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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
KARYA ILMIAH : JURNAL ILMIAH

Judul Jurnal Ilmiah (Artikel) : Multi-Object Face Recognition Using Local Binary Pattern Histogram and Haar Cascade Classifier on Low-Resolution Images

Jumlah Penulis : 4 orang (Rizal Isnanto, **Adian Fatchur Rochim**, Dania Eridani, Guntur Dwi Cahyono)

Status Pengusul : penulis ke-2

Identitas Jurnal Ilmiah :

- a. Nama Jurnal : Journal of Engineering and Technology Innovation
- b. Nomor ISSN : 2226-809X
- c. Vol, No., Bln Thn : Vol. 11 No. 1, Januari 2021
- d. Penerbit : Taiwan Association of Engineering and Technology Innovation, Taiwan
- e. DOI artikel (jika ada) : DOI: <https://doi.org/10.46604/ijeti.2021.6174>
- f. Alamat web jurnal : <https://ojs.imeti.org/>
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- g. Terindex : Scopus, Q3, SJR 0,21

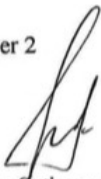
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c. Kecukupan dan kemutakhiran data/informasi dan metodologi (30%)	11	11,10	11,05
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	11	10,70	10,85
Total = (100%)	37	36,1	36,55
Nilai Pengusul = (40% x)/3 = 4,87			

Semarang, 10 Januari 2021

Reviewer 2



Dr. Iwan Setiawan, S.T., M.T.
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 Unit : Dept. Teknik Elektro FT UNDIP

Reviewer 1



Dr. Wahyudi ST, MT
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c. Kecukupan dan kemutakhiran data/informasi dan metodologi (30%)	12,00			11
d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	12,00			11
Total = (100%)	40,00			37
Nilai Pengusul = (40% x)/3 = 4,93				

Catatan Penilaian artikel oleh Reviewer :

1. Kesesuaian dan kelengkapan unsur isi jurnal:

International Journal of Engineering and Technology Innovation memiliki kelengkapan yang cukup. Makalah yang dipublikan di jurnal ini sesuai dengan cakupan topik dari Journal tersebut

2. Ruang lingkup dan kedalaman pembahasan:

Topik dari makalah adalah mengenai identifikasi wajah pada kondisi resolusi rendah menggunakan usulan metode LBP dan Haar Cascade Classifier. Pembahasan sudah dilakukan secara mendalam, dilengkapi dengan alur proses identifikasi, gambar, grafik, dan rumus yang cukup lengkap.

3. Kecukupan dan kemutakhiran data/informasi dan metodologi:

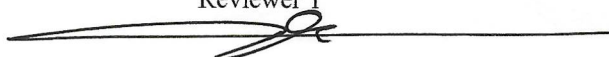
Identifikasi wajah saat ini masih tren dalam riset pengembangannya. Perkembangan teknologi identifikasi akan sangat berkembang dengan teknologi akses transmisi yang tinggi di era 5G. Aplikasi yang dapat diimplementasikan dengan metode tsb cukup beragam terutama pada akses-akses publik guna mengidentifikasi orang, dengan kegunaan yang cukup kompleks. Analisis dan proses pengujian sudah mencukupi untuk digunakan dalam pengambilan kesimpulan penelitian. Kesimpulan yang diambil sudah sesuai dengan metodologi yang dipakai.

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Semarang, 10 Januari 2021

Reviewer 1



Dr. Wahyudi ST, MT

NIP. 196906121994031001

Unit : Dept. Teknik Elektro FT UNDIP

**HASIL PENILAIAN SEJAWAT SEBIDANG ATAU *PEER REVIEW*
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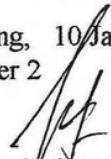
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d. Kelengkapan unsur dan kualitas terbitan/jurnal (30%)	12,00			10,70
Total = (100%)	40,00			36,10
Nilai Pengusul = (40% x 36,10)/3 = 3,88				

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- Ruang lingkup dan kedalaman pembahasan:** Makalah cukup lengkap membahas mengenai kombinasi dua metode untuk kegunaan identifikasi wajah dalam kondisi intensitas gambar rendah. Metode yang diusulkan menghasilkan kecermatan yang tinggi dalam identifikasi data statik, namun demikian untuk kondisi realtime masih perlu untuk ditingkatkan. **Kecukupan dan kemutakhiran data/informasi dan metodologi:** Literatur yang digunakan cukup signifikan dan baru. Topik yang diangkat sedang banyak diperbincangkan dan dibutuhkan saat ini, melihat dari beberapa artikel lain sejenis pada beberapa jurnal yang menjadi referensi.
- Kelengkapan unsur dan kualitas terbitan:** Unsur jurnal lengkap, kualitas terbitan online-nya cukup baik.

