

Car License Plates Detection and Recognition

– AI Lab team –

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Our team: AI Lab



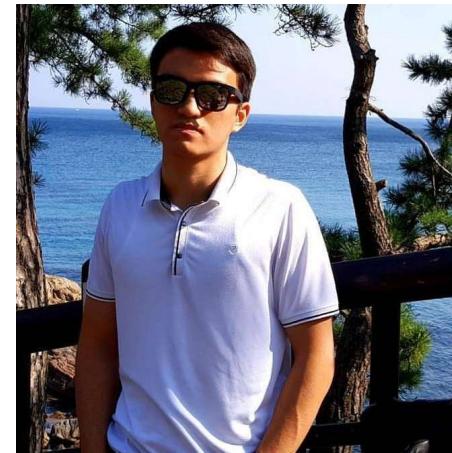
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22182204



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Javokhir Nazarov

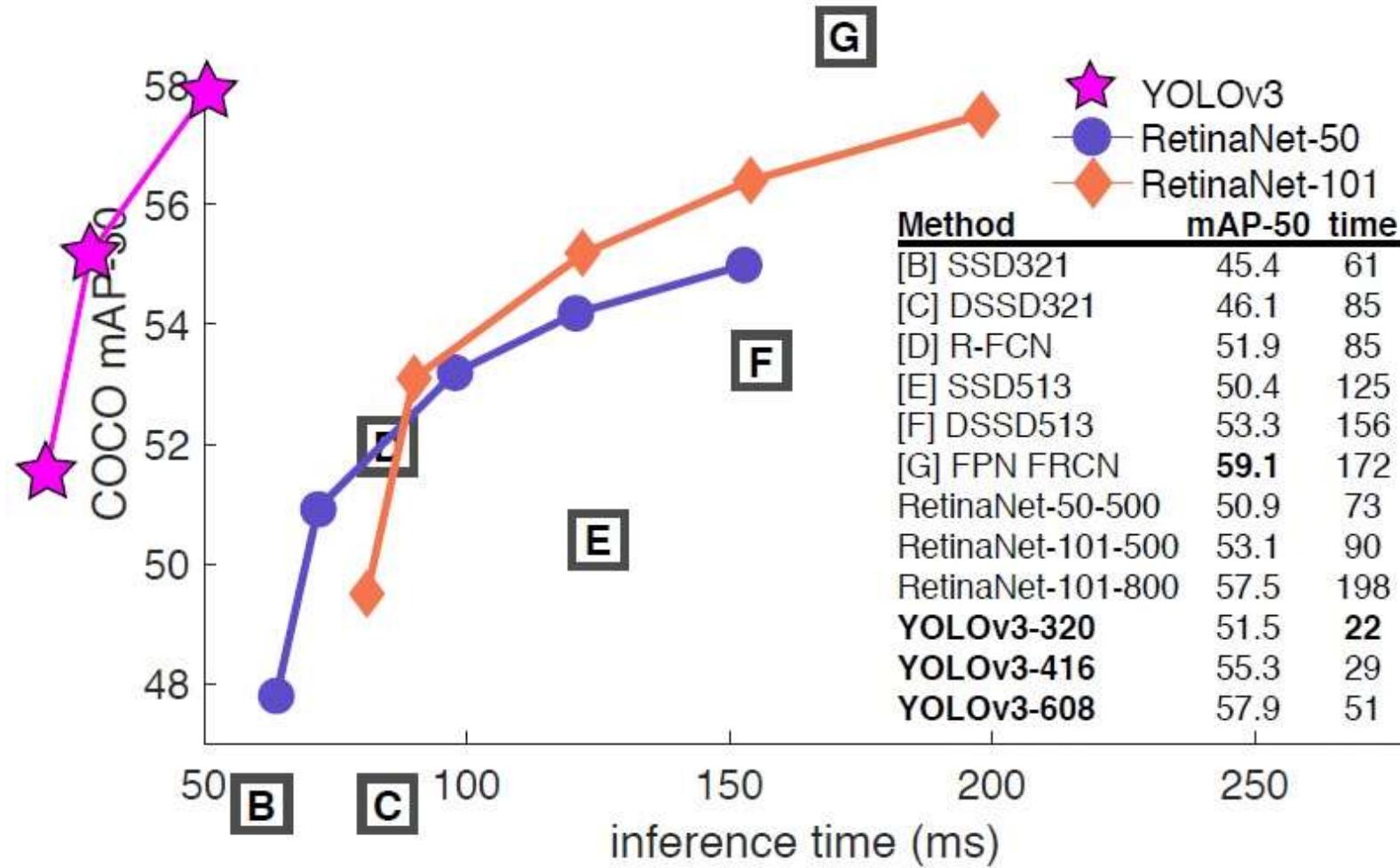
22182210

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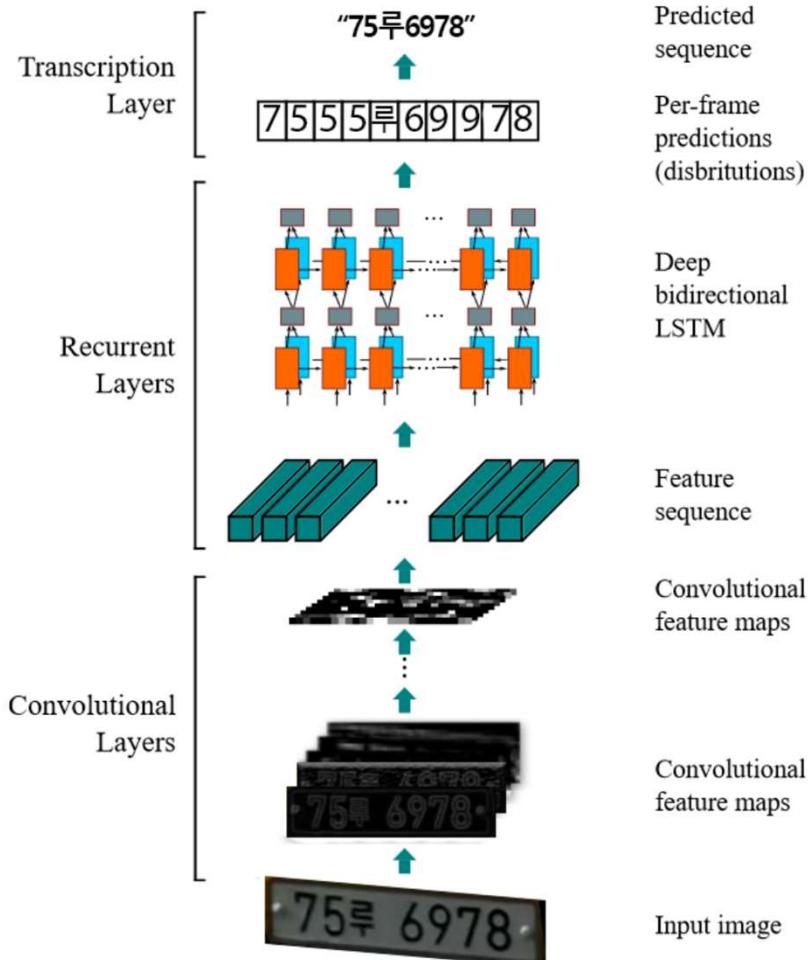
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MODEL SELECTION

Detection - YOLOv3



Recognition - CRNN



- **Convolutional Layer**

Extracts features through CNN Layer (VGGNet, ResNet ...).

