Low-Light Image and Video Enhancement Using Deep Learning: A Survey

作者: Li, CY (Li, Chongyi) [1] ; Guo, CL (Guo, Chunle) [2] ; Han, LH (Han, Linghao) [2] ; Jiang, J (Jiang, Jun) [3] ; Cheng, MM (Cheng, Ming-Ming) [2] ; Gu, JW (Gu, Jinwei) [3] ; Loy, CC (Loy, Chen Change) [1]

查看 Web of Science ResearcherID 和 ORCID (由 Clarivate 提供)

IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE

卷: 44 **期:** 12 **页:** 9396-9416

DOI: 10.1109/TPAMI.2021.3126387

出版时间: DEC 1 2022

已索引: 2022-11-25

文献类型: Article

跳转至

被引参考文献深度分析

摘要

Low-light image enhancement (LLIE) aims at improving the perception or interpretability of an image captured in an environment with poor illumination. Recent advances in this area are dominated by deep learning-based solutions, where many learning strategies, network structures, loss functions, training data, etc. have been employed. In this paper, we provide a comprehensive survey to cover various aspects ranging from algorithm taxonomy to unsolved open issues. To examine the generalization of existing methods, we propose a low-light image and video dataset, in which the images and videos are taken by different mobile phones' cameras under diverse illumination conditions. Besides, for the first time, we provide a unified online platform that covers many popular LLIE methods, of which the results can be produced through a user-friendly web interface. In addition to qualitative and quantitative evaluation of existing methods on publicly available and our proposed datasets, we also validate their performance in face detection in the dark. This survey together with the proposed dataset and online platform could serve as a reference source for future study and promote the development of this research field. The proposed platform and dataset as well as the collected methods, datasets, and evaluation metrics are publicly available and will be regularly updated. Project page: https://www.mmlab-ntu.com/project/lliv_survey/index.html.

关键词

作者关键词: Lighting; Deep learning; Feature extraction; Supervised learning; Cameras; Training data; Photography; Image and video restoration; low-light image dataset; low-light image enhancement platform; computational photography

Keywords Plus: DYNAMIC HISTOGRAM EQUALIZATION; NETWORK; REPRESENTATION; ILLUMINATION

作者信息

通讯作者地址: Loy, Chen Change (通讯作者)

Nanyang Technol Univ NTU, S Lab, Singapore 639798, Singapore

地址:

1 Nanyang Technol Univ NTU, S Lab, Singapore 639798, Singapore

2 Nankai Univ, Coll Comp Sci, Tianjin 300071, Peoples R China

3 SenseTime, San Jose, CA 95110 USA

电子邮件地址: chongyi.li@ntu.edu.sg; guochunle@nankai.edu.cn; lhhan@mail.nankai.edu.cn; jiangjun@sensebrain.site; cmm@nankai.edu.cn; gujinwei@sensebrain.site; ccloy@ntu.edu.sg

类别/分类

研究方向: Computer Science; Engineering

引文主题: 4 Electrical Engineering, Electronics & Computer Science > 4.17 Computer Vision & Graphics > 4.17.861 Image Enhancement

基金资助

基金资助机构	显示所有详细信息
RIE2020 Industry Alignment Fund Industry Collaboration Projects (IAF-ICP) Funding Initiative	
Nanyang Technological University	显示详情
NAP grant	
CAAI-Huawei MindSpore Open Fund	

查看资金资助信息

+ 查看更多数据字段

期刊信息

IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE

ISSN: 0162-8828
eISSN: 1939-3539
当前出版商: IEEE COMPUTER SOC, 10662 LOS VAQUEROS CIRCLE, PO BOX 3014, LOS ALAMITOS, CA 90720-1314
期刊影响因子: Journal Citation Reports ™
研究方向: Computer Science; Engineering
Web of Science 类别: Computer Science, Artificial Intelligence; Engineering, Electrical & Electronic

24.314
期刊影响因子 ™ (2021)

New
4.71
Journal Citation Indicator ™ (2021)

A comprehensive experiment-based review of low-light image enhancement methods and benchmarking low-light image quality assessment
SIGNAL PROCESSING

Lu, HX; Liu, ZB; Gong, JM; et al.
Retinex-inspired contrast stretch and detail boosting for lowlight image enhancement
IET IMAGE PROCESSING

