

# License Plate Recognition

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# Abstract

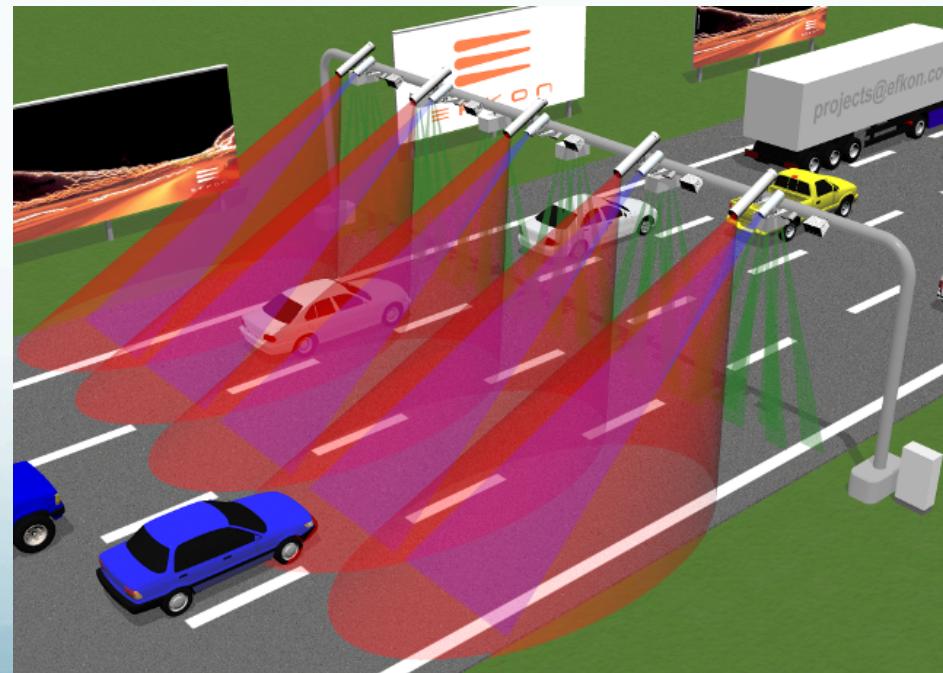
This study aims to simulate an automatic plate recognition system (APR) and will evaluate different techniques of image enhancement to improve the character recognition. For each application, the complications and its characteristics problems are analyzed. For example the angle of the cameras and the quality of the images change from one application to another, some images can be blurry (especially motion blurry), or an object obscuring, such as dirt or fog, can be on plate. In order to recognize the plate, the system firstly enhance the input by using two linear filters: Laplacian of a Gaussian and Sobel. Secondly it extracts the plate location, separate the plate characters individually by segmentation and finally apply template matching with the use of correlation for recognition of plate character. The system was evaluated empirically; one hundred images were tested and for each enhancement algorithm the accuracy was measured. The experiment demonstrated that the background and the image condition modified the final result and that the Laplacian of Gaussian presents the best result.

# Agenda

- Problems and Applications
- Technical Approach
- Results and Analyses
- Demo
- Conclusion and Future work
- Q&A

# Problems and Applications

- Automated toll collection
- Road rules enforcement
- Tracking stolen cars
- Parking control system