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Dr. Iwan Setiawan, S.T., M.T.
NIP. 197309262000121001



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International Journal of Engineering and Technology Innovation [Open Access](#)
Volume 11, Issue 1, 2021, Pages 45-58

Multi-Object Face Recognition Using Local Binary Pattern Histogram and Haar Cascade Classifier on Low-Resolution Images [\(Article\)](#) [\(Open Access\)](#)

Isnanto, R.R., Rochim, A.F., Eridani, D., Cahyono, G.D.

Department of Computer Engineering, Diponegoro University, Semarang, Indonesia

Abstract

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This study aims to build a face recognition prototype that can recognize multiple face objects within one frame. The proposed method uses a local binary pattern histogram and Haar cascade classifier on low-resolution images. The lowest data resolution used in this study was 76 × 76 pixels and the highest was 156 × 156 pixels. The face images were preprocessed using the histogram equalization and median filtering. The face recognition prototype proposed successfully recognized four face objects in one frame. The results obtained were comparable for local and real-time stream video data for testing. The RR obtained with the local data test was 99.67%, which indicates better performance in recognizing 75 frames for each object, compared to the 92.67% RR for the realtime data stream. In comparison to the results obtained in previous works, it can be concluded that the proposed method yields the highest RR of 99.67%. Copyright© by the authors. Licensee TAETI, Taiwan. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY-NC) license (<https://creativecommons.org/licenses/by-nc/4.0/>).

Author keywords

[face recognition](#) [histogram equalization](#) [linear binary pattern histogram](#) [low resolution](#)

Funding details

Funding sponsor	Funding number	Acronym
Universitas Diponegoro	2496/STK05/UN7.5.3.2/PP/2020	UNDIP

Funding text #1

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Funding text #2

through Strategic Research Grant 2020 number: 2496/STK05/UN7.5.3.2/PP/2020.

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-
- ☐ 1 Chen, H.
A kind of effective method of removing compound noise in image

(2016) *Proceedings - 2016 9th International Congress on Image and Signal Processing, BioMedical Engineering and Informatics, CISP-BMEI 2016*, art. no. 7852700, pp. 157-161. Cited 3 times.
ISBN: 978-150903710-0
doi: 10.1109/CISP-BMEI.2016.7852700

[View at Publisher](#)
-
- ☐ 2 Al-Azzeh, J., Zahran, B., Alqadi, Z.
Salt and pepper noise: Effects and removal ([Open Access](#))

(2018) *International Journal on Informatics Visualization*, 2 (4), pp. 252-256. Cited 10 times.
<http://joiv.org/index.php/joiv/article/view/151/149>
doi: 10.30630/joiv.2.4.151

[View at Publisher](#)
-
- ☐ 3 Taskiran, M., Kahraman, N., Erdem, C.E.
Face recognition: Past, present and future (a review)

(2020) *Digital Signal Processing: A Review Journal*, 106, art. no. 102809. Cited 3 times.
<http://www.elsevier.com/inca/publications/store/6/2/2/8/1/8/index.htm>
doi: 10.1016/j.dsp.2020.102809

[View at Publisher](#)
-
- ☐ 4 Wei, D., Chen, T., Li, S., Jiang, D., Zhao, Y., Li, T.
Adaptive dictionary learning based on local configuration pattern for face recognition ([Open Access](#))

(2020) *Eurasip Journal on Advances in Signal Processing*, 2020 (1), art. no. 20. Cited 2 times.
<http://www.springerlink.com/content/1687-6180/>
doi: 10.1186/s13634-020-00676-5

[View at Publisher](#)
-
- ☐ 5 Ahmed, A., Guo, J., Ali, F., Deebea, F., Ahmed, A.
LBPH based improved face recognition at low resolution

(2018) *2018 International Conference on Artificial Intelligence and Big Data, ICAIBD 2018*, pp. 144-147. Cited 18 times.
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8388229>
ISBN: 978-153866987-7
doi: 10.1109/ICAIBD.2018.8396183

[View at Publisher](#)
-
- ☐ 6 Younis, M.I., Muhammad, R.S.
IFRS: An Indexed Face Recognition System Based on Face Recognition and RFID Technologies

(2018) *Wireless Personal Communications*, 101 (4), pp. 1939-1966. Cited 3 times.
<http://www.springerlink.com/content/0929-6212>
doi: 10.1007/s11277-018-5800-8