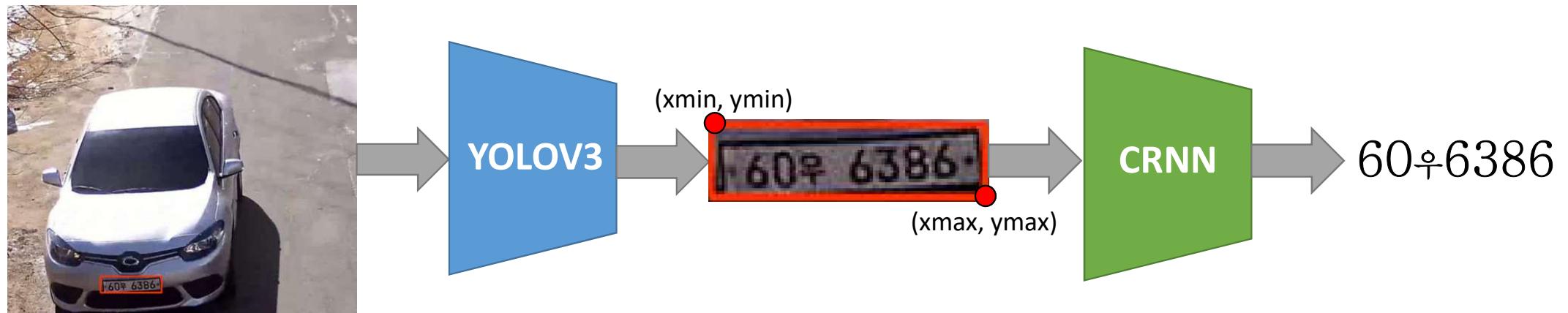
- **Recurrent Layer**

Splits the features into a certain size and inserts them into the input of the Bidirectional LSTM or GRU.

- **Transcription Layer**

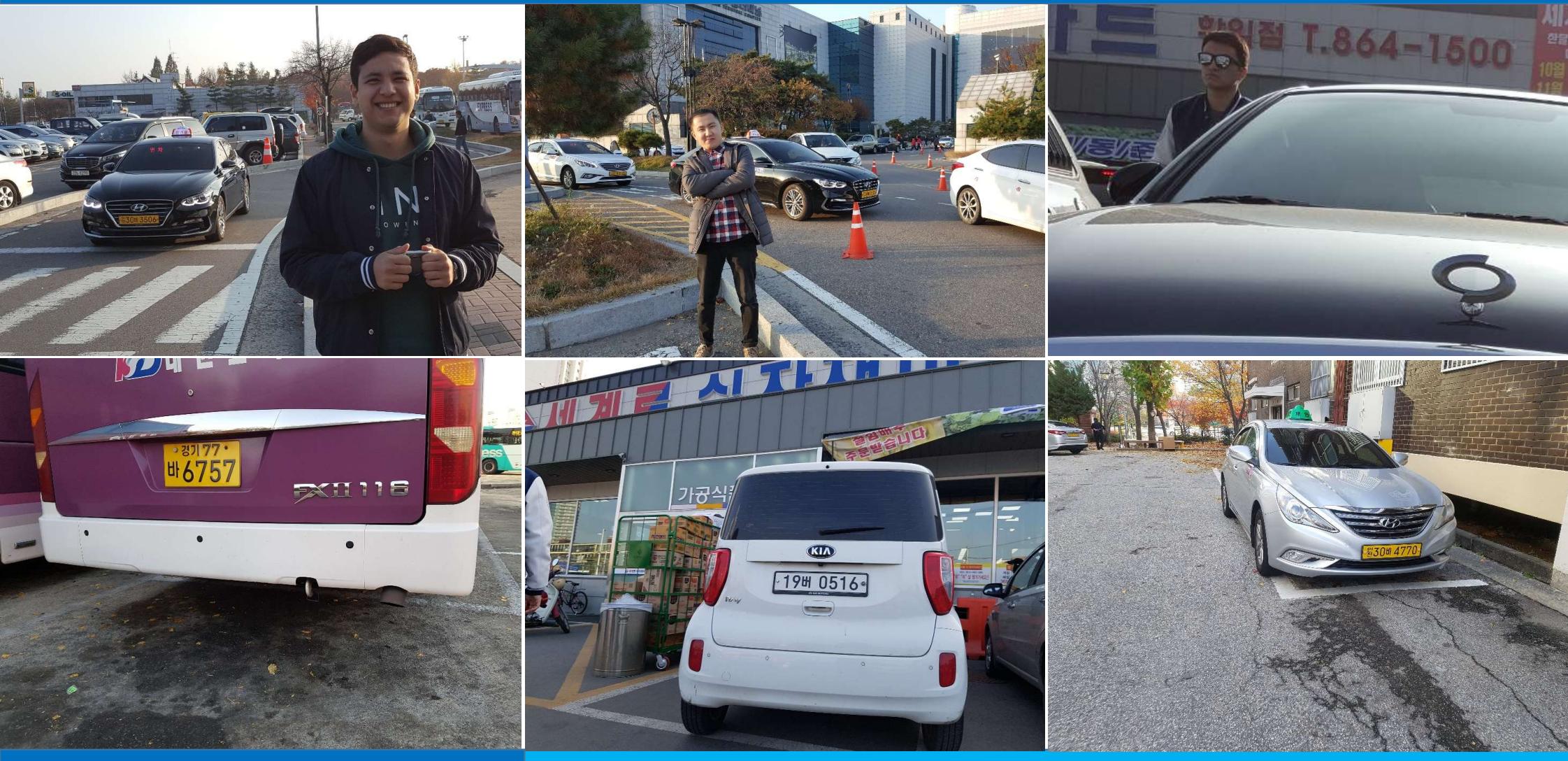
Conversion of Feature-specific predictions to Label using CTC (Connectionist Temporal Classification).