# Technical Approach

Image Acquisition

Image Enhancement

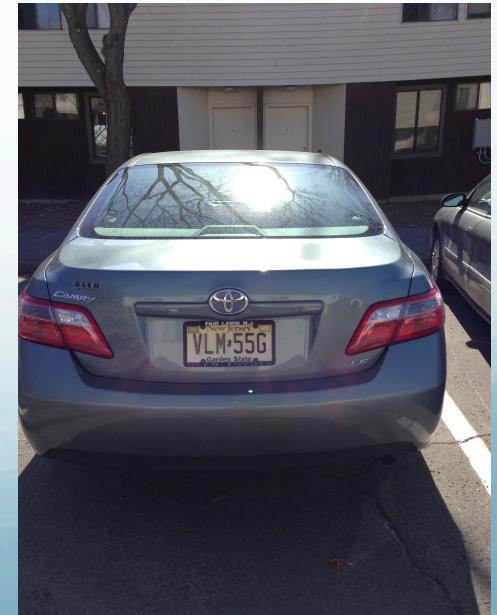
Plate Localization

Character segmentation

Optical Character Recognition

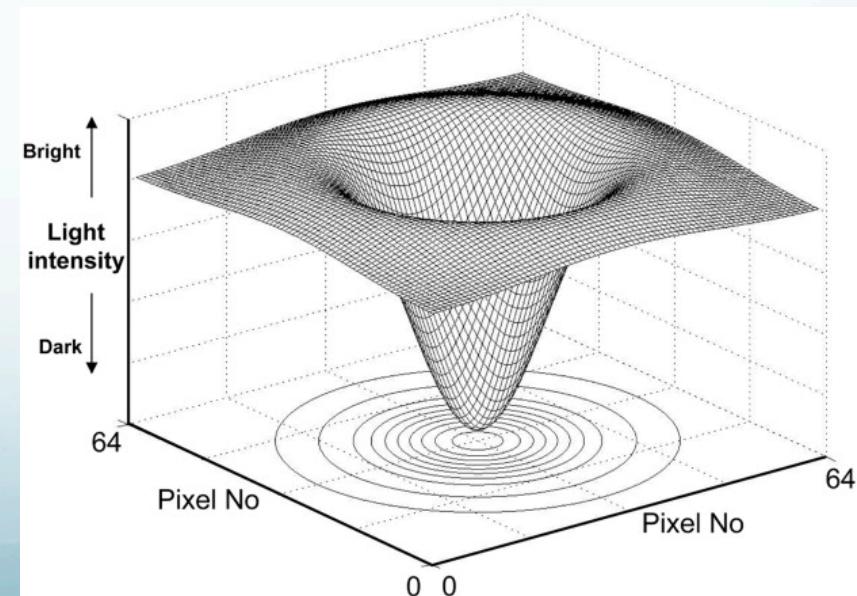
# Image Acquisition

- Fixed position is ideal for recognition
- The light condition changes the results
- The distance i.e. plate to rest the of the image ratio
- All three aspects were considerate, however a fixed set is used for demonstration



