

INTEGRATION OF BLCM AND FLBP IN LOW
RESOLUTION FACE RECOGNITION

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DOCTOR OF PHILOSOPHY

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SUPERVISOR'S DECLARATION

I hereby declare that I have checked this thesis, and, in my opinion, this thesis is adequate in terms of scope and quality for the award of the degree of Doctor of Philosophy.

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STUDENT'S DECLARATION

I hereby declare that the work in this thesis is based on my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at Universiti Malaysia Pahang or any other institutions.

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INTEGRATION OF BLCM AND FLBP IN LOW RESOLUTION FACE
RECOGNITION

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ABSTRAK

Pengecaman wajah dari imej wajah telah menjadi topik yang berkembang pesat dalam komuniti penyelidikan biometrik dan terdapat banyak teknik pengecaman wajah berdasarkan analisis tekstur telah dibangunkan dalam beberapa tahun kebelakangan ini. Teknik-teknik ini berfungsi dengan baik pada imej-imej skala kelabu dan berwarna, dan ia ditangani dengan mudah pada imej binari dan beresolusi rendah. Imej binari menjadi format pilihan dalam imej beresolusi rendah untuk menganalisa wajah. Oleh itu, terdapat keperluan kajian lebih terperinci bagi menyediakan penyelesaian lengkap untuk sistem pengecaman wajah berasaskan imej ini pada ketepatan yang lebih tinggi. Untuk mengatasi keterbatasan teknik sedia ada dalam mengekstrak ciri khas menggunakan imej beresolusi rendah disebabkan perbezaan antara wajah dan latar belakang, kajian ini mencadangkan teknik analisis statistik untuk mengisi jurang tersebut. Bagi mencapai matlamat ini, teknik yang dicadangkan adalah dengan mengintegrasikan Binary Level Occurrence Matrix (BLCM) and Fuzzy Local Binary Pattern (FLBP) yang dinamakan BLCM-FLBP untuk mengekstrak ciri-ciri sejagat dan setempat dari wajah pada imej beresolusi rendah. Tujuan BLCM-FLBP adalah untuk mempertingkatkan prestasi ketajaman pinggir antara piksel hitam dan putih dalam imej binary. Ia juga untuk mengekstrak data penting yang berkaitan dengan ciri-ciri corak wajah. Keputusan eksperimen pada dataset Yale dan FEI mengesahkan kelebihan teknik yang dicadangkan berbanding teknik lain yang berprestasi tinggi yang menggunakan pengkelas berbeza iaitu Neural network (NN) and Random Forest (RF) pengkelas. Teknik yang dicadangkan mencapai ketepatan prestasi iaitu 93.16% (RF), 95.27% (NN) apabila dataset FEI digunakan dan 94.54% (RF), 93.61% (NN) apabila digunakan Yale.B. Teknik yang dicadangkan menandingi teknik lain seperti Matriks Co-Occurrence Matrix (GLCM), Bag of Word (BOW), Fuzzy Local Binary Pattern (FLBP) dan Binary Level Occurrence Matrix (BLCM).

ABSTRACT

Face recognition from face image has been a fast-growing topic in biometrics research community and a sizeable number of face recognition techniques based on texture analysis have been developed in the past few years. These techniques work well on grayscale and colour images with very few techniques deal with binary and low-resolution image. With binary image becoming the preferred format for low face resolution analysis, there is need for further studies to provide a complete solution for image-based face recognition system with higher accuracy. To overcome the limitation of the existing techniques in extracting distinctive features in low resolution images due to the contrast between the face and background, we proposed a statistical feature analysis technique to fill in the gaps. To achieve this, the proposed technique integrates Binary Level Occurrence Matrix (BLCM) and Fuzzy Local Binary Pattern (FLBP) named BLCM-FLBP to extract global and local features of face from face low resolution images. The purpose of BLCM-FLBP is to distinctively improve performance of edge sharpness between black and white pixels in the binary image and to extract significant data relating to the features of face pattern. Experimental results on Yale and FEI datasets validates the superiority of the proposed technique over the other top-performing feature analysis techniques methods by utilizing different classifier which is Neural network (NN) and Random Forest (RF). The proposed technique achieved performance accuracy of 93.16% (RF), 95.27% (NN) when FEI dataset used, and the accuracy of 94.54% (RF), 93.61% (NN) when Yale.B used. Hence, the proposed technique outperforming other technique such as Gray Level Co-Occurrence Matrix (GLCM), Bag of Word (BOW), Fuzzy Local Binary Pattern (FLBP) respectively and Binary Level Occurrence Matrix (BLCM).

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