[View at Publisher](#)
-

- ☐ 7 Niaraki, R.J., Shahbahrami, A.
Accuracy Improvement of Face Recognition System based on Co-occurrence Matrix of Local Median Binary Pattern
(2019) *4th International Conference on Pattern Recognition and Image Analysis, IPRIA 2019*, art. no. 8785969, pp. 141-144. Cited 3 times.
<http://ieeexplore.ieee.org/xpl/mostRecentIssue.jsp?punumber=8778427>
ISBN: 978-172811621-1
doi: 10.1109/IPRIA.2019.8785969
[View at Publisher](#)
-
- ☐ 8 Angulu, R., Tapamo, J.R., Adewumi, A.O.
Age estimation via face images: a survey ([Open Access](#))
(2018) *Eurasip Journal on Image and Video Processing*, 2018 (1), art. no. 42. Cited 29 times.
<http://www.springerlink.com/content/1687-5281/>
doi: 10.1186/s13640-018-0278-6
[View at Publisher](#)
-
- ☐ 9 Meng, J., Gao, Y., Wang, X., Lin, T., Zhang, J.
Face recognition based on local binary patterns with threshold
(2010) *Proceedings - 2010 IEEE International Conference on Granular Computing, GrC 2010*, art. no. 5576288, pp. 352-356. Cited 34 times.
ISBN: 978-076954161-7
doi: 10.1109/GrC.2010.72
[View at Publisher](#)
-
- ☐ 10 Anbarjafari, G.
Face recognition using color local binary pattern from mutually independent color channels ([Open Access](#))
(2013) *Eurasip Journal on Image and Video Processing*, 2013, art. no. 6. Cited 37 times.
doi: 10.1186/1687-5281-2013-6
[View at Publisher](#)
-
- ☐ 11 Yang, B., Li, Q.-Z.
Local binary pattern-based discriminant graph construction for dimensionality reduction with application to face recognition
(2019) *Multimedia Tools and Applications*, 78 (16), pp. 22445-22462. Cited 2 times.
<https://link.springer.com/journal/11042>
doi: 10.1007/s11042-019-7518-3
[View at Publisher](#)
-
- ☐ 12 Singh, C., Mittal, N., Walia, E.
Complementary feature sets for optimal face recognition ([Open Access](#))
(2014) *Eurasip Journal on Image and Video Processing*, 2014 (1), art. no. 35, pp. 1-18. Cited 14 times.
<http://www.springerlink.com/content/1687-5281/>
doi: 10.1186/1687-5281-2014-35
[View at Publisher](#)
-

-
- ☐ 13 Holder, R.P., Tapamo, J.R.
Improved gradient local ternary patterns for facial expression recognition ([Open Access](#))

(2017) *Eurasip Journal on Image and Video Processing*, 2017 (1), art. no. 42. Cited 18 times.
<http://www.springerlink.com/content/1687-5281/>
doi: 10.1186/s13640-017-0190-5

[View at Publisher](#)
-
- ☐ 14 Louis, W., Plataniotis, K.N.
Co-occurrence of local binary patterns features for frontal face detection in surveillance applications ([Open Access](#))

(2011) *Eurasip Journal on Image and Video Processing*, 2011, art. no. 745487. Cited 17 times.
doi: 10.1155/2011/745487

[View at Publisher](#)
-
- ☐ 15 Mahalingam, G., Ricanek Jr., K.
LBP-based periocular recognition on challenging face datasets ([Open Access](#))

(2013) *Eurasip Journal on Image and Video Processing*, 2013, art. no. 36. Cited 22 times.
doi: 10.1186/1687-5281-2013-36

[View at Publisher](#)
-
- ☐ 16 Sapkota, A., Boulton, T.E.
GRAB: Generalized region assigned to binary

(2013) *Eurasip Journal on Image and Video Processing*, 2013, art. no. 35.
-
- ☐ 17 Tang, J., Su, Q., Su, B., Fong, S., Cao, W., Gong, X.
Parallel ensemble learning of convolutional neural networks and local binary patterns for face recognition

(2020) *Computer Methods and Programs in Biomedicine*, 197, art. no. 105622. Cited 2 times.
www.elsevier.com/locate/cmpb
doi: 10.1016/j.cmpb.2020.105622

[View at Publisher](#)
-
- ☐ 18 Zhou, N., Constantinides, A.G., Huang, G., Zhang, S.
Face recognition based on an improved center symmetric local binary pattern

(2018) *Neural Computing and Applications*, 30 (12), pp. 3791-3797. Cited 4 times.
<http://link.springer.com/journal/521>
doi: 10.1007/s00521-017-2963-2

[View at Publisher](#)
-
- ☐ 19 Zhou, L., Wang, H., Lin, S., Hao, S., Lu, Z.-M.
Face recognition based on local binary pattern and improved Pairwise-constrained Multiple Metric Learning

(2020) *Multimedia Tools and Applications*, 79 (1-2), pp. 675-691. Cited 2 times.
<https://link.springer.com/journal/11042>
doi: 10.1007/s11042-019-08157-0

[View at Publisher](#)
-

-
- ☐ 20 García-Olalla, O., Alegre, E., Fernández-Robles, L., García-Ordás, M.T., García-Ordás, D.
Adaptive local binary pattern with oriented standard deviation (ALBPS) for texture classification ([Open Access](#))

(2013) *Eurasip Journal on Image and Video Processing*, 2013, art. no. 31. Cited 8 times.
doi: 10.1186/1687-5281-2013-31

[View at Publisher](#)
-
- ☐ 21 Muqet, M.A., Holambe, R.S.
Local binary patterns based on directional wavelet transform for expression and pose-invariant face recognition ([Open Access](#))