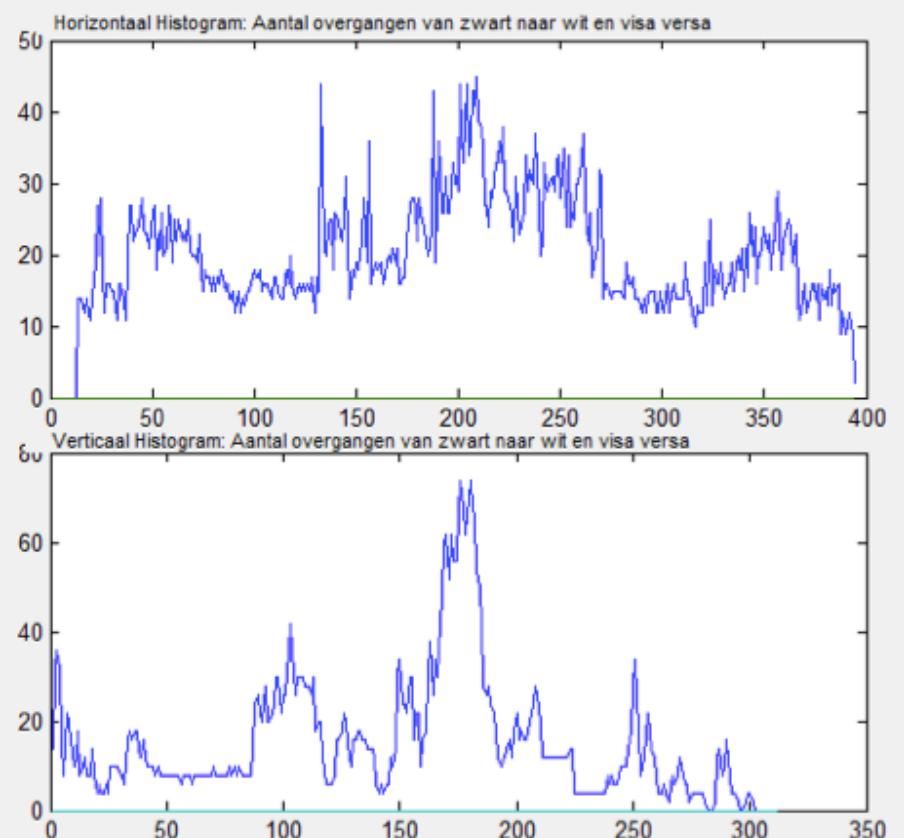
# Image Enhancement

- Edges enhancement
- Noise reduction
- Improve luminosity in the plate area
- Two techniques were used:
  - Laplacian or Gaussian
  - Gaussian->Sobel



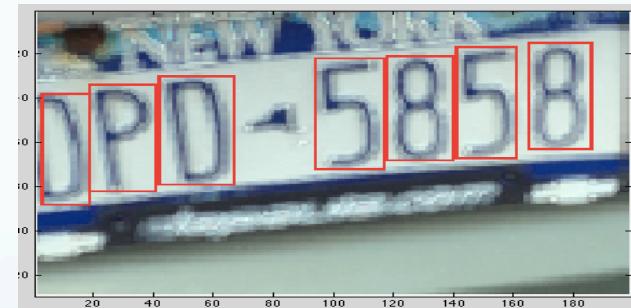
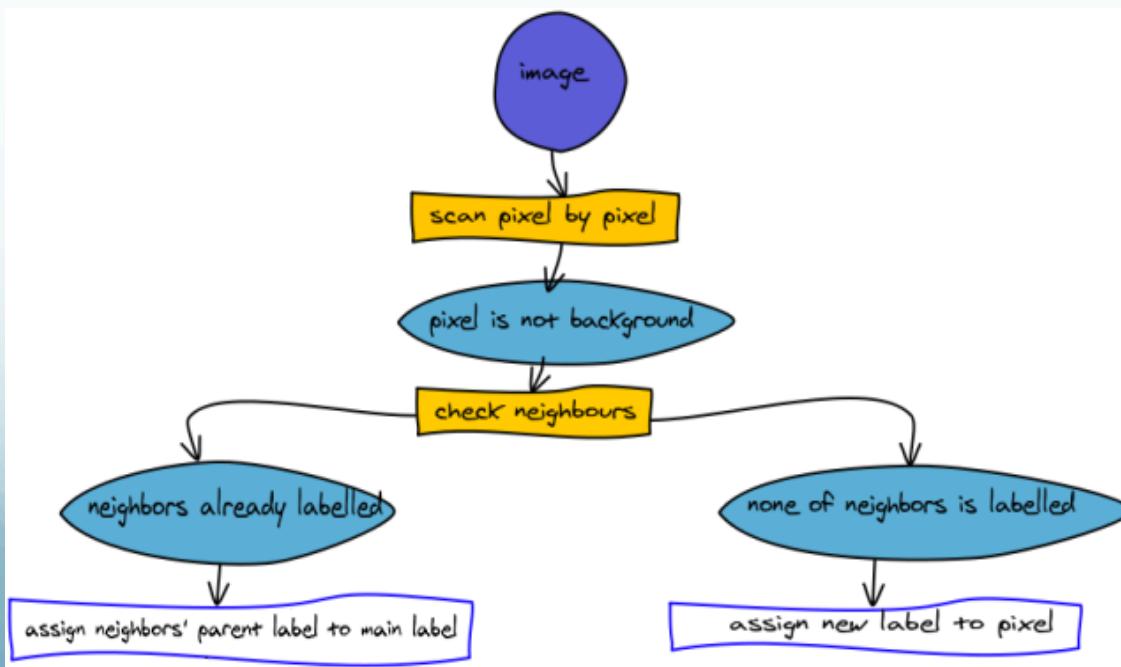
# Plate location

- Most difficult task
- Assumptions had to be made
- Application Specific
- Two techniques
  - Smearing
  - Edge Histogram



