model is getting better at each training iteration (while minimizing the error function)

- In reality , hundreds/thousands of dimensions (or features or columns)
- Dimensionality Reduction : eliminate redundant, correlated, useless dimensions
- Feature Extraction: creation of additional features to better undertand the phenomenon. A neural network does this extraction automatically, major difference vs. Classic Machine Learning.
- Model quality : precision on test dataset . Does it work fine with new data ? overfitting vs. underfitting , bias & variance. Regularization methods…



Classification

→ Solutions exist to assist in all these phases (Relax ☺)

Machine Learning Solutions

On Premises ? Public Cloud ?

AI libraries & frameworks

- ML: scikit learn, R, Rstudio, SQL, H2O-3 , H2O Driverless AI ...
- DL: PyTorch, TensorFlow, Caffe , Theano, Chainer ...
- Distributed : Apache Spark, H2O Sparking Water, HPC tooling...
- Accelerated ML: Nvidia CUDA, Rapids , IBM Snap ML

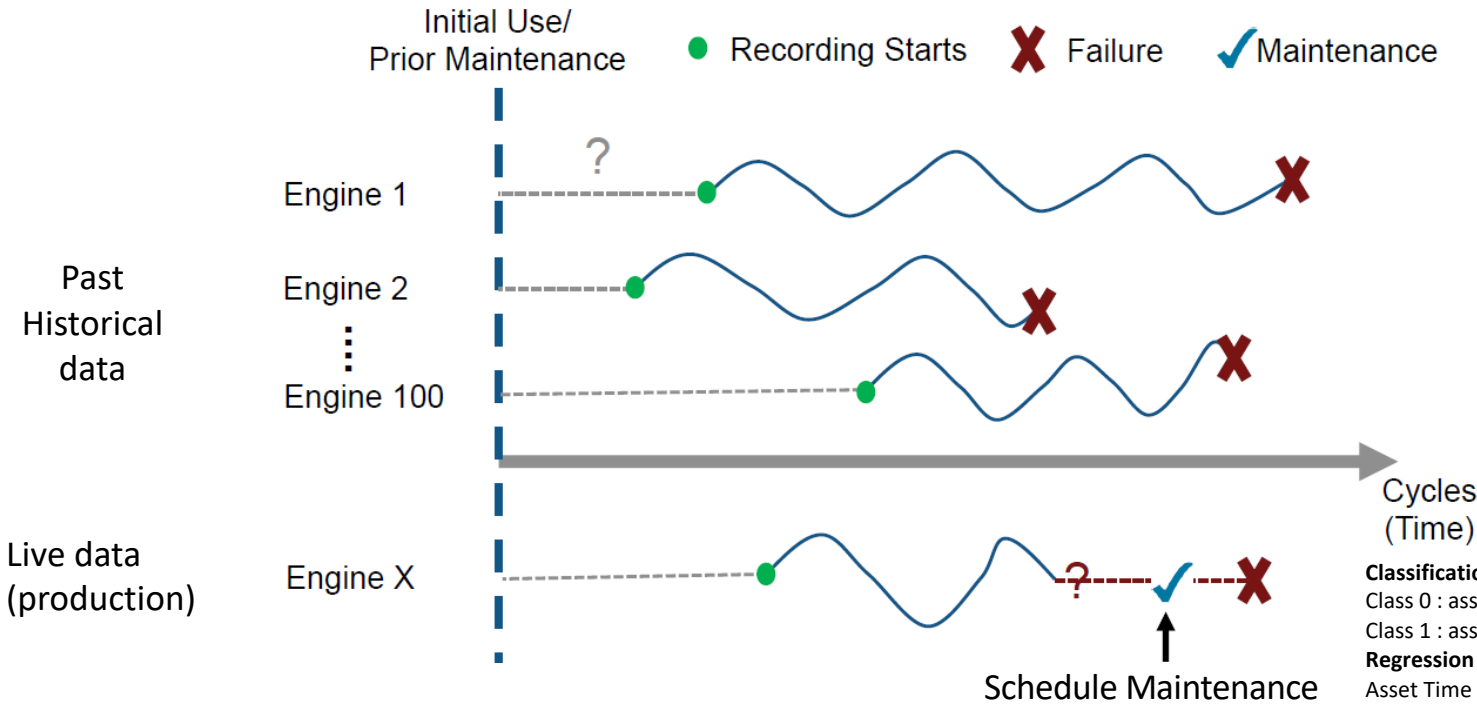
→ Hundreds to come every month...most of them are **free open source**

Desktop & Server Appliance with Accelerators (GPU)

Nvidia DGX , Intel ... GPU / FPGA based etc.

