

# Research License Plate Recognition

## Version History

Version	Date	Author(s)	Changes
1.0	March 2021	David	First draft
2.0	April 2021	David,Florin	Added options
2.1	23 April 2021	David,Florin	Improved document based on feedback

## Introduction

For the parking app, once a visitor enters the parking lot they should receive a text. In order to know who the text needs to be sent to, their license plate will be used. With the footage received from a camera on-site the license plate should be detected. We are researching an option which can be integrated into our application, can be customized to fit our needs, as well as being free

## How are license plates recognised?

After our application receives an image, firstly a plate must be located. This can be done by searching for a yellow area and checking the dimensions of a license plate. After, a form of character recognition must be used to turn the image into a string we can use.

## What are the ways of doing this?

Because it is not reliable or practical to have a person on-site reading the license plates, and because we have a camera at our disposal, it is more practical to make use of Artificial intelligence or the subset of it known as machine learning.

Methods from the DOT framework used:

- Library method: researching available options, seeing what is popular and the relevant work of others in this field. Also going into the documentations of analyzed choices and deciding if it is a good fit for our needs, verifying that our constraints are not violated.
- Lab method: using the application and seeing if it is a good fit for our project

# 1. Artificial Intelligence

## What is artificial intelligence?

Artificial intelligence refers to any human-like intelligence exhibited by a machine. It can be used to make decisions, solve problems, understand and respond to language, recognizing objects and many more actions. Today, AI is part of our everyday life which is possible due to the more advanced computer systems that can process data faster than humans. (IBM, 2020) Within AI, there are 2 subsets known as Machine Learning and Deep Learning.

## Why is Artificial Intelligence a good option?

Artificial Intelligence takes less time to create, and is great for repetitive jobs such as this one. (Kumar, 2019)

# 2. Machine Learning

## What is Machine learning?

Machine learning is a subset of AI that learns by itself. It actually reprograms itself as it takes more data to perform the design task which will increase the accuracy. (IBM, 2020)

## Why is Machine learning a good choice?

Machine learning doesn't require human intervention, can continuously improve and easily identifies patterns. (Data flair, 2021) However, it does take extensive time and data. (Williams, 2021)

# What are the options?

## 1. JavaANPR

### What is JavaANPR?

JavaANPR is an automatic license plate recognition application made with maven and Java. It is tailored with patterns found in slovakian plates. By altering these patterns the application can be changed to recognize dutch license plates. JavaANPR makes use of AI.

Given the fact that the project is available for free on github with the source code and the fact that it is a person's bachelor thesis, we can read his document to gain better insight on how to modify the code to match our needs.

Because it is also a maven project we can easily combine and add a dependency in our own project to make use of the functionality

Github Repository: <https://github.com/oskopek/javaanpr>

Full Documentation: <http://javaanpr.sourceforge.net/anpr.pdf>

- Pros: Does all of the heavy lifting, and has a how-to file making it easy to use.
- Cons: There is no documentation on what types of license plates it will work on so the application will have to be tested and modified if it doesn't work on Dutch plates.

## 2. Wpod-net

### What is Wpod-net?

Wpod-net is a pre-trained machine learning model that excels at segmenting images to retrieve license plates. This ECCV paper from 2018 shows in detail how it works:

[https://www.ecva.net/papers/eccv\\_2018/papers\\_ECCV/papers/Sergio\\_Silva\\_License\\_Plate\\_Detection\\_ECCV\\_2018\\_paper.pdf](https://www.ecva.net/papers/eccv_2018/papers_ECCV/papers/Sergio_Silva_License_Plate_Detection_ECCV_2018_paper.pdf)

### Why is Wpod-net a good choice?

Because the model is pre-trained this could save us lots of time collecting data and letting the model learn. However, it only crops the license plate and does not return a string. A module such as OpenCV can be used to fix this as it can recognize characters from a given image.