Architecture



DATA PREPARATION

Finding car plates on our pictures



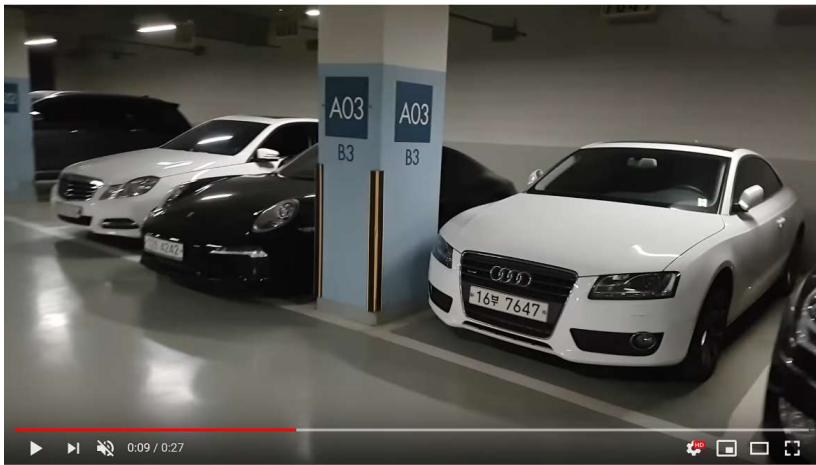
Gathering data from internet (YouTube)



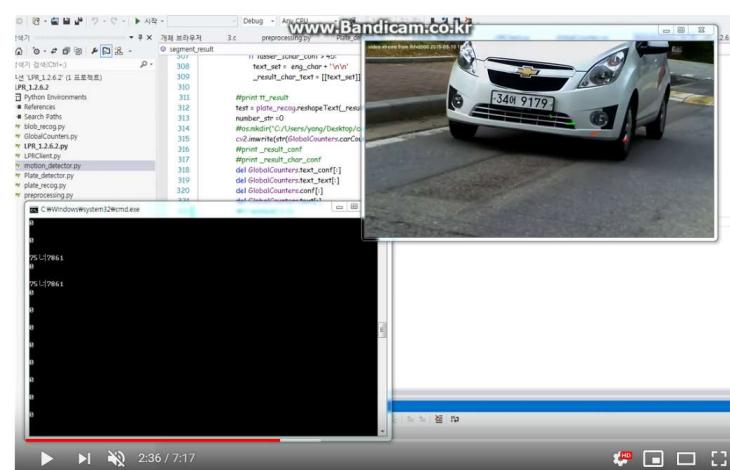
Looking for Fast Cars in Seoul, South Korea