(2019) *Applied Computing and Informatics*, 15 (2), pp. 163-171. Cited 13 times.
www.journals.elsevier.com/applied-computing-and-informatics
doi: 10.1016/j.aci.2017.11.002

[View at Publisher](#)
-
- ☐ 22 Yoo, C.-H., Kim, S.-W., Jung, J.-Y., Ko, S.-J.
High-dimensional feature extraction using bit-plane decomposition of local binary patterns for robust face recognition

(2017) *Journal of Visual Communication and Image Representation*, 45, pp. 11-19. Cited 15 times.
<http://www.elsevier.com/inca/publications/store/6/2/2/9/0/6/index.htm>
doi: 10.1016/j.jvcir.2017.02.009

[View at Publisher](#)
-
- ☐ 23 Zhao, X., Zhang, S.
Facial expression recognition using local binary patterns and discriminant kernel locally linear embedding ([Open Access](#))

(2012) *Eurasip Journal on Advances in Signal Processing*, 2012 (1), art. no. 20. Cited 56 times.
doi: 10.1186/1687-6180-2012-20

[View at Publisher](#)
-
- ☐ 24 Chai, Z., Mendez-Vazquez, H., He, R., Sun, Z., Tan, T.
Explore semantic pixel sets based local patterns with information entropy for face recognition ([Open Access](#))

(2014) *Eurasip Journal on Image and Video Processing*, 2014, art. no. 26. Cited 4 times.
doi: 10.1186/1687-5281-2014-26

[View at Publisher](#)
-
- ☐ 25 Massoli, F.V., Amato, G., Falchi, F.
Cross-resolution learning for Face Recognition ([Open Access](#))

(2020) *Image and Vision Computing*, 99, art. no. 103927. Cited 4 times.
<https://www.journals.elsevier.com/image-and-vision-computing>
doi: 10.1016/j.imavis.2020.103927

[View at Publisher](#)
-
- ☐ 26 Dahmouni, A., El Moutaouakil, K., Satori, K.
Face description using electric virtual binary pattern (EVBP): application to face recognition

(2018) *Multimedia Tools and Applications*, 77 (20), pp. 27471-27489. Cited 3 times.
<https://link.springer.com/journal/11042>
doi: 10.1007/s11042-018-5932-6

[View at Publisher](#)
-

- ☐ 27 Zhou, L., Wang, H., Liu, W., Lu, Z.-M.
Face feature extraction and recognition via local binary pattern and two-dimensional locality preserving projection
(2019) *Multimedia Tools and Applications*, 78 (11), pp. 14971-14987. Cited 2 times.
<https://link.springer.com/journal/11042>
doi: 10.1007/s11042-018-6868-6
[View at Publisher](#)
-
- ☐ 28 Liang, J., Tu, H., Liu, F., Zhao, Q., Jain, A.K.
3D face reconstruction from mugshots: Application to arbitrary view face recognition
(2020) *Neurocomputing*, 410, pp. 12-27.
www.elsevier.com/locate/neucom
doi: 10.1016/j.neucom.2020.05.076
[View at Publisher](#)
-
- ☐ 29 Chude-Olisah, C.C., Sulong, G., Chude-Okonkwo, U.A.K., Hashim, S.Z.M.
Face recognition via edge-based Gabor feature representation for plastic surgery-altered images
([Open Access](#))
(2014) *Eurasip Journal on Advances in Signal Processing*, 2014 (1), art. no. 102, pp. 1-15. Cited 6 times.
<http://www.springerlink.com/content/1687-6180/>
doi: 10.1186/1687-6180-2014-102
[View at Publisher](#)
-
- ☐ 30 Bolotnikova, A., Demirel, H., Anbarjafari, G.
Real-time ensemble based face recognition system for NAO humanoids using local binary pattern
(2017) *Analog Integrated Circuits and Signal Processing*, 92 (3), pp. 467-475. Cited 18 times.
<http://springerlink.metapress.com/app/home/journal.asp?wasp=3c35ad1151604369b8fc57d35afe8871&referrer=parent&backto=linkingpublicationresults,1:100232,1>
doi: 10.1007/s10470-017-1006-3
[View at Publisher](#)
-
- ☐ 31 Liu, Z., Song, X., Tang, Z.
Fusing hierarchical multi-scale local binary patterns and virtual mirror samples to perform face recognition
(2015) *Neural Computing and Applications*, 26 (8), pp. 2013-2026. Cited 17 times.
<http://link.springer.com/journal/521>
doi: 10.1007/s00521-015-1863-6
[View at Publisher](#)
-
- ☐ 32 Xu, Z., Jiang, Y., Wang, Y., Zhou, Y., Li, W., Liao, Q.
Local polynomial contrast binary patterns for face recognition
(2019) *Neurocomputing*, 355, pp. 1-12. Cited 13 times.
www.elsevier.com/locate/neucom
doi: 10.1016/j.neucom.2018.09.056
[View at Publisher](#)
-

