

Car As You Go



Group Members

Daojun LUO

Jiayun XU

Jingyi CHEN

Lingyao LI

Zhijian ZOU

Executive Summary

A potential second-hand car buyer might face many challenges before his purchasing. What if he needs a car but he knows nothing about cars? What if he comes across a dream car without any information about it? What if he is attracted by some elements of a car that he himself cannot even tell?

Even if he knows well about his target, what if he is not satisfied with any single trading platform? What if he wants to compare a specific second-hand car with another?

Ten years ago, it would be impossible to address all those problems. However, thanks to the era we are living in, there exists an optimal answer for every single question listed above.

We developed a solution based on IBM Visual Recognition service. Our solution can be used for the typical case where a buyer uploads a car photo to our application, he can immediately obtain aggregated information across different second-hand car trade platforms.

In long-term, this solution can be extended to a fully functional website and mobile application on which buyers can gather second-hand car trade information by just taking a photo and a few clicks thanks to AI components. It is not even limited to the second-hand car market. Given the resources, all layers in the vehicle industry can benefit from the solution.

Introduction

The car business is encountering a technology evolution that will adjust the way vehicles are advertised and sold. The image recognition market is estimated to grow from USD 15.95 Billion in 2016 to USD 38.92 Billion by 2021, at a CAGR of 19.5% between 2016 and 2021. Advancements in machine learning and use of high bandwidth data services is fueling the growth of this technology. We perceived these moving elements and situated ourselves to exploit quickly changing buyer patterns.

Image recognition refers to technologies that distinguish places, logos, individuals, objects, and several other variables in images. Users are sharing vast amounts of data through apps, social networks, and websites. Also, cell phones outfitted with cameras are prompting the production of boundless computerized pictures and recordings. The expansive volume of computerized information is being utilized by organizations to convey better and more intelligent services.

Giant tech companies such as Alibaba and Google are the pioneers of image recognition. Alibaba Cloud Image Search helps users find similar or identical images. Based on machine learning and deep learning, the product enables end-users to take a screenshot or upload an image to search and find desired products and fulfill other search requests. Inspired by them, the main purpose of this report is to show a second-hand car dealer web application, on which car image recognition technology is applied.

Assuming that somebody is interested in finding out the detailed information of a vehicle, our application will provide him with all the possible information regarding the car so that he will be able to make more informed decisions. We will only choose a limited number of car models as our training set and testing sets, just to illustrate that the idea actually works.

Our solution applies IBM Visual Recognition technology to analyse the relevant car images and to identify meaningful attributes, such as brand, color and type etc. It leverages IBM's powerful Visual Recognition features, and it is supposed to improve over time as new data and concepts are introduced.

Problem Statement

Business Context

A classical buying decision-making process model is composed of five steps: recognition of unsatisfied need, information search, evaluation of alternatives, actual purchase decision and post-purchase evaluation. Buyers typically spend a significant amount of time in **information search** and **evaluation of alternatives** when they are making buying decision for a high-value products. In our case, we aim at facilitating these two steps for buyers who desire a second-hand car.

Despite the fact that various websites or agencies provide information to help buyers when they look for a second-hand car, buyers can get overwhelmed by the endless offers across different second-hand car trade platforms. Imagine a typical scenario that a second-hand car buyer comes across a car on the street, but he has no idea about the price if he intends to buy a similar one. If he is no expert in vehicles, he might even does not have the slightest idea of what brand and model the car is. At this moment, although his need for a similar second-hand car is triggered, he has no quick access to the information he needs. How can he get the detailed information and price for all possible alternatives as quickly as possible?

Technology Context

In the scenario we described above, in order to identify the car quickly, computer vision technology might comes in handy. All the buyer needs to do to identify the vehicle is to take a photo of it.

On the one hand, there are some websites specialising in image recognition service, and buyers are able to make the best of these websites to grasp the information they need about the car. On the other hand, none of them is able to integrate market information across different second-handed trade platforms with the basic detailed information about the vehicle itself for the buyers. Never mention the possibility of filtering all the information in an intended way.

To conclude, our solution aims at tackling three major problems throughout the second-hand car purchase decision process:

- 1 - How to identify a car and acquire the detailed information of the car when a potential buyer knows nothing about it?**
- 2 - How to access and acquire the market information about the car to the buyer?**
- 3 - How to enable the buyer to check and filter all the alternatives coming from different platforms?**

Methodology

To solve the problems we mentioned above, we propose to launch a business application which will finish both the image recognition and information aggregation.