[KOREA] 국내 슈퍼카 주행영상 [아벤타도르, F12베를리네타, 포르쉐GT3, 페라리458이탈리아]

The Most Popular Car Brands in Korea



Supercars parking lot in South Korea, Seoul



Korea license plate recognition test 2

Gathering data from internet (Google)

www.olavplates.com/south_korea_submissions.html

NUMBER PLATES OF THE REPUBLIC OF KOREA (ROK) SUBMISSIONS FROM VISITORS

Last updated 28.11.2018

Home
Country index
South Korea page 1
South Korea duplicates
Submissions page 2

Jan Verasdonck submitted some photos, taken in 2008.

Normal series. 2007 onwards plate style. 39 = Kyōnggi-do.

Taxi series. 2007 onwards plate style.

License Plates of South K...
worldlicenseplates.com

South Korean license plate - Seo...
pbase.com

South Korean license plates. Visi...
olavplates.com

June 9th to have blue license plates ...
youtube.com

Commercial Passenger car - Sejong...
commons.wikimedia.org

€uroplates License Plates | Asia ...
europlates.eu

Blue License Plates Introductio...
koreabizwire.com

€uroplates License Plates | Asia ...
europlates.eu

Korea License Plates - GTA5-Mods.com
gta5-mods.com

European License Plates - Custom ...
customeuropelicenseplates.com

German EU" license plate in Se...
bulleten.eu

AI Lab team, 2018

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Generator (plates)



Generator (parking)



Generator (CCTV)