-
- ☐ 33 Huang, D., Shan, C., Ardabilian, M., Wang, Y., Chen, L.
Local binary patterns and its application to facial image analysis: A survey ([Open Access](#))

(2011) *IEEE Transactions on Systems, Man and Cybernetics Part C: Applications and Reviews*, 41 (6), art. no. 5739539, pp. 765-781. Cited 599 times.
doi: 10.1109/TSMCC.2011.2118750

[View at Publisher](#)
-
- ☐ 34 Wisesa, L.
OpenCV Face Recognition Berbasis Algoritma Haar Cascade
[34] May 04, 2020
<https://medium.com/purwadhikaconnect/opencv-face-recognition-berbasis-algoritma-haar-cascade-1a5e23d9e8cb>
-
- ☐ 35 Mordvintsev, A., Rahman, A.
Histograms-2: Histogram Equalization
[35] May 04, 2020
https://opencv-python-tutroals.readthedocs.io/en/latest/py_tutorials/py_imgproc/py_histograms/py_histogram_equalization/py_histogram_equalization.html
-
- ☐ 36 Jezebel Priestley, J., Nandhini, V., Elamaran, V.
An improved trimmed median filter for the restoration of images corrupted by high density impulse noise

(2015) *International Journal of Applied Engineering Research*, 10 (5), pp. 11587-11598. Cited 2 times.
http://www.ripublication.com/ijaer10/ijaerv10n5_04.pdf
-
- ☐ 37 Xiaofeng, F., Wei, W.
Centralized binary patterns embedded with image euclidean distance for facial expression recognition

(2008) *Proceedings - 4th International Conference on Natural Computation, ICNC 2008*, 4, art. no. 4667260, pp. 115-119. Cited 63 times.
ISBN: 978-076953304-9
doi: 10.1109/ICNC.2008.94

[View at Publisher](#)
-
- ☐ 38 Kavita, K., Kau, M.
A Survey Paper for Face Recognition Technologies
(2016) *International Journal of Scientific and Research Publication*, 6 (7), pp. 441-445. Cited 5 times.
[38]
-
- ☐ 39 *Advantages and Disadvantages of Machine Learning Language*
[39] November 23, 2020
<https://data-flair.training/blogs/advantages-and-disadvantages-of-machine-learning>
-
- ☐ 40 Wang, M., Deng, W.
Deep Face Recognition: A Survey. Cited 132 times.
[40] November 23, 2020
<https://arxiv.org/abs/1804.06655v9>
-

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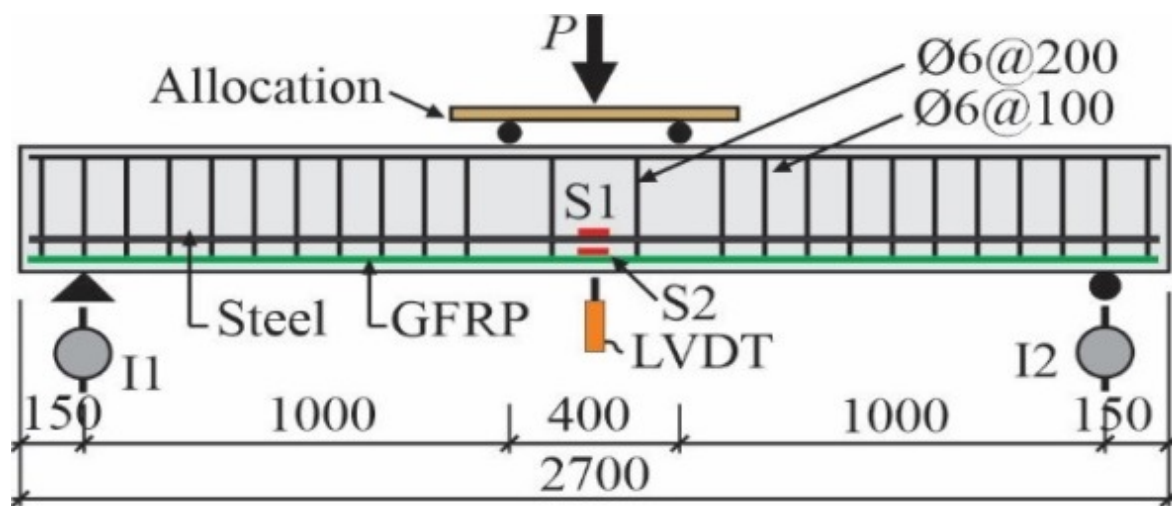
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Limiting Reinforcement Ratios for Hybrid GFRP/Steel Reinforced Concrete Beams