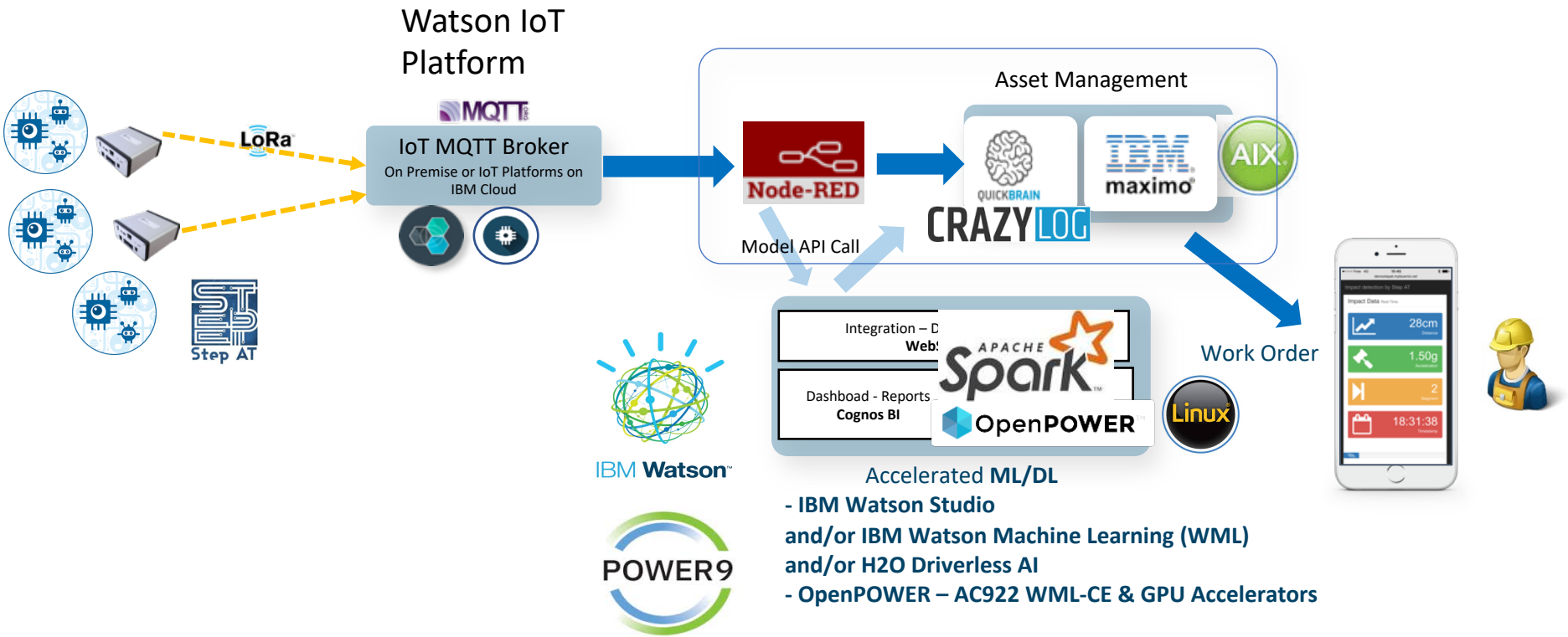
IBM AC922 : Oak Ridge 'Summit' SuperComputer Building Block

Example: Predictive Maintenance



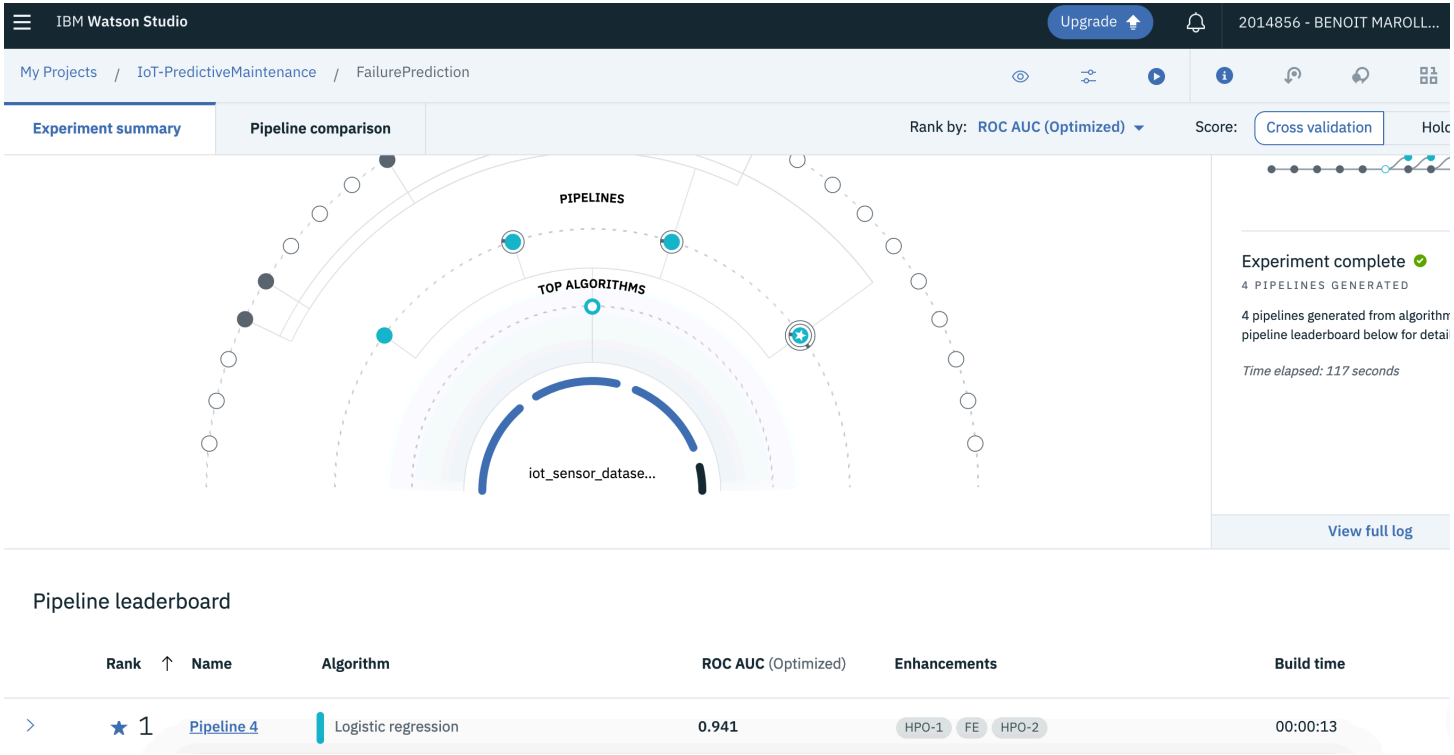
Classification:
Class 0 : asset will fail within the next 15 cycles
Class 1 : asset won't fail within the next 15 cycles
Regression (prediction):
Asset Time to failure = 18 cycles

