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on Semiconductor and Electronics, Information and Communications Technology and Energy

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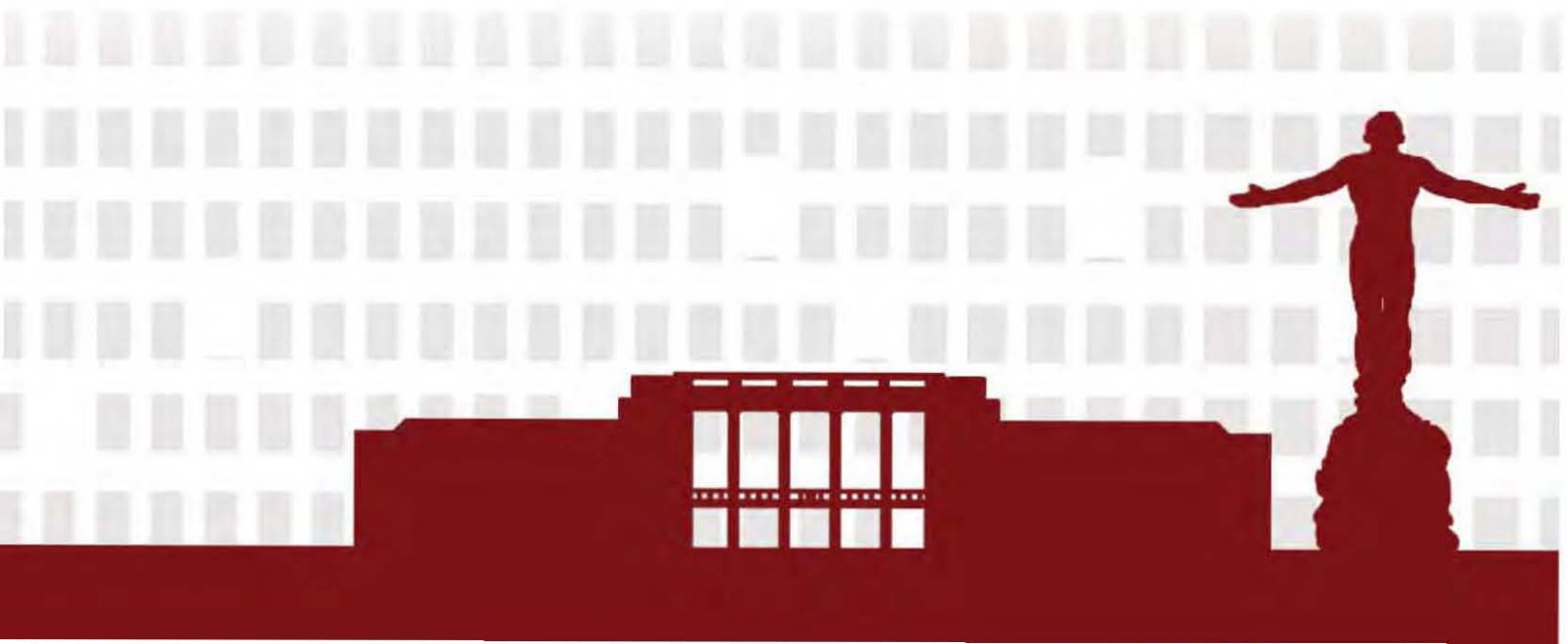

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REPORT ON THAI AND LAOS BI-LANGUAGE CHARACTER RECOGNITION AND FUTURE IMPROVEMENT

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ABSTRACT

The demand of multi-language character recognition systems are arisen from the commitment of among countries in ASEAN to establish the ASEAN community by 2015. The established community generates ease of movement of goods, capital, and labor across the countries in the region [1]. Multi-language character recognition systems are a new challenge for recognition multi-language documents and other character-based identification; *e.g.*, product manuals or automobile license plate. However, existing character recognition systems were developed for a character set of a specific language rather than multi-language. A complication is increased when a character recognition system is used for recognition alike character sets such as Thai and Laos character sets. Therefore, this document presents the possibility of a character recognition system for Thai and Laos character sets.

