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SAP Innovation Awards 2019 Entry Pitch Deck

Machine Learning for Enhanced Quality and Efficiency in
Installation Management

Daikin (CHINA) Investment Co.,Ltd.

THE BEST RUN



Machine Learning for Enhanced Quality and Efficiency in Installation Management



Daikin(CHINA) Investment Co.,Ltd.

“Quote”

“Collaborating with SAP, we have created an unique installation management tool in the industry. Through this challenging project, we come to understand what AI can benefit us. We will further work with SAP to explore AI technology, to drive IT innovations and create business value.”

Takeshi Kurashige, Manager of Information Technology Center, Daikin (CHINA) Investment Co., Ltd

Challenge

Daikin, the world No.1 air conditioning company, is facing challenges with its quality control process in air condition installations, which was manual driven with heavy workload and limited inspection coverage. To improve the installation service and sustain its leadership position in China, Daikin sees the need to transform the process through IT innovation.

Solution

Daikin launched Image Recognition Sprint 0, an air condition installation management tool powered by SAP machine learning technology, to replace manual process with greater efficiency, improved quality control and reduced cost.

Outcome

Image Recognition Sprint 0 project was successfully delivered with high success rate in image recognition, a milestone towards full implementation which will drive substantial business benefits.

✓ High image recognition rate:
-- refrigerant tanks recognition at 93%, meter reading at 79%, pipes text at 70%

✓ Foreseeable benefits in improved installation quality, reduced cost and enhanced competitiveness of Daikin brand

✓ Inspiration for more innovation projects leveraging SAP technologies



Business Challenge & Objectives

Daikin, the industry leader in air conditioning in China, has encountered business challenges in a highly competitive market:

- Complexity of installation and construction requires close supervision and quality control by Daikin factory, to prevent fire, water leakage and other dangerous situations. Does the air pressure value reach the specified threshold? Is compliant refrigerant tank used? Does the pipeline meet technical specifications? Do the pipeline models match?
- In the past, Daikin required construction contractors or its own quality inspectors to take photos on site first and then ran manual sampling to define follow up inspections. Inspections could only cover 20% of the installations due to heavy workload.
- Daikin is looking for an operational mechanism to replace the manual process and to execute better quality supervision and efficient inspections. This will help Daikin to stay competitive in installation service, thus strengthening Daikin brand and sustaining its leadership position in the market.

Daikin launched Image Recognition Sprint 0 project with the following objectives:

- Improve the quality and reliability of air condition installation projects, with efficient supervision and early detection/warning to inappropriate procedures, supported by real-time image recognition
- Extend inspection coverage and improve the efficiency with targeted inspections instead of random checking
- Reduce after-sales costs by improving installation quality and avoid extra service cost in warranty periods
- Enhance Daikin brand through optimization in installation quality control process
- Prove the technical capability of SAP product (SCP, MLF, HANA) and inspire further innovations



Project / Use Case Details

- Daikin Image Recognition Sprint 0, the first machine learning implementation project in China, leveraged several SAP cutting-edge technologies such as
 - Scene Text Recognition Service in Machine Learning Foundation
 - Customized CNN Model (Python & TensorFlow)
 - OpenCV based(Python Runtime) image processing
- Image Recognition is targeting at:
 - Pipes such as text recognition for refrigerant pipes, refrigerant pipe insulations, condensate pipes and signal cables, using SAP Machine Learning Foundation Scene Text Recognition, CRNN (Convolutional Recurrent Neural Network) and the fuzzy query feature of SAP HANA
 - Meter reading of pressure gauges and vacuum gauges, based on OpenCV image processing, with 79% success rate in recognition
 - Refrigerant tanks identification, adopting convolutional neural network modeling based on deep learning, with 93% success rate
 - Wire specifications recognition which proves to be very challenging due to complex image content and image features in different installation scenarios
- A collaborative project team was set up, consisting of IT specialists from Daikin Information Center, SAP Innovative Business Solutions organization data scientists and architect developers from Germany and China. The project started in Oct 2018 and was completed in less than three months, running through phases from process analysis and optimization, to algorithm study and detail design, and to final development and implementation.



Benefits and Outcomes

Business / Social

- ✓ High recognition success rate, meeting key performance indicators:
 - refrigerant tanks recognition at 93%
meter reading recognition at 79%, pipes text at 70%
- ✓ Expect to greatly improve installation quality by enlarging inspection coverage from the current 20% to 100% after full implementation
- ✓ Expect to largely reduce installation risk, saving quality control cost at nearly three million RMB annually
- ✓ Strengthen Daikin brand influence with superior installation quality and service
- ✓ Daikin Image Recognition Sprint 0 is the first machine learning implementation project in China, an encouraging case in IT innovation.