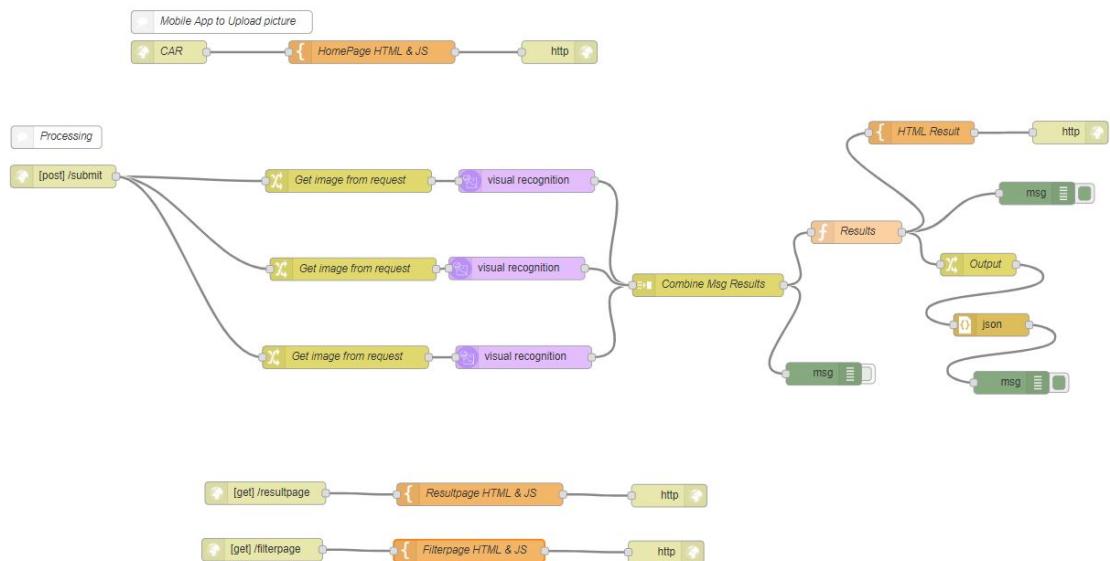
By launching such a business application, buyers will have easy access to all the information they need before making the final purchasing decision. Buyers will also be empowered to sort and filter the result as they want.

The application we propose will be demanding for both the service providers and the buyers. The services providers need to have access to the computer vision technology to correctly identify, label and search. They also need a large amount of server capacity to handle the possible requests and the vast amount of vehicle data. For buyers, the ability to take photo and upload the data in a fast and cost-efficient way will be essential. Luckily, both conditions are becoming more and more realistic with the rapid growth of artificial intelligence and telecom industry.

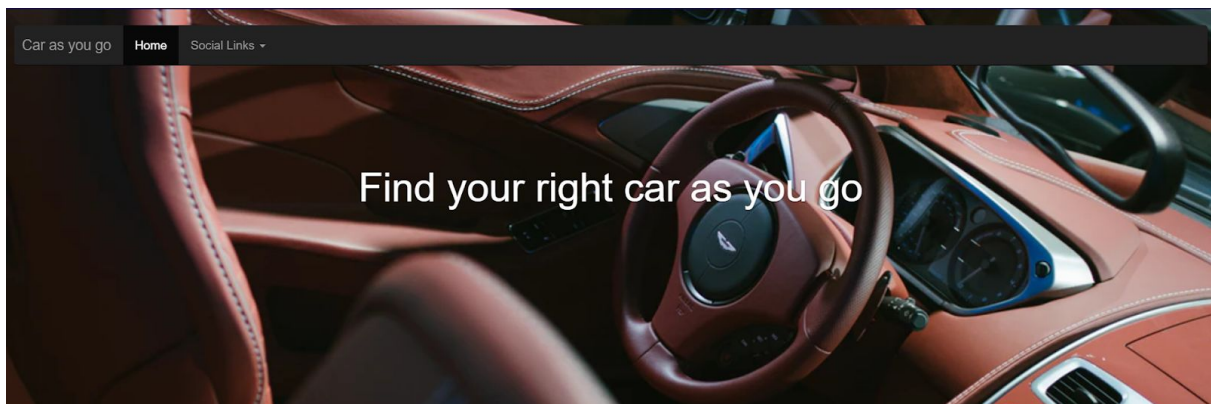
Thus, we made a relatively simple mockup using **Node-RED application** running on IBM Cloudary service, integrating **IBM Visual Recognition customized classifier**, the web crawler we wrote in **Python** and the web page we developed under the **standard framework of front-development**. The mockup has some problems regarding the data transmission between different units as the purpose of the mockup is solely to show the possibility of such an application.

The first step of a typical user case will be to take the picture of the target car and upload it to the website we developed. The system will then transmit the image to a bunch of classifiers we previously developed using the recognition service of IBM Watson Studio.

These classifier will output different labels that are most likely associated with the image. The labels will be shown to the buyer and the buyer has all the right to decide whether to keep or to drop a certain label. Using the labels selected by the buyer, Python script will come into play and crawl through all the target trade platforms and record all alternatives that shares the same labels. The result and relevant attributes (including photo, price, car model, color etc) will then be exhibited on the website. URLs will be provided to the buyer so that the buyer can check more on the certain websites if purchasing intention is triggered in any way.



Node-RED Flows powering the web application



Scan or upload the car you want by click on the button below

Home page

Scan or upload the car you want by click on the button below

选择文件 demo.png



Attributes	Labels	Include in Search?
Brand	Audi	<input type="checkbox"/>
Type	SUV	<input type="checkbox"/>
Color	BLACK	<input type="checkbox"/>

Labels identified after uploading a car photo

Search Result

We find these cars that matches your interest

[Back to Home Page](#)

Car Brand:Audi Q5 Tdi Quattro S Line Plus [177] (BLACK OPTICS !! BIG SPEC ...