OpenCV (Character segmentation and recognition)

Full documentation and tutorials: <https://docs.opencv.org/master/>

- Pros: Supports Java, free.
- Cons: None

## 3. PLATEbber

Official Website: <https://www.de-vis-software.ro/license-plate-recognition-api.aspx>

### What is PLATEbber?

PLATEbber is a REST API which takes a still image and some optional settings such as language code and returns a JSON string of the license plate. (PLATEbber, 2021)

### Why is PLATEbber a bad choice?

PLATEbber would be a bad fit for our project because we cannot see what technologies were used to create the api and recognition software. This is not ideal because there would be no way to tailor the application to our specific needs, or to fully understand it. Although we tried implementing it, we decided to drop it because if it ever stopped running, working or we ran out of the 7 day free trial then our project would need a replacement. Because PLATEbber is such a bad fit for our project we won't be taking it into further consideration.

## 4. OpenAlpr (OpenAlpr, 2021)

OpenAlpr was by far the choice with the most documentation available. They have in-depth explanations that allow their application to integrate to almost all possible systems. The app can apply the recognition software to still images, videos and live footage from cameras. Also they provide their own interface so you can use their application standalone. Conversely they also provide an API so you can integrate all the functionality into your own app and adjust it accordingly. (they have data bindings for most programming languages including Java)

The disadvantage is in their cost. If we were to choose this option there were choices that fit our project needs:

### Rekor Scout (OpenAlpr, 2021)

For 5 euros a month it allows a connection directly to a camera which will send data to their interface dashboard. However this is not what we need so we would have to purchase the commercial license for 50 euros a month in order to use their StreamApi that can be integrated into our application and also process a video at the same time.

We tried to implement this application with the free trial where we could use all the functionality, but this is not a good approach for the long term as we would need to keep making accounts for free trials.

### RekorCarCheck (OpenAlpr, 2021)

For 30 euros a month we would have access to their web based API that analyzes still images. That means our app would need to constantly send them screenshots to get back a JSON file with the car information in return.

A free open source version of OpenAlpr also exists but in order to use it we would have to install a lot of external software for it to work making the process more difficult for us than other available options. The documentation for this free version is also not enough for us to be able to modify the source code to fit our needs.

## Conclusion

All in all, between artificial intelligence and machine learning, both could work for our project, but because artificial intelligence takes significantly less time and data it is better for our project. Using the specified Java Anpr mentioned earlier which makes use of AI is our choice for this project based on its ease of integration into our app, customizability and cost.

## Bibliography

- Data flair. (2021). *Advantages and disadvantages of machine learning*. Data-flair. Retrieved 3 15, 2021, from <https://data-flair.training/blogs/advantages-and-disadvantages-of-machine-learning/>
- IBM. (2020, 6 3). *What is Artificial Intelligence*. IBM Cloud Learn Hub. Retrieved 4 13, 2021, from <https://www.ibm.com/cloud/learn/what-is-artificial-intelligence>
- Kumar, S. (2019, Nov 25). *Advantages and Disadvantages of Artificial Intelligence*. towards data science. Retrieved 3 15, 2021, from <https://towardsdatascience.com/advantages-and-disadvantages-of-artificial-intelligence-182a5ef6588c>
- OpenAlpr. (2021, 4 11). *Document*. Rekor Ai. <https://docs.rekor.ai/getting-started>
- OpenAlpr. (2021, 4 11). *Rekor Carcheck*. Rekor Docs. <https://docs.rekor.ai/rekor-carcheck>
- OpenAlpr. (2021, 4 11). *Rekor Scout*. Rekor Docs. <https://docs.rekor.ai/rekor-scout>
- PLATEbber. (2021, 3 29). *License Plate Recognition API*. de vis software. Retrieved 3 29, 2021, from <https://www.de-vis-software.ro/license-plate-recognition-api.aspx>
- Williams, L. (2021, Feb 20). *Pros and cons of machine learning*. 7t. Retrieved 3 15, 2021, from <https://7t.co/blog/what-are-the-pros-and-cons-of-machine-learning/>