# Character Segmentation

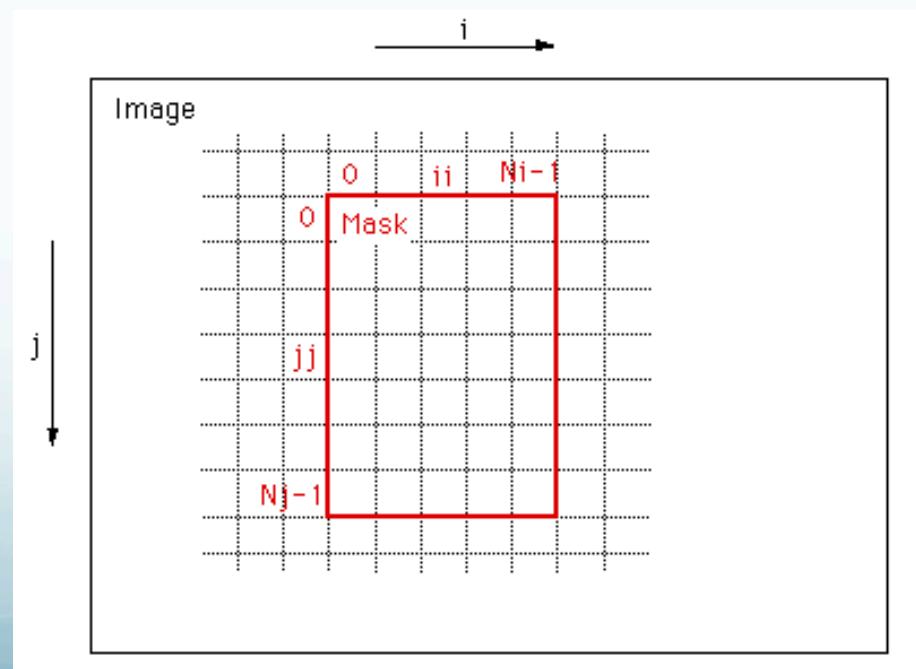
- Separate each character -> Erosion
- Connect component -> bwlabel
- Select the components based on size and position



# Character Recognition

- A template with the letters
- Improve the letter using dilatation
- Binary inversion
- Correlation

W      H      E  
Z      K      G



# Result and Analyses

- The results vary a lot depending on the image
- The Laplacian of Gaussian was the best enhancement technique
- The correlation works for most of the cases, however when the letter is very deteriorated it may fail.

# Demo

# Conclusion and Future work

- License plate recognition is a very hard task. Many factor changes the final results.
- It's almost impossible to do one system that works in every situation.
- As a future work the smearing technique should be improved. Other techniques, such as Hough transform and Contour algorithm should be implemented. And the effect of motion blur should be analyzed.

# References

- [1] <http://users.utcluj.ro/~rdanescu/proiecte/01-licenseplate.pdf>
- [2] [http://pdf.aminer.org/000/349/486/gray\\_scale\\_character\\_recognition\\_by\\_gabor\\_jets\\_projection.pdf](http://pdf.aminer.org/000/349/486/gray_scale_character_recognition_by_gabor_jets_projection.pdf)
- [3]  
[http://ac.els-cdn.com/S0167865505001406/1-s2.0-S0167865505001406-main.pdf?\\_tid=acdf9518-8985-11e2-adb3-00000aacb35f&acdnat=1362921979\\_902d579f2e482404e4439330e451c25b](http://ac.els-cdn.com/S0167865505001406/1-s2.0-S0167865505001406-main.pdf?_tid=acdf9518-8985-11e2-adb3-00000aacb35f&acdnat=1362921979_902d579f2e482404e4439330e451c25b)
- [4] <http://www.itfrindia.org/ICCIC/Vol2/9024ICCIC.pdf>
- [5] [http://ieeexplore.ieee.org/xpls/abs\\_all.jsp?arnumber=413580](http://ieeexplore.ieee.org/xpls/abs_all.jsp?arnumber=413580)
- [6] <http://vortex.cs.wayne.edu/papers/ijns1997.pdf>
- [7] [http://www.win.tue.nl/aime/Files/apr2002\\_license.pdf](http://www.win.tue.nl/aime/Files/apr2002_license.pdf)

# Questions?

