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DEEPPRINT: A SOLUTION TO ENABLE CUSTOMERS TO PRINT THEIR CLOUD DOCUMENTS BASED ON VOICE INPUT

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DeepPrint : A Solution to Enable Customers to Print their Cloud Documents Based on Voice Input

The idea talks about DeepPrint which combines Machine Learning, Deep Learning, and Natural Language Processing to enable a rich user experience for Printer customers. DeepPrint takes as input a voice command from the user, identifies the correct document and sends it to the user's printer. This bridges a critical gap in voice-enabled printing by making it easy for the user to choose the correct document to print.

Cloud storage market (Google Docs, Dropbox, OneDrive, iCloud etc.) is expected to reach USD 88.91 billion by 2022 at an Annual Growth Rate of 23.7%. More and more users are choosing to store their documents on the cloud for ease of access. With millions of users also buying voice assistants, it becomes essential to enable the users to manage their cloud documents through voice assistants. Printing is an essential part of document workflow. Cloud storage solutions and voice assistants have well-defined interfaces which can be utilized to implement very valuable workflows. Currently, there are no solutions provided which enables users to use voice commands to select and print a document from their cloud storage based on voice input. Currently, the user must browse their documents to identify the document they want to print, select it and send it manually to their printer. Our solution enables a seamless experience for customers through a unique combination of Speech Recognition, Natural Language Processing and Machine Learning.

DeepPrint is machine learning solution hosted in the cloud. It will connect to the user's cloud document storage after the user provides access. DeepPrint creates a knowledge graph for every document in the user's cloud and for every new document that comes in. DeepPrint also connects to the user's voice assistant to provide a voice interface between the user's cloud documents and printer. Once the connection with the voice assistant is made, the user will be able to tell the voice assistant in natural language to print any of his documents. DeepPrint will use machine learning to identify which exact document user wants to print and sends that document to the user's printer for printing.

1. DeepPrint has two main components : a) Learning Engine and b) Document Identification and Printing

Learning Engine consists of 2 major modules: **a. Document Classification** and **b. Knowledge Graph creation**

Document classification uses Deep Learning to classify the type of the user documents on the cloud. Documents are classified into various categories such as flight itinerary, invoices, emails, official ID cards etc. This module will also be able to classify every new document that the user is uploading.

Knowledge Graph module extracts text from the documents and creates a graph representing the data contained in the document. Text data from documents are extracted through parsing (for text documents) or Optical Character Recognition (OCR) for image or PDF documents. A machine learning technique known as Named Entity Recognition is used to identify the key phrases from the documents and create a knowledge graph for each of the documents. Learning Engine workflow for a sample document is shown in Figure 1.

