For the 1st edition of

MACHINE LEARNING PROJECT COMPETITION
PROJECT: CAMEROON LICENSE PLATE RECOGNITION

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Introduction

Automated license plate recognition is a technology used to identify vehicle license plates through the use of detection techniques and characters/strings recognition's techniques. This technology is used in several countries such as Morocco, Egypt, South Africa, countries of the European Union. They are used in these countries for several applications including:

- Border crossings ;
- Access control for car parks or private roads: automatic opening, or entry registration
- A marketing tool to record consumption patterns;
- Traffic management systems to ensure that motorists obey the rules of the road and drive in a responsible manner.
- Compare license plates to the Stolen Vehicle Register

They thus make it possible to automate and facilitate several police tasks. But the specificity of these systems is that they are local to the countries because they strongly depend on the principle of registration used in the country (plate color, number of characters for certain systems ...). Our work for this project was to develop a system for recognizing license plates specific to Cameroon in order to solve a local problem of non-compliance with traffic regulations by many motorists, which is the cause of many accidents..

Followed Method

The approach followed to implement the solution is as follows:

- The understanding of the problem
- Data collection, cleaning and annotation
- The construction of the model
- The test of the model

The understanding of the problem

During this phase it was a question of determining which category our problem fell into. It was found that the given problem fell into a two-phase AI problem:

- Firstly the detection of the license plate (since when the camera captures a car the location of the license plate would have to be located).
- Secondly the recognition of the text written on the plate (just the registration number)

Data collection, cleaning and annotation

Data collection

Since the problem of license plate recognition is a rather local problem (depending on the background colour and handwriting of the plate as well as the police), we had to collect different pictures of vehicles with Cameroonian license plates on them. These photos were taken in car day-care centres, on the way, in petrol stations... for a total of nearly 240 photos (which is really low).

Data cleaning

After the collection of the various photos, it was necessary to identify and remove all those that could cause problems (duplicates, photos of cars without license plates on them, very blurred photos ...). At the end of this cleaning, 218 photos were selected as usable.

Data annotation

The last phase concerning the data is the annotation. In order to be able to apply various plate location algorithms, it was necessary to annotate the different photos collected. For this we used the LabelImg software which allows us to annotate the boxes of interest and to keep them in xml files in Pascal VOC format.

The construction of the model

The model had two phases:

- The detection of the plate
- The recognition of text on plates

The detection of the plate

With the small number of plates acquired, directly applying a plate detection algorithm would result in too low an accuracy and therefore unusable. We therefore opted for transfer learning using pre-trained models to detect the shapes. We preferred to use the RCNN models present in Detectron2 and then re-trained these models from our plates so that they could detect them. The working environment was Google Colab and we performed 3000 iterations. The precision obtained by evaluating the algorithm with the test data (20 percent of the total amount of data) was 80.25 percent (due to the low quantity of data).

The recognition of text plates

This has been the hardest part of the job. The goal being to recognize the text on the license plates, we thought first of all to use character segmentation and then character recognition on each of the segmented characters (segmentation done by image processing): thresholding by the OTSU method and then edge discovery by the Canny Edge method or and handwritten recognition algorithm). Moreover this method in real life is reduced to failure because the photos taken can have a lot of contrast, can be distorted, oblique ... thus biasing the segmentation and / or character recognition.

Finally in order to recognize the texts on the plate, we proceeded to implement a kind of OCR allowing to read texts on images. Our architecture was inspired from the article.
We opted for a CRNN (Convolutional Recurrent Neural Network) model which is known to have very good results in this task.

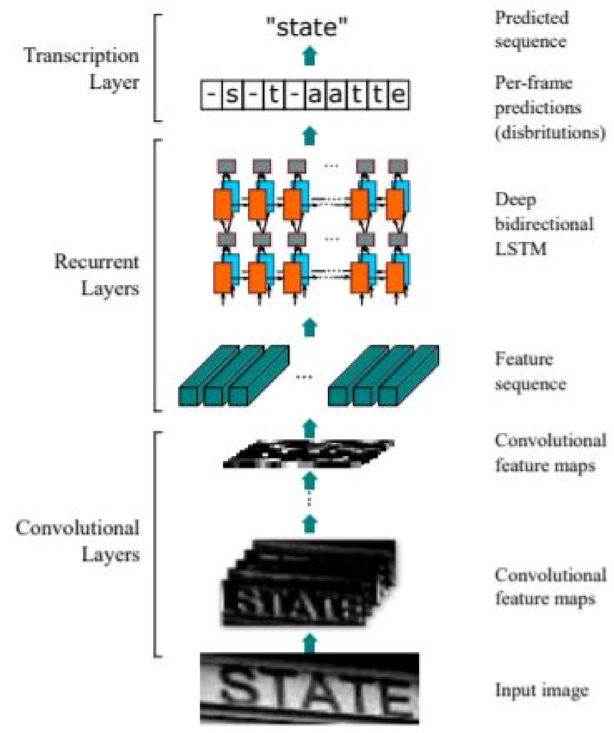

Figure 1: CRNN model

CRNN is an architecture created to solve the problem of reading text on a wilderness background. It has been trained with more than 9 million images of text written in English (https://www.robots.ox.ac.uk/ vgg/data/text/) and has a 93 percent rate on this dataset.
So since this architecture works well with texts on real backgrounds, we assumed that it could also work well with ours. So we proceeded to implement this architecture but we couldn't use our dataset on this one because it was too small.

Results

After implementation, the results were also not very good (because of the difference in distribution) but for most plates, at least 4 to 5 characters were predicted correctly but the algorithm inserted for almost every plate a first character which doesn't exist. Below is an example of a case test which lost :

Figure 2: a character was inserted

Improvements

Given the problems with the results, we thought of some strategies to improve the algorithm: change the annotation of the plates to take only the part of the plates that has the letters and considerably increase the number of plates in order to be able to do a transfer learning on the RCNN algorithm or to implement (if the plates are in really large quantities) only with our data.

Conclusion

At the end of our study, it appears that our license plate recognition project is a two-step project: plate detection and plate recognition. The presented plate recognition algorithm still has bad results for the moment due to the letters added mainly. In order to overcome this problem, our next goal is to collect about 10000 pictures of registered cars in order to increase the accuracy of our algorithms to 98% (state-of-art value of the algorithm implemented with Chinese license plates).

References

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