DIGITAL CAMERA IDENTIFICATION FROM SENSOR NOISE PATTERN

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Introduction

- Source camera identification is the process of determining which camera device has been used to capture an image.
- Camera source detection has drawn a lot of attention in past decade. It enables us to solve a wide range of problems, from crime evidence identification to photo tampering detection.
- This project is entirely software-based and it is implemented by an algorithm for the identification based on the different noise patterns so-called PRNU of the cameras.

Specifications and Design Requirements

MATLAB

Extracting PRNU patterns

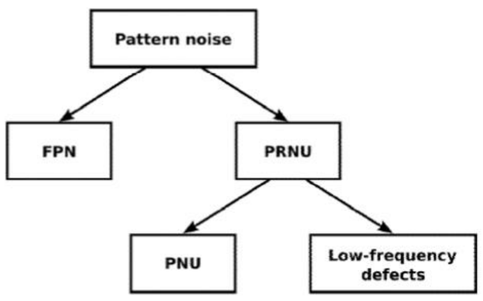
Convolution Neural Network Training

Implementation of classification to classify the image database.

Solution Methodology

- Image Featuring Method: PRNU, CNN

Photo Noise Response Non-Uniformity (PRNU)



- PRNU can be estimated by the method described as follows:

$$I = I^o + I^o K + \Theta$$

I^o: original input image,
I : output image,
K :the effect of the sensor pattern noise,
Θ :random error term

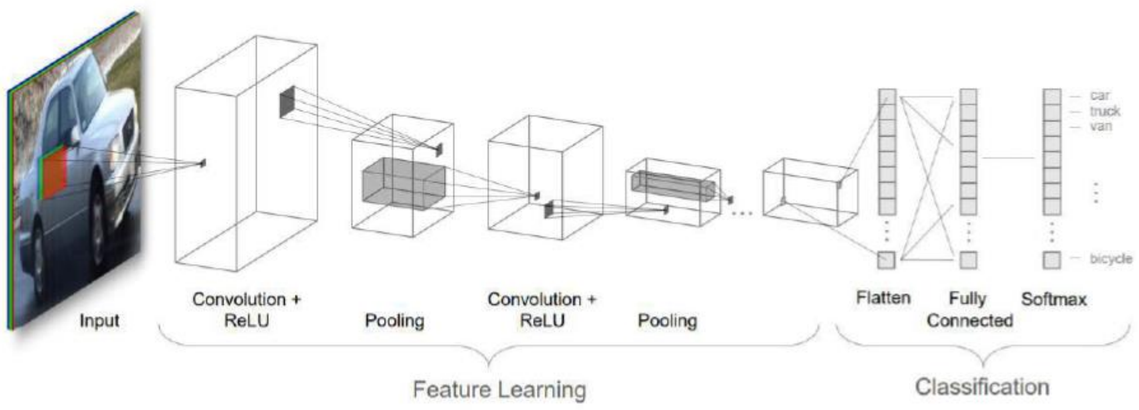
- K can be estimated as

$$W = I - F(I) = I - I^o = I^o K + \Theta$$

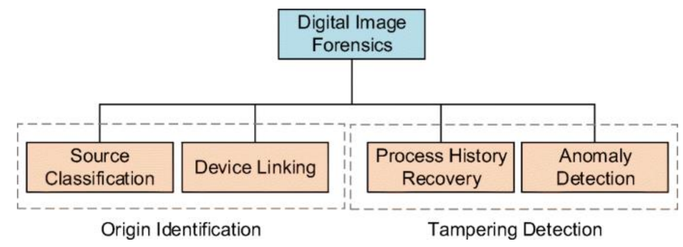
- The estimated K is

$$\acute{K} = \frac{\sum_{i=1}^{N} w_i I_i}{\sum_{k=1}^{N} (I_k)^2}$$

Convolutional Neural Network (CNN)

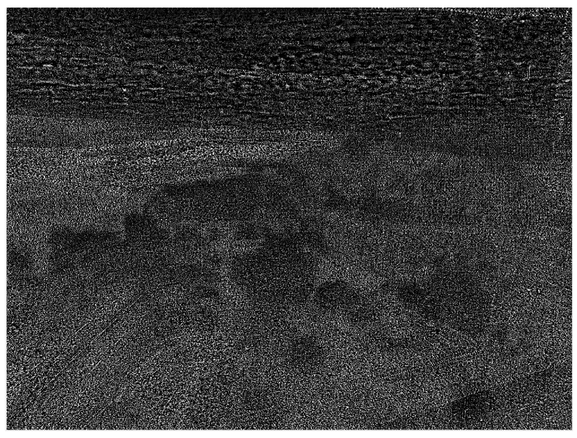


Application Areas



Results and Discussion

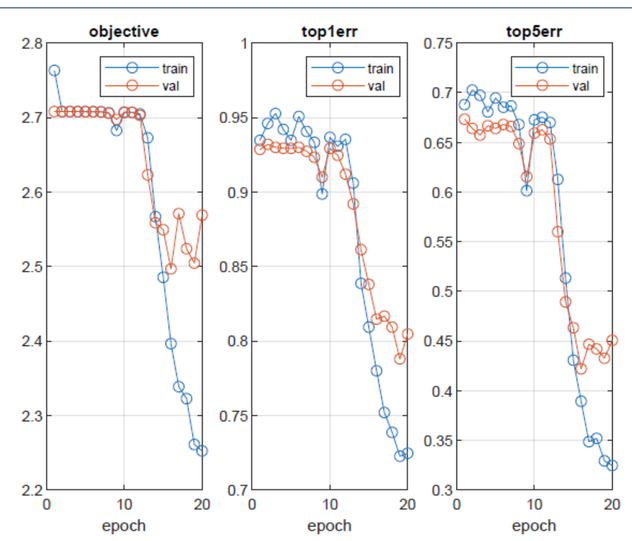
Input Image



PRNU pattern

Detection for PRNU:

PCE	194.3930
Peak Location	[0 0]
Peak Height	1.7712e+06



CNN Training Results

For final result, by using PRNU patterns as an input to our CNN algorithm:

- Accuracy of the first prediction for identification of the camera model is obtained as 27%.
- Accuracy of the first five predictions for identification of the camera model is obtained as 68%.
- The higher the epoch number is, higher the accuracy is.

References

- M. Kirchner and T. Gloe, “Forensic camera model identification,” in T. Ho, S. Li, (eds.) Handbook of Digital Forensics of Multimedia Data and Devices. Wiley-IEEE Press, 2015.
- Tuama A, Comby F, Chaumont M. Camera model identification with the use of deep convolutional neural networks. 2016 IEEE international workshop on information forensics and security (WIFS). Abu Dhabi, United Arab Emirates: IEEE; 2016. p. 1–6.

Acknowledgements

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