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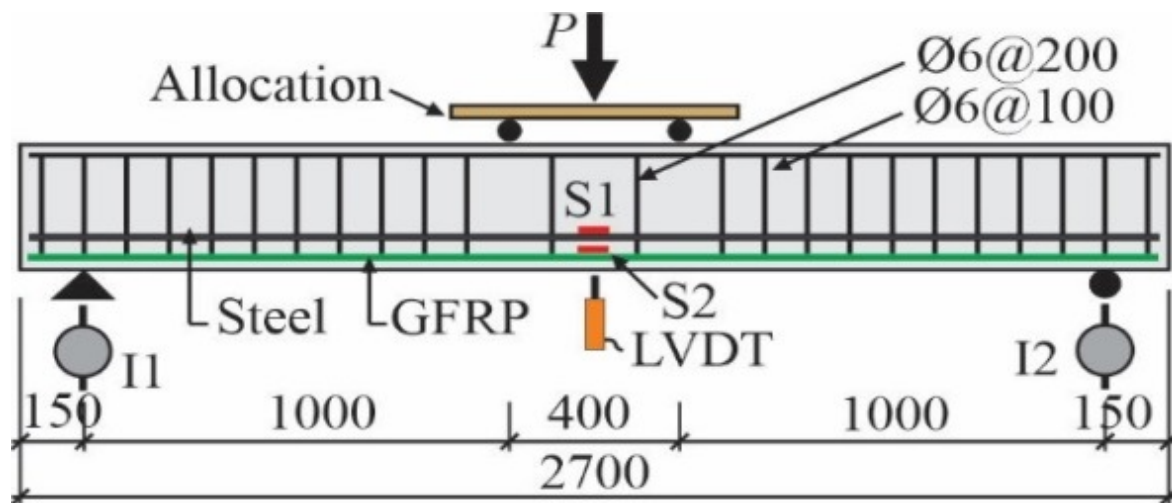
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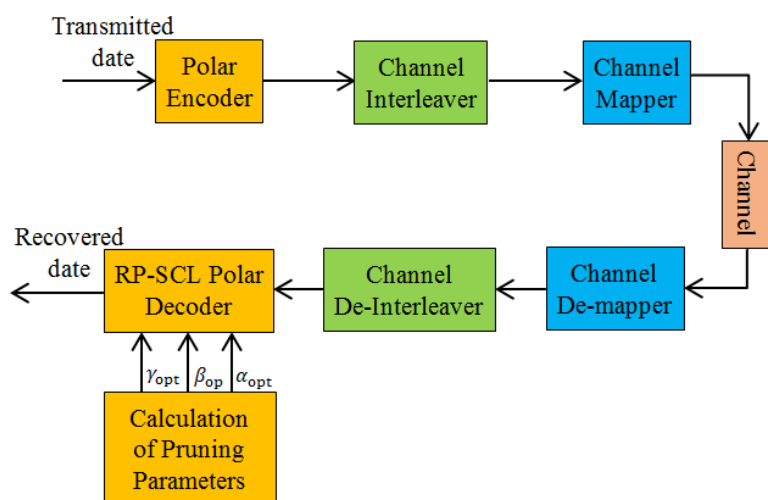
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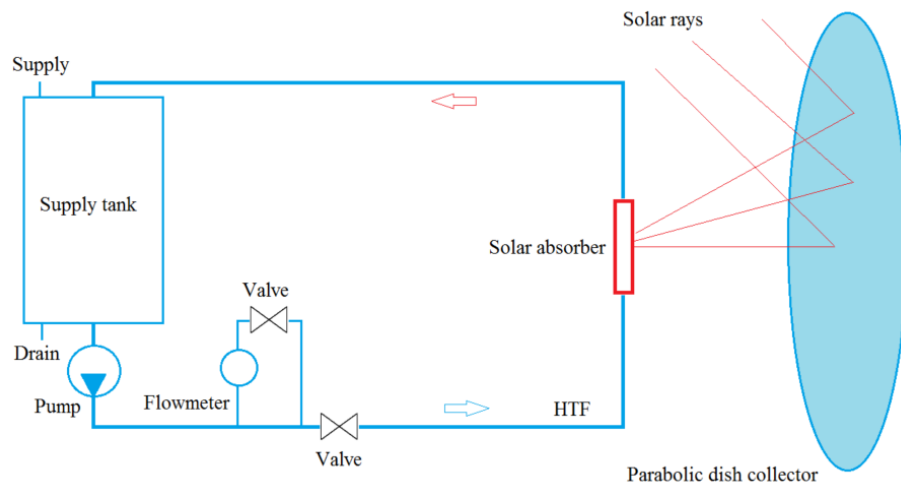
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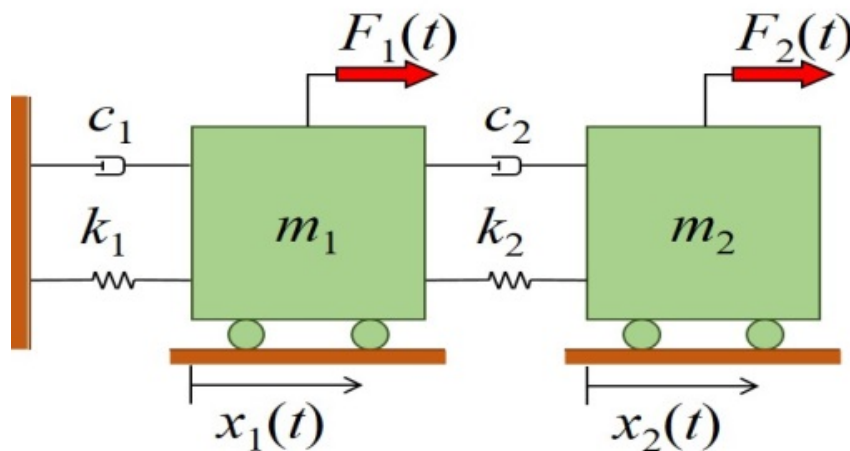
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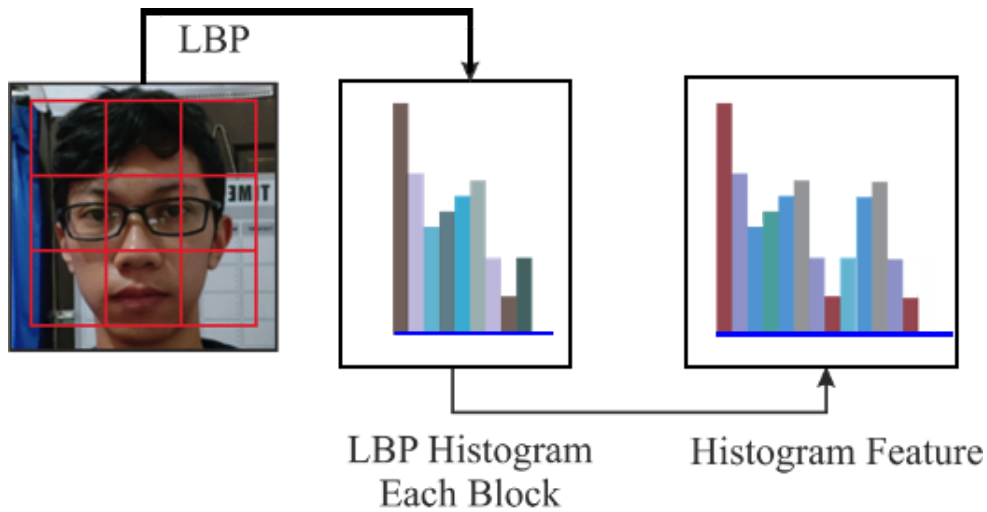
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Multi-Object Face Recognition Using Local Binary Pattern Histogram and Haar Cascade Classifier on Low-Resolution Images