全部查看

Web of Science 中的使用情况

Web of Science 使用次数

33 最近 180 天
53 2013 年至今

进一步了解

此记录来自:
Web of Science 核心合集

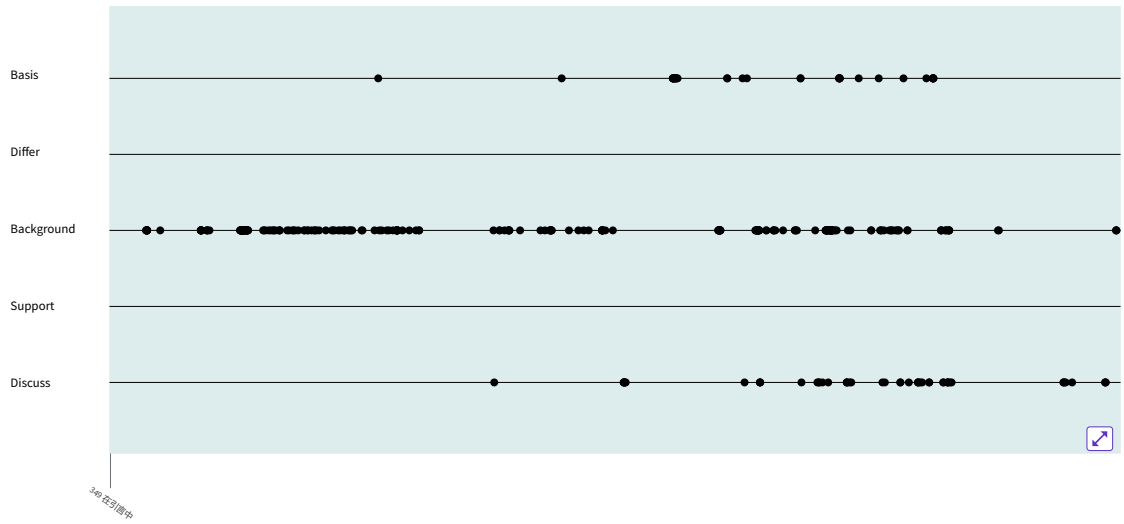
- Science Citation Index Expanded (SCI-Expanded)

建议修正

如果您要改进此记录中的数据质量，请建议修正

102 篇引用的参考文献

探索



可视化数据包括 6 文献正文中未提及的参考文献。

显示 102 / 102 作为一组检索结果查看 首次出现

16

(来自 Web of Science 核心合集)

1 Retinex-inspired Unrolling with Cooperative Prior Architecture Search for Low-light Image Enhancement

Liu, RS; Ma, L; (...); Luo, ZX
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2021 | 2021 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION, CVPR 2021 , pp.10556-10565

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 2

61 被引频次

50 参考文献

相关记录

2 An Experiment-Based Review of Low-Light Image Enhancement Methods

Wang, WC; Wu, XJ; (...); Gao, ZR
2020 | IEEE ACCESS 8 , pp.87884-87917

Full Text Finder 出版商处的免费全文 •••

在文献中引用: 2

72 被引频次

313 参考文献

相关记录

3 The Unreasonable Effectiveness of Deep Features as a Perceptual Metric

Zhang, R; Isola, P; (...); Wang, O
31st IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2018 | 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.586-595

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 4

2,082 被引频次

63 参考文献

相关记录

4 Pre-Trained Image Processing Transformer

Chen, HT; Wang, YH; (...); Gao, W
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2021 | 2021 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION, CVPR 2021 , pp.12294-12305

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

222 被引频次

86 参考文献

相关记录

5 Low-Light Image Enhancement via Progressive-Recursive Network

Li, JJ; Feng, XM and Hua, Z
Nov 2021 | IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY 31 (11) , pp.4227-4240

Full Text Finder 查看全文 •••

在文献中引用: 2

45 被引频次

48 参考文献

相关记录

6 DeepExposure: Learning to Expose Photos with Asynchronously Reinforced Adversarial Learning

Yu, RS; Liu, WY; (...); Zhang, B
32nd Conference on Neural Information Processing Systems (NIPS)
2018 | ADVANCES IN NEURAL INFORMATION PROCESSING SYSTEMS 31 (NIPS 2018) 31

