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CHARACTER EXTRACTION from BLURRED LICENSE PLATE IMAGES USING OCR TECHNIQUE

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DOS in Computer Science and Engineering

Abstract: The unique identification of a vehicle, license plate is a key clue to uncover over-speed vehicles or the ones involved in hit-and-run accidents. However, the snapshot of overspeed vehicle captured by surveillance camera is frequently blurred due to fast motion, which is even unrecognizable by human. Those observed plate images are usually in low resolution and suffer severe loss of edge information, which cast great challenge to existing blind deblurring methods. For license plate image blurring caused by fast motion, the blur kernel can be viewed as linear uniform convolution and parametrically modeled with angle and length. In this paper, we propose a novel scheme based on sparse representation to identify the blur kernel.

Keywords: Kernel parameter estimation, license plate deblurring, linear motion blur, Gaussian noise,OCR

INTRODUCTION

LICENSE plate recognition (LPR) is an important research topic in intelligent transportation systems (ITS) and important in olden days. All vehicles around the world should have a license number as their principal identifier. With the rapid development of computer vision technology, more and more vision-based license plate recognition methods are applied in ITS such as electronic payment systems, traffic activity monitoring and automatic vehicle ticketing. Although significant progress of LPR techniques has been made in the last decade and various commercial products are reliable under some best conditions, it is still a challenging task to recognize license plates from composite idols. A robust system should work effectively under a variety of conditions such as sunny day, night time or with different colors and complex backgrounds. To our knowledge, there is a lack of researches on both vehicle license plates detection and recognition in these challenging traffic scenes. And many methods are proposed to deal with images with low resolution in local view. Many other works have been done only to locate the license plates. In general, LPR consists of three parts: license plate detection (LPD), character segmentation, and character recognition. To detect the Iranian license plate by using a geometric template on connected target pixels with the same color. However, the methods that use color features to localize license plates may become invalid when there are regions in the image whose color information is similar to that of the license plate.

Moreover, license plate detection based on color information is sensitive to adverse illumination conditions and camera settings. On the other hand, texture-based methods use high edge-density areas where color or intensity transition occurs dramatically. The moving concrete plane is applied to find borders from vehicle region on the basis of statistical measurement of standard deviation. These methods can detect license plate regions in relatively simple environments, but can easily be affected by noises and are computationally complex when there are many edges in the image. Characters are segmented after license plate detection. To use grey-level quantization and morphology analysis to obtain candidate characters. The extracted license plate is rescaled to a template size, while in the template all the character positions are known. This method is incapable of dealing with any shift in the extracted license plates. Considering that the characters and license plate backgrounds have different colors, some methods project the extracted binary license plate vertically to determine the starting and the ending positions of characters, and then project the extracted characters horizontally to extract each character alone. In addition, the projection method is also applied when the extraction is not successful because of discontinuity and connectivity. The projection method is common and simple, but is dependent of their accurate positions.

Moreover, the extracted characters are very small and may be similar in their shapes, such as the pairs of S-5, C-G, and D-0. A large number of character recognition methods have been proposed, including neural networks, Character templates and so on.

LITERATURE SURVEY

W. Zhou, M. Yang, H. Li, X. Wang, Y. Lin, and Q. Tian,[4] "Towards codebook-free: Scalable cascaded hashing for mobile image search". State-of-the-art image retrieval algorithms using local invariant features mostly rely on a large visual codebook to accelerate the feature quantization and matching. This codebook typically contains millions of visual words, which not only demands for considerable resources to train offline but also consumes large amount of memory at the online retrieval stage. This is hardly affordable in resource limited scenarios such as mobile image search applications. To address this issue, we propose a codebook-free algorithm for large scale mobile image search. In our method, we first employ a novel scalable cascaded hashing scheme to ensure the recall rate of local feature matching. Afterwards, we enhance the matching precision by an efficient verification with the binary signatures of these local features. Consequently, our method achieves fast and accurate feature matching free of a huge visual codebook. Moreover, the quantization and binarizing functions in the proposed scheme are independent of small collections of training images and generalize well for diverse image datasets. Evaluated on two public datasets with a million distractor images, the proposed algorithm demonstrates competitive retrieval accuracy and scalability against four recent retrieval methods in literature.