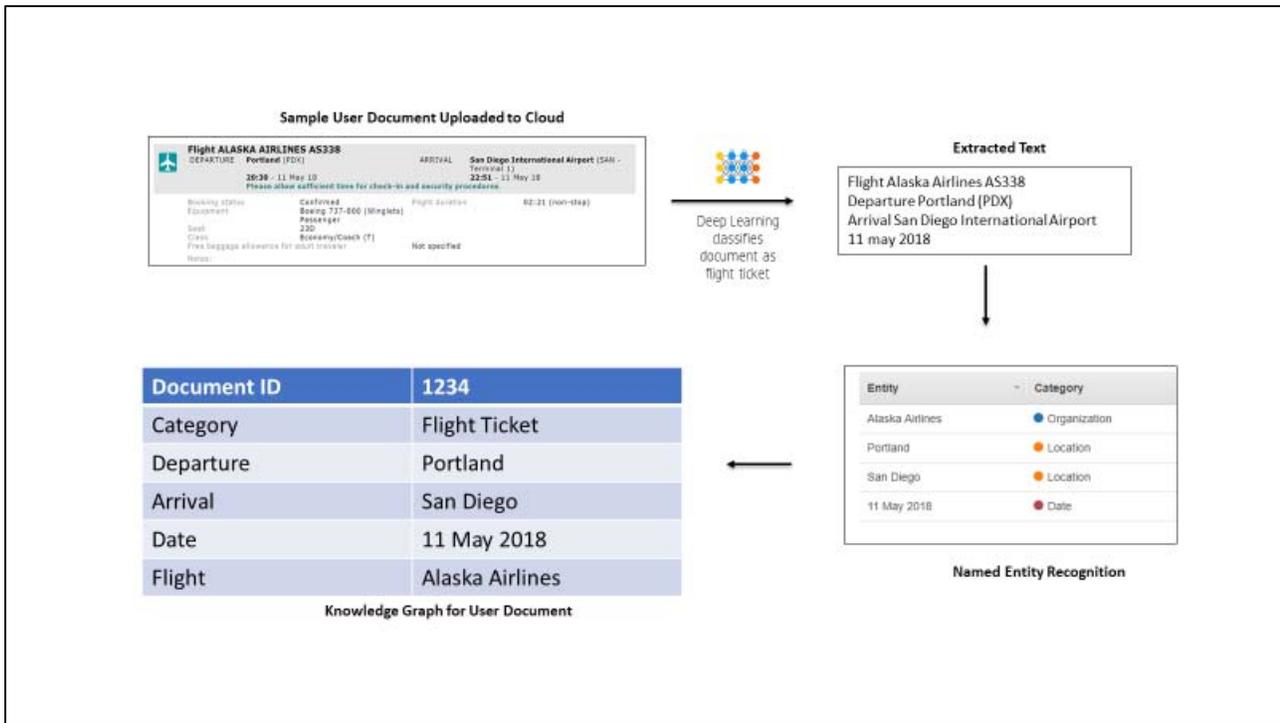


Figure 1. Learning Engine Workflow

The second part of our solution takes user’s speech command to voice assistant as input, identifies the document user is asking for and sends the right document to the user's printer. The detailed workflow of this module is shown in Figure 2.

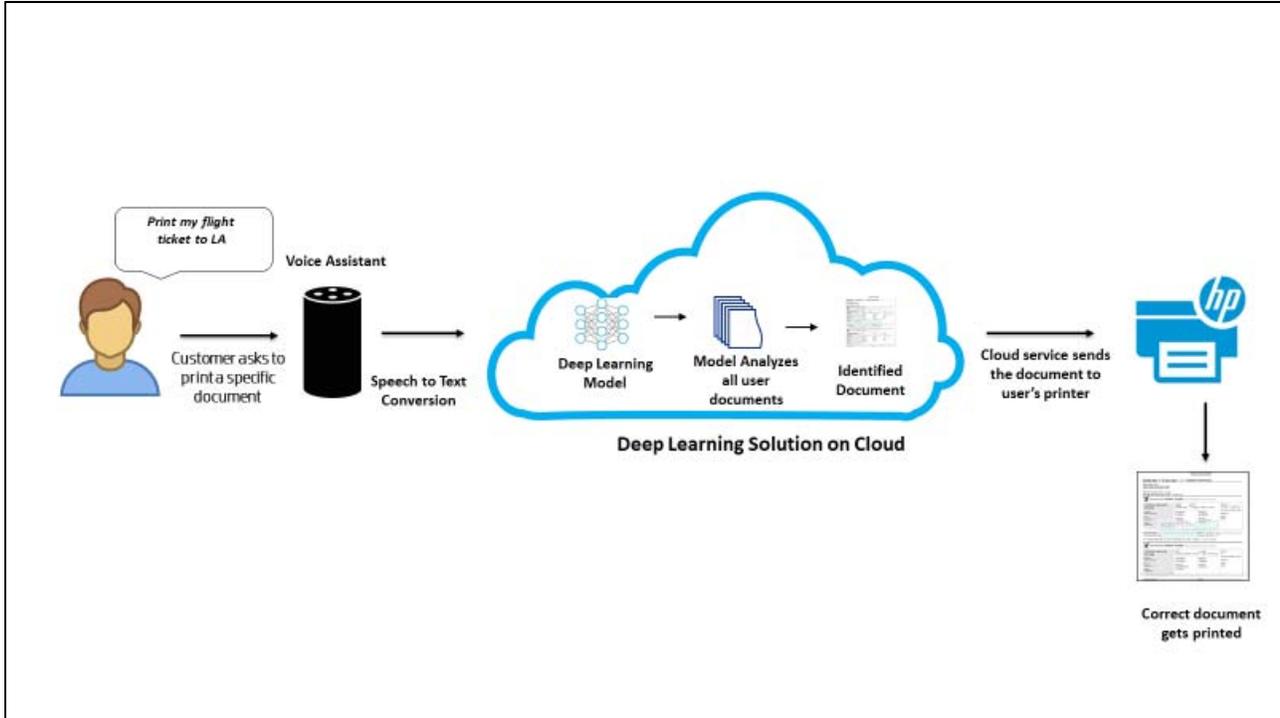


Figure 2: Document Identification and Printing

Our solution converts speech to text and the text query is converted to a feature vector to identify the category of the document the user is looking for. The query is then converted to a knowledge graph vector which can be used

to identify the exact document within the selected category. Our 2-level selection makes sure that our solution maximizes the chances for right selection.

Disclosed by Shameed Sait, Ambrose Rajendram and Rao Madhusoodhana, HP Inc.