Example: Predictive Maintenance



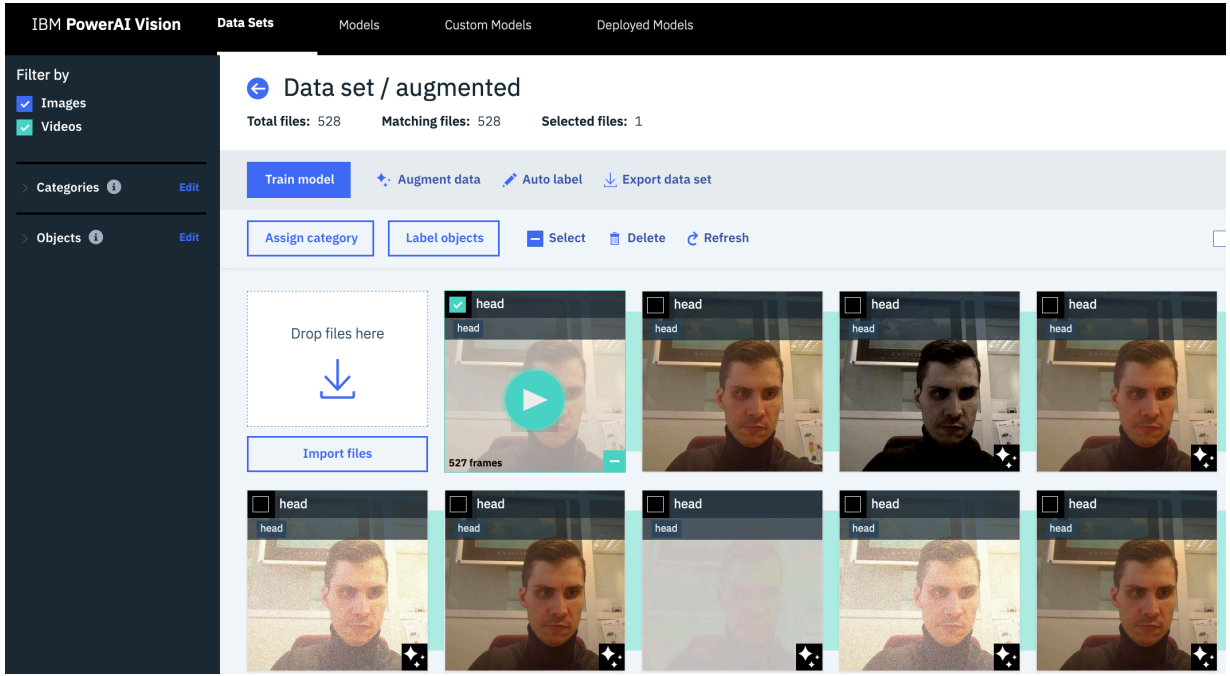
Example: Predictive Maintenance

with Watson Studio



Model created with AutoAI on Studio. Can be deployed on WML (REST API...)

Computer Vision with IBM Visual Insights & IBM i



- IBM POWER SYSTEMS

AC922

An Acceleration Superhighway
Unleash state of the art IO and accelerated computing potential in the post “CPU-only” era

Designed for the AI Era
Architected for the modern analytics and AI workloads that fuel insights

Delivering Enterprise-Class AI
Flatten the time to AI value curve by accelerating the journey to build, train, and infer deep neural networks