Q. Shan, J. Jia, and A. Agarwala, "High-quality motion deblurring from a single image".[5] We present a new algorithm for removing motion blur from a single image. Our method computes a deblurred image using a unified probabilistic model of both blur kernel estimation and unblurred image restoration. We present an analysis of the causes of common artifacts found in current deblurring methods, and then introduce several novel terms within this probabilistic model that are inspired by our analysis. These terms include a model of the spatial randomness of noise in the blurred image, as well a new local smoothness prior that reduces ringing artifacts by constraining contrast in the unblurred image wherever the blurred image exhibits low contrast. Finally, we describe an efficient optimization scheme that alternates between blur kernel estimation and unblurred image restoration until convergence. As a result of these steps, we are able to produce high quality deblurred results in low computation time. We are even able to produce results of comparable quality to techniques that require additional input images beyond a single blurry photograph, and to methods that require additional hardware.

I. PROPOSED SYSTEM

Generally, the blur kernel is determined by the relative motion between the moving vehicle and static surveillance camera during the exposure time. When the exposure time is very short and the vehicle is moving very fast, the motion can be regarded as linear and the speed can be considered as approximately constant. In such cases, the blur kernel of license plate image can be modeled as a linear uniform kernel with two parameters: *angle* and *length* [15]. In the following we introduce how to utilize sparse representation on over-complete dictionary to evaluate the angle of kernel robustly. After the angle estimation in, frequency domain-based method is proposed to estimate the length of kernel. Fig. 2 shows the overall flow chart of our proposed scheme.

A. Angle Estimation of Linear Uniform Kernel

Sparsity on learned over-complete dictionary as the prior of sharp image has been well discussed however, sparse representation has received little attention in parameter inference.

Furthermore, we explore this characteristic of sparse representation on three plate images. Each image is blurred by a series of linear motion blur kernels (angle varying in the range [0°, 90°] under three length settings) with Gaussian noise. The angle that corresponds to the smallest score A is regarded as our estimated angle. The errors of angle estimation stay in a low level and are essentially independent of the ground truth angles.

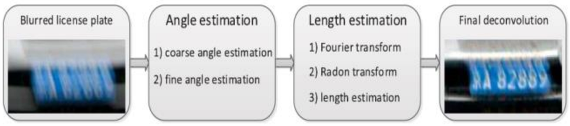


Fig. 2. Flow chart of the proposed method.

II. IMPLEMENTATION

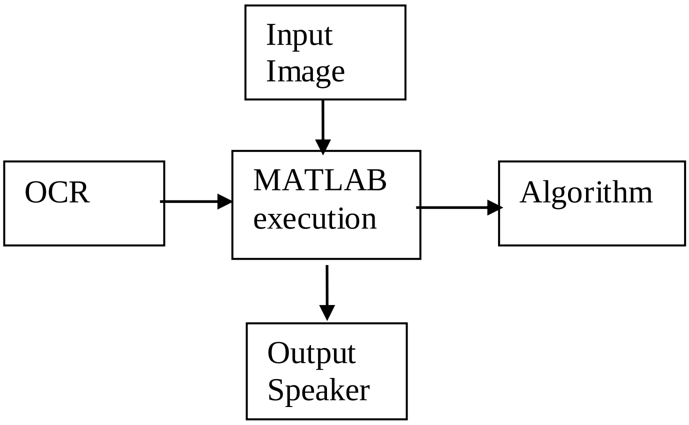
For the blurred images we captured in real scenario, the basic instance is unavailable. In order to test the validity of our proposed algorithm, we deblur the captured images with different linear kernels which have small bias compared with our known features. Demonstrate that our estimated results are exact or near the best parameters on three examples under different blur levels. The plate images become recognizable after deblurring under our estimated parameter settings. The deblurring performance of our scheme and other comparing algorithms under different situations. In most cases, the proposed method achieves the best performance improvement and successfully improves the plate image from unrecognizable to recognizable. The second and third images, the first and second images the same great improvement on semantic recognition. It can be observed that in real scene and very large blur condition, deblurring artifact is unavoidable no matter which BID algorithm is chosen.