Past publications reported Thai character recognition systems for processing documents, images, license plate, and other media such as in [2] and Laos character recognition system for processing document [3]. To the best of the authors' knowledge the only report of Thai and Laos bi-language character recognition using four distinct recognition algorithms was in [4]. In [4] four recognition algorithms, namely a multi-layer feed-forward back propagation neural network, *k*-nearest neighbor, naïve Bayes, and decision tree, were evaluated on their tolerance of various levels of noise and light condition. The results were assessed using percent accuracy. The experiments were performed on characters and numbers generated from Sarun's ThangLuang font for Thai characters and Arabic numbers and from Phetsarath OT font for Laos characters. Nine SNR levels of Gaussian noise were mixed into the characters and numbers. Additionally, ten levels of brightness were included in the noisy character and number set to simulate various lighting condition under real world environments. The results from the algorithms except the decision tree showed high percent accuracy greater than 96% accuracy even with -25db noise and greater than 99% accuracy with ±75 level light intensity. The accuracy deteriorated greatly when noise and light disturbance both appeared in the characters. With -15db noise and ±25 level light intensity the *k*-nearest neighbor and the naïve Bayes obtained greater than 93% accuracy while the neural network obtained greater than 82% accuracy. The decision tree was apparently not prone to noise and disturbed light condition. The experiments in [4] did not yet test with real world images. 2

General procedure for character recognition consists of four steps, which are pre- processing, feature extraction, classification model, and recognition. The pre-processing step explores the input image and identifies an area of character and background. Also, the process resizes the area of character in the image to a specific size such as 32×32 pixels. The process, then, converts the grayscale image to one bit per pixel which is either 0 or 1 using a uniform quantizer. The feature extraction step extracts useful feature from the pre-processed image. A simple feature used in this step is an average of sub-image group so that pepper and salt noise are average out. The output of the feature extraction step is transferred to a classifier model, and the recognition step identifies a character based on the output from the classifier model.

Taken the real world recognition requirement such as images from wide range light condition, signal noise, or motion blur, the improvement of current methods is necessary. For example, the pre-processing step may be improved the quantization process using a noise-enhanced method to contain some information or substituting the uniform quantizer with an adaptive quantizer to support wide range light condition image. The feature extraction process may require other functions rather than a simple average of sub-image; *e.g.*, applying the COSFIRE filter to extract interest key points which would improve the overall accuracy. The classification for bi- or multi-language character recognition needs to consider forming multi-layer classifier. Each classification layer for some specific group of characters or language. Another approach in classification process is to replace the classical classification paradigm with the new one such as using Extreme Learning Machine (ELM) or deep learning network. Thus, features are learned from the training data rather than specified by a designer.

Clearly, the reported results shows a possibility of classification bi- or multi-language characters, but an improvement is necessary up to an acceptable accuracy when applying with the real world scenario.

Keywords: Multi-language character recognition systems, Thai and Laos character recognition.

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References

[1] International Labour Organization (ILO) and the Asian Development Bank (ADB), *ASEAN community in 2015: Managing integration for better jobs and shared prosperity*, ILO and ABD, Bangkok, Thailand, 2014.

[2] T. Hong and A.K. Gopalakrishnam, "License plate extraction and recognition of a Thai vehicle based on MSER and BPNN," in *The 7th International Conference on Knowledge and Smart Technology (KST)*, Chonburi, Thailand, pp. 48 – 53, 2015.

[3] W. Sinthupinyo and C. Chansylilath, "Lao optical character recognition (Lao OCR)," National Electronic and Computer Technology Center, 2008.

[4] S. Pichetjamroen and P. Watanachaturaporn, "A comparative study on tolerance of Thai/Laos characters and Arabic number recognition algorithms, (published in Thai)" in *The 11th National Conference on Computing and Information Technology* (NCCIT 2015), Bangkok, Thailand, pp. 384 – 389, 2015.