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Abstract

This study aims to build a face recognition prototype that can recognize multiple face objects within one frame. The proposed method uses a local binary pattern histogram and Haar cascade classifier on low-resolution images. The lowest data resolution used in this study was 76×76 pixels and the highest was 156×156 pixels. The face images were preprocessed using the histogram equalization and median filtering. The face recognition prototype proposed successfully recognized four face objects in one frame. The results obtained were comparable for local and real-time stream video data for testing. The RR obtained with the local data test was 99.67%, which indicates better performance in recognizing 75 frames for each object, compared to the 92.67% RR for the real-time data stream. In comparison to the results obtained in previous works, it can be concluded that the proposed method yields the highest RR of 99.67%.

Keywords: face recognition, linear binary pattern histogram, low resolution, histogram equalization

1. Introduction

Object identification by artificial intelligence is a research topic that is attracting growing interest. Various methods are used for object identification in the field of artificial intelligence. One of the implementation concepts under development is the identification of human faces. The development and implementation of face recognition technology is an interesting field. In this modern era, emerging technologies for smartphones utilize face recognition technology in their security systems.

Face recognition technology uses a camera to capture image data, which can have various resolutions. Low-resolution images are those that lack sharp focus or fine detail. Compared to high-resolution images, low-resolution images have fewer pixels and greater compression. This compression compromises the quality of smaller image files [1]. Furthermore, the acquisition of low-resolution images can produce noise that looks like black or white dots on the original image known as salt-and-pepper noise. This noise is generally caused by software failure, hardware failure in the image capturing, transmission, or the defect of a camera sensor. A standard salt-and-pepper noise value may be either minimum (pixel value 0) or maximum (pixel value 255) [2].