However, the quasi-convex property from the sparse representation brings a great improvement on this optimization problem. Even though the gradient $\partial A \, \partial\theta$ has no closed form. Then we use the gradient descent method to find the optimization value. We can see that there are several outliers on the curves. In order to reduce the effect of outliers, the step of gradient descent should not be too small. However, large step may lead to the degradation of accuracy. So we propose a two-step coarse-to-fine angle estimation algorithm, which will be elaborated. As mentioned above, the sparse representation score A provides us a useful clue to determine the angle of the blur kernel. In addition, there are also some other blurriness metrics which were proposed recently. As a typical example, Liu *et al.* proposed a complex metric for motion deblurring, which combined several popular image quality assessment measures. We first blur with kernel (θ = 80°, l = 35) to obtain the blurred image, which is then deblurred with a series of linear uniform kernels For each deblurred image, the corresponding Liu's measure can be calculated, shows the relation between Liu's metric and the kernel parameters, where higher value means better deblurring performance.

Evolution of Optical Character Recognition

The origin of character recognition can be found in 1870 when Carey invented the retina scanner, and image transmission system using a mosaic of photocells. Later in 1890, Nipkow invented the sequential scanner which was a major breakthrough both for modern television and reading machines. Character recognition as an aid to the visually handicapped was at first attempted by the Russian scientist Tyurin in1900. The OCR technology took a major turn in the middle of 1950s with the development of digital computer and improved scanning devices. For the first time OCR was realized as a data processing approach, with particular applications to the business world. From that perspective, David Shepard, founder of the Intelligent Machine Research Co. can be considered as a pioneer of the development of commercial OCR equipment. Currently, PC-based systems are commercially available to read printed documents of single font with very high accuracy and documents of multiple fonts with reasonable accuracy. Most of the available systems work on European scripts which are based on Roman alphabets. Research reports on oriental language scripts are few, except for Korean, Chinese and Japanese scripts. Depending on versatility, robustness and efficiency, the commercial OCR systems can be divided into four generations. The first generation systems can be characterized by the constrained letter shapes which the OCRs read. Such machines appeared in the beginning of 1960s. The first widely commercialized OCR of this generation was the IBM 1418, which was designed to read a special IBM font, 407. The recognition method was logical template matching where the positional relationship was fully utilized. The next generation is characterized by the recognition capabilities of a set of regular machine printed characters as well as hand-printed characters. At the early stages, the scope was restricted to numerals only. Such machines appeared in early1970s. In this generation, the first and famous OCR system was IBM 1287, which was exhibited at the 1965 New York world fair. In terms of hardware configuration, the system was a hybrid one, combining analog and digital technology. The first automatic letter-sorting machine for postal code numbers of Toshiba was also developed during this period. The methods were based on the structural analysis approach. The third generation can be characterized by the OCR of poor print quality characters, and hand-printed characters for a large category character set. Commercial OCR systems with such capabilities appeared roughly during the decade 1975 to 1985. The fourth generation can be characterized by the OCR of complex documents intermixing with text, graphics, table and mathematical symbols, unconstrained handwritten characters, color document, low quality noise documents like photocopy and fax etc. some pieces of work on complex documents provided good results. Although many pieces of work on unconstrained handwritten character are available in the literature, the recognition accuracy hardly exceeds 85%. Among other commercial products, postal address readers are available in the market. In the United States, about 60% of the hand printed is sorted automatically. Reading aid for the blind is also available. An integrated OCR with speech output system for the blind has been marketed by Xerox-Kurxweil for English language. At present, more sophisticated optical readers are available for Roman, Chinese, Japanese and Arabic text. These readers can process a document which has been typewritten or printed. They can recognize characters with different fonts and sizes as well as different formats including intermixed text and graphics. Although lot of research is carried out for the OCR in these scripts, no OCR systems are found for the recognition of handwritten Indian scripts. Extensive research is being carried out in these languages recently for the recognition of handwritten characters and words. In a multi-lingual country like India, which has many languages with their own distinctive scripts and rich literary traditions, it is particularly important to develop computer systems that allow users to interact with them in Indian languages. There are 14 Indic scripts and there is a huge untapped potential for Indian population to access Information Technology through Indian languages. Handwriting being a natural interface to computers, recognition of handwritten Indian documents offers a huge area for research. In spite of widespread use of computers, paper documents will continue to remain important for a long period of time and hence it is necessary to have computer systems that can seamlessly integrate paper documents with other electronically created ones.