Full Text Finder •••

在文献中引用: 2

24 被引频次

41 参考文献

相关记录

7 Automatic Photo Adjustment Using Deep Neural Networks

Yan, ZC; Zhang, H; (...); Yu, YZ
May 2016 | ACM TRANSACTIONS ON GRAPHICS 35 (2)

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

98 被引频次

28 参考文献

相关记录

8 Articulating the Logic of China's Postsocialist Society in the Era of Neo-Liberal Transformation INTRODUCTION

Wang, XP
2018 | POSTSOCIALIST CONDITIONS: IDEAS AND HISTORY IN CHINA'S INDEPENDENT CINEMA, 1988-2008 19 , pp.1-+

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

1,012 被引频次

237 参考文献

相关记录

9 Progressive Retinex: Mutually Reinforced Illumination-Noise Perception Network for Low Light Image Enhancement

Wang, Y; Cao, Y; (...); Wu, F
27th ACM International Conference on Multimedia (MM)
2019 | PROCEEDINGS OF THE 27TH ACM INTERNATIONAL CONFERENCE ON MULTIMEDIA (MM'19) , pp.2015-2023

Full Text Finder 出版商处的全文 •••

在文献中引用: 2

36 被引频次

42 参考文献

相关记录

10 Model-blind Video Denoising Via Frame-to-frame Training

Ehret, T; Davy, A; (...); Arias, P
32nd IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2019 | 2019 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2019) , pp.11361-11370

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

40 被引频次

51 参考文献

相关记录

11 Image Super-Resolution Using Deep Convolutional Networks

Dong, C; Loy, CC; (...); Tang, XO
Feb 2016 | IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 38 (2) , pp.295-307

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

4,389 被引频次

50 参考文献

相关记录

12 Low-Light Image Enhancement With Semi-Decoupled Decomposition

Hao, SJ; Han, X; (...); Wang, M
Dec 2020 | IEEE TRANSACTIONS ON MULTIMEDIA 22 (12) , pp.3025-3038

Full Text Finder 查看全文 •••

在文献中引用: 1

81 被引频次

44 参考文献

相关记录

13 TBEFN: A Two-Branch Exposure-Fusion Network for Low-Light Image Enhancement

Lu, K and Zhang, LH
2021 | IEEE TRANSACTIONS ON MULTIMEDIA 23 , pp.4093-4105

被引参考文献深度分析

Full Text Finder 查看全文 •••

在文献中引用: 14

25 被引频次

51 参考文献

相关记录

14 Photo-Realistic Single Image Super-Resolution Using a Generative Adversarial Network

Ledig, C; Theis, L; (...); Shi, WZ
30th IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2017 | 30TH IEEE CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2017) , pp.105-114

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

5,147 被引频次

71 参考文献

相关记录

15 Benchmarking Low-Light Image Enhancement and Beyond

Liu, JY; Xu, DJ; (...); Huang, HF
Apr 2021 | Jan 2021 (在线发表) | INTERNATIONAL JOURNAL OF COMPUTER VISION 129 (4) , pp.1153-1184

被引参考文献深度分析

Full Text Finder 出版商处的全文 •••

在文献中引用: 6

21 被引频次

113 参考文献

相关记录

16 Image quality assessment: From error visibility to structural similarity

Wang, Z; Bovik, AC; (...); Simoncelli, EP
Apr 2004 | IEEE TRANSACTIONS ON IMAGE PROCESSING 13 (4) , pp.600-612

Full Text Finder 出版商处的全文 •••

在文献中引用: 3

26,369 被引频次

58 参考文献

相关记录

17 Kindling the Darkness: A Practical Low-light Image Enhancer

Zhang, YH; Zhang, JW and Guo, XJ
27th ACM International Conference on Multimedia (MM)
2019 | PROCEEDINGS OF THE 27TH ACM INTERNATIONAL CONFERENCE ON MULTIMEDIA (MM'19) , pp.1632-1640

Full Text Finder 出版商处的全文 •••

在文献中引用: 10

261 被引频次

34 参考文献

相关记录

18 Beyond Brightening Low-light Images

Zhang, YH; Guo, XJ; (...); Zhang, JW
Apr 2021 | Jan 2021 (在线发表) | INTERNATIONAL JOURNAL OF COMPUTER VISION 129 (4) , pp.1013-1037

