Enhancing license plate numeric character detection and extraction using Super Resolution

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Nopphawan Nurnuansuwan   
School of Engineering & Technology  
Asian Institute of TechnologyPathum Thani, Thailand  
Nopphawan.Nurnuansuwan@ait.asia

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line 2: *dept. name of organization   
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Keywords—Super-resolution, SRCNN, SRGAN, License plate detection and extraction, OCR

# Introduction

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# Background

## Super-resolution (SR)

First,

#### SRCNN: A super-resolution

#### SRGAN: A super-resolution generative adversarial network (SRGAN) was proposed by C. Ledig et al. in 2017 [1] which the mean-opinion-score (MOS) scores of obtained images are closer to those of the original high-resolution images than images obtained with other methods. The structure of SRGAN was presented by replacing CNN algorithm in SRCNN structure with GAN algorithm. The GAN consists of a discriminator network D which adopts the VGG network [2] and a generator network G which uses a ResNet structure [3]. In SRGAN, the generator network G tries to generate super-resolution (SR) images from low-resolution (LR) images while the discriminator D tries to identify between SR images generated from generator network G and high-resolution (HR) images. According to the performance of SRGAN, there are many works developed [4-7] which can be obtained with a satisfied result.

## Image detection

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## Optical character recognition

Optical character recognition (OCR) is a method used in converting text images such as scanned images, handwriting images, photo-taken text images, or license place images into editable text. OCR is a very useful and popular method used in various applications [4]. In license plate recognition study, OCR has been playing an important role in automatic license plate characters extraction [5] [6]. There are many techniques and tool based on OCR. Tesseract is an open-source optical character recognition engine which was developed between 1984 to 1994 [7].

# Dataset

In this study, the datasets were collected from 2 sources. According to the hypothesis that the super resolution technique can enhance the performance such as an accuracy of license plate numeric character detection and extraction, the first dataset has to be collected as the high resolution images for evaluating the test result compared with known license plate numbers. The second dataset was collected from the real world to show the result from super resolution and OCR techniques. Therefore, the license plate number in this dataset may be blurred and unreadable.

## Train/Test dataset

The dataset for training and testing has to be collected with high resolution and have clear license plate numbers. The images were collected by using a smartphone camera when the cars were stationary in the daytime. Approximately, 50 images were collected from an military base entrance in Thailand. An example of the images is shown in Fig. 1

A person standing next to a car

Description automatically generated with medium confidence

Fig. 1 a train/test image

## Real world datset

The real world dataset was collected by using a car camera attached to the front window inside a car. The images were taken while the car was both stationary and moving. Fig. 2 is an example of real world images.

A group of cars on a road

Description automatically generated with low confidence

Fig. 2 a train/test image

# Methodology

## Image detection

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## Super-resolution (SR)

First,

#### SRCNN: Place

#### SRGAN: In this study, Martin Krasser’s pre-trained weight and model [8] was used for generate HR images from LR cropped images. The pre-trained model consists of generator and discriminator model. The generator of Martin Krasser’s model was built from SR resnet algorithm which consists resnet blocks. A resnet block combine many layers such as Conv2D layers, BatchNormalization layers, and PReLU layers, complexly. The pre-trained generator in a model python file (srgan.py) was imported as a library. Next, the pre-trained weight (gan\_generator.h5) was loaded into the model. Then, super-resolution (SR) of the cropped LR images from test dataset was implemented in the SRGAN model.

## Optical character recognition using Tesseract

In this method, the numbers in cropped license plate image from 3 difference models (SRCNN, SRGAN, and LR) were extracted by using OCR technique. The image augmentation techniques were used for pre-processing the images before OCR implementation. The image augmentation steps following The AI Guy’s GitHub [9] are image resizing, Gaussian blurring, median blurring, Otsu thresholding, element structuring, and dilating, respectively. After image augmentation, sorted contours was performed to find the rectangle boundary of each number or character. Next, numbers of license plate in pre-processed images were extracted by using Pytesseract, a Tesseract library for python.

# Result and Discussion

After

# Conclusion

# Future work

##### Acknowledgment

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