Color Black

Type: SUV

Price: GBP 21,995

[Link to page](#)



Search result on second-hand car market

Findings

After building the mockup of our business application, we find that in order to provide our customers with a more friendly and efficient second-hand car recognition and aggregation tool, more features should be included.

We would like to conclude our business findings in this part as the following points. First, even if the car recognition service can probably provide you with the core information like model, color and brand, there are tons of information that any VR classifier are not able to recognize. However, these unrecognized information can be fairly important during the decision making process of the buyer.

Thus, **advanced search tool** should be added. our added search tool feature will let you select more filters than simply the model, colour and brand. It allows you to filter your results based on fuel type, dealer type, kilometers driven and all other specifications. For example, do you want a car with a navigation system? You'll be able to merely check the box for your required functions and the result will return to you.

Also, despite the fact that our crawling significantly reduce the time that buyers spent on searching, there is a high possibility that the buyer needs a more **in-depth comparison tool**. Imagine a buyer is interested in multiple second-hand vehicles on different platforms, we should offer them the tool to compare directly all the available technical specs that are posted on the platforms. The buyer only needs to provide us with the links of the vehicles that he is interested in, and we will direct him to the page where a comparison table is made for all the links we receive. It shall help the buyers to make more informed decisions. You can also see how long a vehicle has been listed on the site, and how its list price has changed over time. This gives you negotiating power on cars that have been listed for a while, or lets you know when it's too soon to ask for a big price cut.

Our website should allow buyers to save their **favorite cars and search history** when choosing between different vehicles, and each search result provides a handful of images detailing the condition of each car.

In addition, our aggregation result should also include **news, updated blogs and several other resources** aimed at giving your newest insights on second-hand car market. Buyers can also find online shops where they can buy additional equipments such as small in-car refrigerator.

Our home page should also feature **buying guides**, **checklists**, and **advice**, as well as on **negotiation tips**. We shall provide you specific guides for a selection of car makes and models, along with comprehensive car reviews and a compilation of frequently asked questions. Expert and consumer reviews are also available, along with options for finding local dealers and checking the credit scores.

Discussion

In this part we would like to further discuss the technical obstacles that we encounter during the developing stage of the demo and the business obstacles we expect the application will come across.

Technical setback and possible solution:

While we decided that both computer vision technology and search-engine-like crawler should be combined in this business application, we did not expect the most complex part to be the integration of these two. Restricted by the expertise of our team member and limited time span, we did not solve the integration problem at the end of the project.

We chose to use the recognition service of IBM Watson Studio, build the whole front-end process on Node-Red and achieve the crawling script in Python. The integration of recognition service and front-end website was smooth since both of them are indigenous to the Watson Studio. However, the problem arose when it came to the integration of the crawler script.

We tried several ways to integrate the script into the Node-Red structure, including uploading the local script and writing the jupyter notebook in Watson-Studio. None of them worked out.

In our opinion, given enough time, we will redevelop the whole system in an independent local python framework. We will use Django to finish the development of the front-end. Watson Studio also offers remote API for classifiers in image recognition. After finishing the whole demo, we will host it on an online server.

Business obstacles and discussion:

Computer vision technology, as one of the most widely known fruit of artificial intelligence, are applied to multiple areas including public security, public transportation management, automatic driving system and etc. Its reputation has determined that it can be understood and replicated easily.

As the business application of artificial intelligence, we does not have any strong entry barrier and competitive advantage comparing with our potential rivals. The other part of our technology, crawler, requires an advanced searching algorithms and considerable server capacity. Without the support of giant technology companies, we, the startup, may become very fragile in the possible market competition.

Thus, we propose the three possible solutions to fight our way out.

1. To develop and launch more content related functions like we described in the finding part. By testing the market response of certain functions, we should make the best of being the few first players in the market and build a large and loyal user base.
2. To build partnership with the mainstream trading platforms. Since we collect and aggregate the information from different trading platforms while we have no direct competition with these platforms, establishing a long-term partnership with them could be a wise choice so that we will have lower cost and more accurate information than our rivals.
3. To cooperate with onsite car repairing and maintenance shops. While the majority of those brick and mortar shops seldomly do any online advertisement, they have a fast and reliable information access to local vehicle information. By cooperating with them, we will quickly acquire more users with a low cost.

Another business obstacles that we would like to discuss is related to the monetizing model of our business application.

As a vertical search platform, the way we profit is limited. In the short term, we would have to spend quite a fortune to build our server and hire experts to maintain the platform. And with a small number of users, the platform will be very likely to lose money in the first several months or years.

If the vertical search platform make through the fierce competition and excel in its area, the profits are most likely limited to redirecting users to other trading platforms and making advertisement for car related entities. There is also a fat chance that the technology giant will come into the play and acquire the startup, which might not be the worst result for both founders and investors.