IT

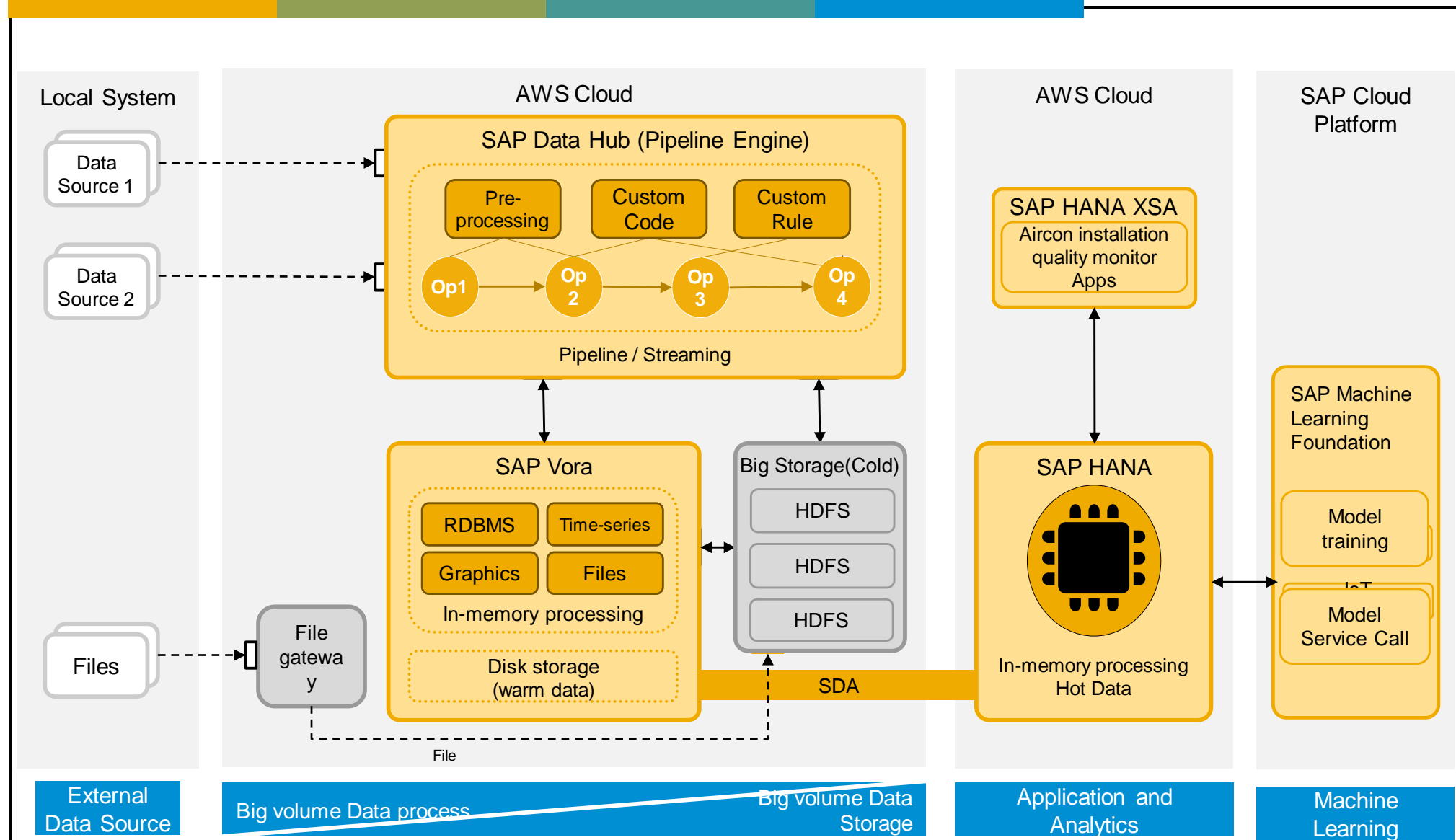
- ✓ Enhanced IT expertise and encouraged continuous innovation, with the breakthrough in machine learning development
- ✓ Gained valuable experiences in the field of deep learning neural networks, text recognition and OpenCV computer vision
- ✓ Enriched knowledge in SAP Cloud Platform and SAP HANA development, building up strong confidence in more innovation projects with SAP platform
- ✓ Enhanced IT importance in driving business value to support company success

Human Empowerment

- ✓ Able to release manpower from time consuming manual processes using AI, with efficiency gain equivalent to 120 human resource savings
- ✓ Improved workforce efficiency and productivity, with the intelligent system to detect most of the problems in the installation process



Architecture





Deployment

Date of Deployment or POC: 2018.12.28

Number of live users: POC Completion

SAP Technologies Used:

- SAP Cloud Platform(Cloud Foundry), Machine Learning Foundation, SAP S/4 HANA, Pre delivered Machine Learning model(Scene Text Recognition service in Machine Learning Foundation) , Customized CNN Model (Python & TensorFlow), OpenCV based image processing (Python runtime), fuzzy search service in HANA
- Image Recognition Sprint 0 project has been successfully delivered and accepted. Full deployment will be carried out after technical and commercial formalization.

Server Processor: Demo application deployed at SAP Cloud Platform (Cloud Foundry)

Linux Distribution: Demo application deployed at SAP Cloud Platform (Cloud Foundry)



Emerging Technologies and Use Cases

The following Emerging Technologies and use-cases are part of the project and describe the contribution

	Technology or Use Case	Yes/No	Contribution to Project
1.	Machine Learning / Artificial Intelligence	yes	Core technologies in the project is based on scene text recognition service in SAP ML foundation, CNN of Tensor Flow and OpenCV based computer vision
2.	IoT		
3.	3D printing		
4.	Blockchain		
5.	API Economy / Integrate the Intelligent Enterprise		
6.	Cloud Native / Event Based Architectures	Yes	Cloud Native Microservice Architecture is used for application development. Application is deployed and running on SAP Cloud Platform (CF)
7.	Extending the digital core with SAP CP / ABAP in SAP CP		
8.	SAP Leonardo Application (extending SAP application, using Industry Innovation Kits or result of Design Thinking workshop)		