

Technical Disclosure Commons

Defensive Publications Series

March 19, 2019

ADVANCED DIAGNOSTICS FOR PRINT/ SCAN

HP INC

Follow this and additional works at: https://www.tdcommons.org/dpubs_series

Recommended Citation

INC, HP, "ADVANCED DIAGNOSTICS FOR PRINT/SCAN", Technical Disclosure Commons, (March 19, 2019)
https://www.tdcommons.org/dpubs_series/2042



This work is licensed under a [Creative Commons Attribution 4.0 License](https://creativecommons.org/licenses/by/4.0/).

This Article is brought to you for free and open access by Technical Disclosure Commons. It has been accepted for inclusion in Defensive Publications Series by an authorized administrator of Technical Disclosure Commons.

Advanced Diagnostics for Print/Scan

Introduction

Printers are used for printing documents and photos. When a customer tries to print, and the print fails for any reason, he usually calls the support agents. These support agents then find out more about the problem, and advise the customer to download the print scan doctor (PSDR) which is a tool that is used for diagnosing and fixing print/scan problems. However, the effectiveness of the tool is about 60%. This means, there are still another 40% of the problems which do not have a fix. Additionally, running this tool requires a level of technical knowledge from customer. The current invention solves both these problems by using machine learning to predict solutions to problems, and automatically running those fixes on customer devices.

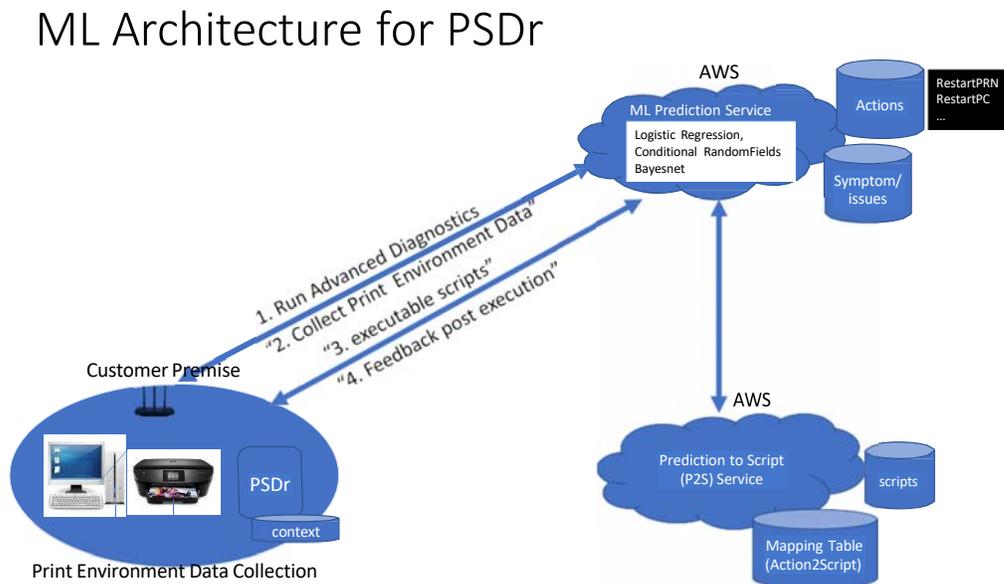
Solution

- 1) We have created a solution using machine learning which is trained with data coming from customer support agent log files. This training has enabled the model to predict solutions for problems for all the problems which are fixed by any support agent.
- 2) Secondly, the prediction from the machine learning model helps us identify a sequence of steps which when performed solve the customer problem. We have converted these steps (in natural language form) to actionable scripts (exes or dlls). Thereby, the output of our model is a set of scripts which can be directly executed on a PC.

How it works

Initially when the customer faces a problem with the print, our diagnostic software gets launched. Currently we are using PSDr as a launch pad for this software, though going forward, it could automatically get launched.

Refer to the architecture diagram below:



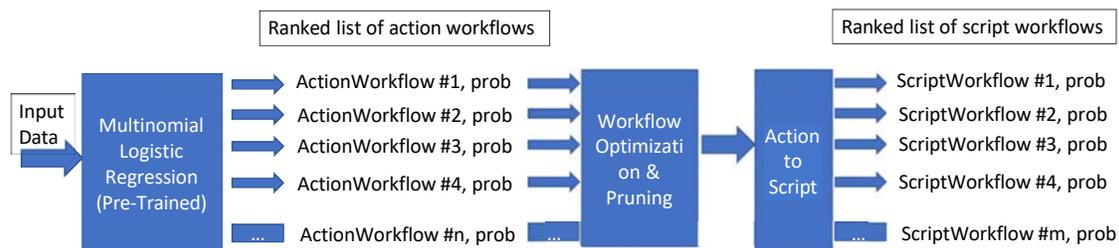
PSDR sends a request to the machine learning service (for this example, deployed in cloud). The machine learning service then sends a data collection executable (dll) to the PSDr.

PSDr runs this executable, which collects the relevant data from the network/PC/printer. It builds up an object (json or xml) which is then sent back to the machine learning service.

The machine learning service then uses logistic regression and conditional random fields to predict a sequence of steps for fixing the specific problem.

The sequence of steps is then passed onto the action2scripts service, which converts it into a set of actions. These actions are then sent back to the PSDr, which executes them and fixes the problem.

Machine Learning Service and Action2Script Service:



As we can see from the above diagram, the input data collected from the customer network is fed into the machine learning service. This is implemented using the Multinomial Logistic Regression which is trained using the customer support agent logs. The input variable for the logistic regression model is the support agent log fields, and the output variable is the action workflows. The action workflows are extracted from the problem log description available in the support agent logs. The output is ranked in the decreasing order of probability. The sequence of steps from logistic regression model is then fed into the workflow optimization & pruning module, which optimizes the workflow (removes unwanted steps, remove redundant steps, and builds a workflow).

This workflow is then fed into the action2script service which has a database of scripts and a mapping table that enables mapping between actions and scripts. Using this table, the service converts the actions into scripts. Then the script workflow is composed for the top ranked workflows (say m). This workflow along with the individual scripts is the sent back to PSDr.

Current Status

This work is in POR for PSDR, and is being released to customers in Mar'19. Hence, it is important to file disclosures at the earliest.

Related work

Many efforts are going on to apply machine learning to perform diagnostics. These are fuser failure rate prediction, predictive analytics and so on. But, they are not related to our work. In the industry, I don't see any equivalent at this time.

Advantages

There are many advantages to both the company and customers.

- 1) For the company, reduces support calls, and support agent visits, and thereby provides warranty savings. The printers become more reliable, since they print every time now.

- 2) Increases the overall effectiveness of our diagnostics software, thereby addressing more number of problems in the field.
- 3) As the number of defects that blocked print from happening are removed, more people will print, and thereby sales of print supplies will increase. This increases revenue and profits.
- 4) Enabling these fixes without any customer involvement is a great relief to the customer, and customer would start enjoying the print experience. This has the advantage of increasing stickiness.

Disclosed by Raghu Anantharangachar, Gaurav and Pavleen Kaur Brar, HP Inc.