This paper presents a prototype face recognition system based on the test data with four face objects within the same frame. This prototype system implements an LBPH algorithm for generating a model for face recognition purposes. The training data were generated by a low-resolution webcam implemented by the Haar cascade method, which is used to detect specific objects based on a model loaded in the program. Additional methods are used to improve the quality of the image data, including histogram equalization and median filtering. Unlike previous research, in this study, the images with multiple

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Non-Parametric Operational Modal Analysis Methods in Frequency

Domain: A Systematic Review

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Abstract

The objective of this research is to present a systematic review of the non-parametric modal analysis methods in the frequency domain. Peak picking (PP), frequency domain decomposition (FDD), enhanced frequency domain decomposition (EFDD), and frequency-spatial domain decomposition (FSDD) are revisited and didactically illustrated by means of modal identification for a study case proposed in previous researches. Algorithm schemes are illustrated to summarize these frequency domain OMA techniques. Modal frequencies, modal damping ratios, and modal shapes are estimated using the different OMA techniques and compared to estimations obtained by the free decay (FD) method reported in previous researches. These are employed to compare the results obtained by the methods presented herein and show a very good correlation in obtaining modal frequencies and a low correlation in the case of modal damping.

Keywords: operational modal analysis, peak picking, frequency domain decomposition, enhanced frequency domain decomposition, frequency-spatial domain decomposition

1. Introduction

Operational modal analysis (OMA) arises as a response to the need to identify the modal parameters of the structures, which may be difficult, expensive, or restricted for conventional experimental modal analysis (EMA). OMA is addressed in the modal parameters identification for systems subjected to one or more excitation sources, which cannot be measured [1-2]. These excitation signals are produced in normal operating conditions of the system under environmental forces [3]. Thus, the system response is the only information available for identification purposes [4-5]. OMA has been widely used in civil engineering since the 1990s as environmental tests [3, 6-7]. Due to the advantages provided by these methods, their use has spread to other areas such as aerospace engineering [8-10] and mechanical engineering [11-15], as well as monitoring of equipment for preventive maintenance [6, 16-17].

OMA methods obtain information physically related to structure from correlation functions and spectral densities [2, 4]. The methods available to perform these analyses can be carried out in the time domain and the frequency domain. In the time domain identification in OMA, the information is extracted from the correlation functions [18]. The biggest drawback of using these identification techniques is that all modes contribute to the range of the problem at any time when working with free decays, usually estimated as correlation functions. However, it is possible to obtain bias-free data [4].

Frequency domain methods start with estimating the output response spectrum. The main advantage of these methods is the simplicity and speed with which the modal parameters can be obtained at a very low computational cost, compared to those

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Limiting Reinforcement Ratios for Hybrid GFRP/Steel Reinforced Concrete Beams

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Abstract

In this work, a theoretical approach is proposed for estimating the minimum and maximum reinforcement ratios for hybrid glass fiber reinforced polymer (GFRP)/steel-reinforced concrete beams to prevent sudden and brittle failure as well as the compression failure of concrete before the tension failure of reinforcements. Equilibrium equations were used to develop a method for determining the minimum hybrid GFRP/steel reinforcement ratio. A method for determining the maximum hybrid GFRP/steel reinforcement ratio was also developed based on the equilibrium of forces of the balanced failure mode. For estimating the load-carrying capacity of concrete beams reinforced with hybrid GFRP/steel, less than the minimum and more than the maximum reinforcement ratio is recommended. Comparisons between the proposed expressions, experimental data, and available test results in the literature shows good agreement between the theoretical and experimental data, with a maximum discrepancy of 7%.

Keywords: GFRP, hybrid reinforcement, reinforcement ratio

1. Introduction

Since the 1980s, fiber reinforced polymer (FRP) reinforcement has been used in modern construction [1-3] to replace conventional steel bars in reinforced concrete (RC) structures in specific environments [2-4]. Glass fiber reinforced polymer (GFRP) is one of the FRPs with high tensile strength and low elastic modulus. Thus, a concrete beam reinforced with GFRP exhibits a higher deflection and wider crack width than that reinforced with steel bars [5-8]. Many researchers have suggested adding longitudinal steel bars to GFRP RC beams to improve their flexural performance; hence, hybrid FRP/steel RC beams were developed. Experimental studies have shown that the ductility of hybrid GFRP/steel RC beams is significantly enhanced compared with that of pure GFRP RC beams. Moreover, steel reinforcement increases the flexural stiffness of GFRP RC beams, and hybrid GFRP RC beams exhibit lower deflection, smaller crack width, and higher load-carrying capacity compared with the concrete beams reinforced with GFRP bars [9-15]. Depending on the hybrid reinforcement ratios, six failure modes, including two balanced failure modes, have been identified for hybrid GFRP/steel RC beams [15]. Based on the classification of failure modes, researchers have proposed formulas to determine the load-carrying capacity of hybrid GFRP/steel RC beams [12, 14-16]. According to many researchers, for hybrid GFRP/steel RC beams, the preferred failure mode is concrete crushing after the yielding of steel [15-18]. To the best of our knowledge, previous studies have focused on the classification of the failure modes of hybrid GFRP/steel RC beams, and proposed analytical equations to separate these failure modes according to their reinforcement ratios. There are no studies on limits on the minimum and maximum reinforcement ratios of concrete beams reinforced with hybrid GFRP/steel bars.

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