Architecture diagram



FEATURE EXTRACTION:

Once the contour of the image is obtained we apply freeman chain-code.

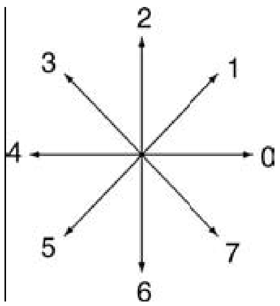


Fig3 :Eight chain-code directions.

The coordinates of the boundary pixels are obtained first , based on these coordinates the chain code of the character image is found.

The normalized chain code is obtained by transforming it to a two dimensional matrix. The first row of this matrix contains the value of the chain code, and the second row contains the frequency of occurrence of that value.[3] . For example, if the chain code of a given character is: 88883331111225833312 then it can be converted into the following form of a 2×9 matrix:

8 3 1 2 5 8 3 1 2

4 3 4 2 1 1 3 1 1

we remove all values whose frequencies are 1. For instance, in the above example, the chain code will be reduced to:

8 3 1 2 3

4 3 4 2 3

8 3 1 2

4 6 4 2

The process of removing the less-frequent digits can be continued. For instance in our test, the frequencies less than or equal to five were deleted. Again in the resulted chain code the frequency of each remained digit is summed. Then to transform the chain code matrix to a normalized chain code with length of 10, the relative frequency of each digit is computed using:

$$F_i^n = \frac{F_i}{\sum F_i} \times 10$$

Where F_i^n is the normalized frequency and F_i is the frequency of each digit in the chain code respectively. In the above example we will obtain:

8	3	1	2
2.22	3.33	2.22	1.11

Then the normalized frequency would be rounded of to nearest decimal which in turn would be concatenated to generate the length 10 chain code: 8833311222

Contour Tracing/Analysis

Contour tracing is also known as border following or boundary following. Contour tracing is a technique that is applied to digital images in order to extract the boundary of an object or a pattern such as a character. The boundary of a given pattern *P* is

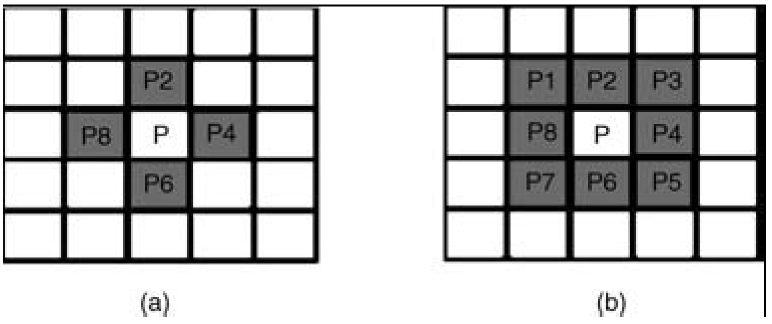


Fig (a) 4-neighbors (4-connected); (b) 8-neighbors (8-connected).

For the obtained characters we use contour tracing.

Fig: Small blur example with various angles

III. CONCLUSION

A novel kernel parameter estimation algorithm for license plate from fast-moving vehicles. Under some very weak assumptions, the license plate deblurring problem can be reduced to a parameter estimation problem. An interesting quasi-convex property of sparse representation coefficients with kernel parameter (angle) is uncovered and exploited. This property leads us to design a coarse-to-fine algorithm to estimate the angle efficiently. The length estimation is completed by exploring the well-used power-spectrum character of natural image. Further Optical character recognition is applied to extract the character from license plate. Graphical User Interface is created and embedded codes in that to create user friendly application.

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