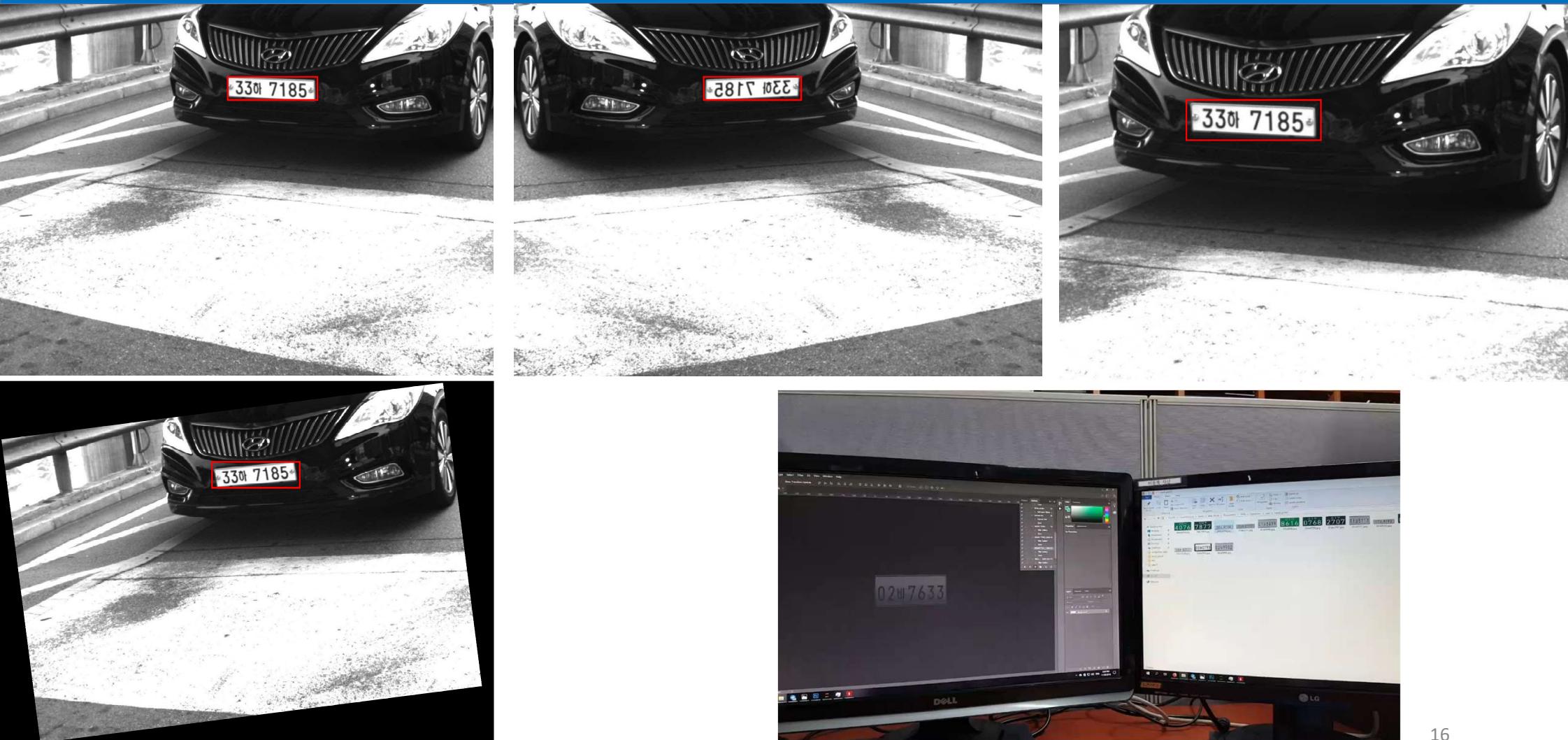
Dataset issues

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  </source>
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    <height>1080</height>
    <depth>3</depth>
  </size>
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  <object>
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    <difficult>0</difficult>
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      <xmax>1473</xmax>
      <ymax>330</ymax>
    </bndbox>
  </object>
</annotation>
```



- Letter:
 - Private Vehicles: 가 (Ga), 나 (Na),
다 (Da), 라 (Ra), 마 (Ma), 거 (Geo),
너 (Neo), 더 (Deo), 러 (Reo), 머¹ (Meo), 벼 (Beo), 서 (Seo), 어 (Eo),
저 (jeo), 고 (Go), 노 (No), 도 (Do),
로 (Ro), 모 (Mo), 보 (Bo), 소 (So),
오 (O), 조 (Jo), 구 (Gu), 누 (Nu), 두
(Du), 루 (Ru), 무 (Mu), 부 (Bu), 수
(Su), 우 (U), 주 (Ju)
 - Rental Cars: 허 (Heo), 하 (Ha), 호
(Ho)

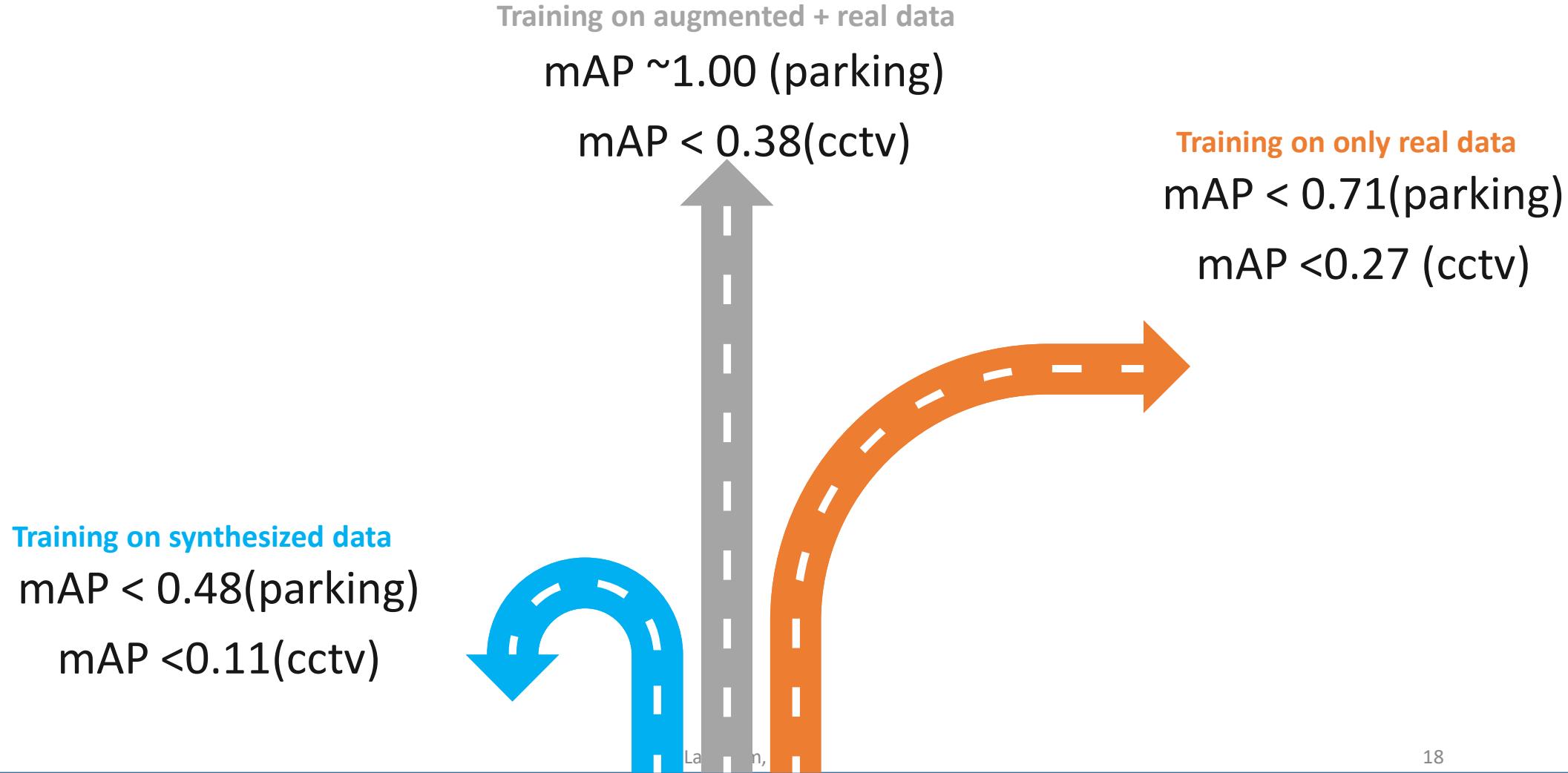
Augmentation





TRAINING PIPELINE

Detection



Recognition



Synthesized images



Augmented images



Real images

PERFORMANCE

Parking: 67%(ACC), 93%(Letter Accuracy)

CCTV: 41%(ACC), 81%(Letter Accuracy)

500, ~50,000 ~3,000 IMAGES

LAYERS

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n

19



PROBLEMS AND CHALLENGES

FINAL RESULTS

Results

Parking

| | |
|-------------------|--------|
| num_bbox_examples | 285 |
| num_bbox_corrects | 282 |
| bbox_accuracy | 98.95 |
| num_rec_examples | 285 |
| num_rec_corrects | 160 |
| rec_accuracy | 56.14 |
| avg_pt | 115.51 |
| score | 153.54 |

Expected: 167.00

CCTV

| | |
|-------------------|--------|
| num_bbox_examples | 451 |
| num_bbox_corrects | 147 |
| bbox_accuracy | 32.59 |
| num_rec_examples | 436 |
| num_rec_corrects | 120 |
| rec_accuracy | 27.52 |
| avg_pt | 101.57 |
| score | 59.96 |

Expected: 79.00

CONCLUSION



Summary

- We learned different models for various purposes.
- We understood the importance of data, as it significantly affects the model's performance.
- We learned different fine-tuning techniques.
- Our first big experience in Deep Learning.
- Overall course as foundation for future developments in AI field.