被引参考文献深度分析

Full Text Finder 出版商处的全文 •••

在文献中引用: 14

59 被引频次

51 参考文献

相关记录

19 Contrast Enhancement Based on Layered Difference Representation of 2D Histograms

Lee, C; Lee, C and Kim, CS
Dec 2013 | IEEE TRANSACTIONS ON IMAGE PROCESSING 22 (12) , pp.5372-5384

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

268 被引频次

32 参考文献

相关记录

20 EnlightenGAN: Deep Light Enhancement Without Paired Supervision

Jiang, YF; Gong, XY; (...); Wang, ZY
2021 | IEEE TRANSACTIONS ON IMAGE PROCESSING 30 , pp.2340-2349

Full Text Finder 知识库中的免费已提交文章 查看全文 •••

在文献中引用: 9

298 被引频次

59 参考文献

相关记录

21 Learning Photographic Global Tonal Adjustment with a Database of Input/Output Image Pairs

Bychkovsky, V; Paris, S; (...); Durand, F
IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
2011 | 2011 IEEE CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.97-104

Full Text Finder •••

在文献中引用: 5

250 被引频次

17 参考文献

相关记录

22 Aesthetic-Driven Image Enhancement by Adversarial Learning

Deng, YB; Loy, CC and Tang, XO
26th ACM Multimedia Conference (MM)
2018 | PROCEEDINGS OF THE 2018 ACM MULTIMEDIA CONFERENCE (MM'18) , pp.870-878

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

32 被引频次

46 参考文献

相关记录

23 Learning to Enhance Low-Light Image via Zero-Reference Deep Curve Estimation

Li, CY; Guo, CL and Loy, CC
Mar 3 2022 | IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 44 (8) , pp.4225-4238

被引参考文献深度分析

Full Text Finder 知识库中的免费已提交文章 查看全文 •••

在文献中引用: 3

65 被引频次

49 参考文献

相关记录

24 Luminance-Aware Pyramid Network for Low-Light Image Enhancement

Li, JQ; Li, JC; (...); Zhang, GX
2021 | IEEE TRANSACTIONS ON MULTIMEDIA 23 , pp.3153-3165

被引参考文献深度分析

Full Text Finder 查看全文 •••

在文献中引用: 3

23 被引频次

55 参考文献

相关记录

25 LightenNet: A Convolutional Neural Network for weakly illuminated image enhancement

Li, CY; Guo, JC; (...); Pang, YW
Mar 1 2018 | PATTERN RECOGNITION LETTERS 104 , pp.15-22

Full Text Finder 知识库中的免费已接受文章 出版商处的全文 •••

在文献中引用: 12

163 被引频次

28 参考文献

相关记录

26 A Probabilistic Method for Image Enhancement With Simultaneous Illumination and Reflectance Estimation

Fu, XY; Liao, YH; (...); Ding, XH
Dec 2015 | IEEE TRANSACTIONS ON IMAGE PROCESSING 24 (12) , pp.4965-4977

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

194 被引频次

44 参考文献

相关记录

27 Guided Image Filtering

He, KM; Sun, J and Tang, XO
Jun 2013 | IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 35 (6) , pp.1397-1409

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

3,310 被引频次

59 参考文献

相关记录

28 Natural image denoising with convolutional networks

Jain, V. and Seung, S.H.
2008 | Proceedings of the IEEE International Conference on Neural Information Processing Systems , pp.769-776
IEEE, Piscataway, NJ

在文献中引用: 1

183 被引频次

0 参考文献

29 A Novel Retinex-Based Fractional-Order Variational Model for Images With Severely Low Light

Gu, ZH; Li, F; (...); Zhang, GX
2020 | IEEE TRANSACTIONS ON IMAGE PROCESSING 29 , pp.3239-3253

Full Text Finder 查看全文 •••

在文献中引用: 1

33 被引频次

27 参考文献

相关记录

30 From Fidelity to Perceptual Quality: A Semi-Supervised Approach for Low-Light Image Enhancement

Yang, WH; Wang, SQ; (...); Liu, JY
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2020 | 2020 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.3060-3069

Full Text Finder 出版商处的全文 •••

在文献中引用: 8

102 被引频次

34 参考文献

相关记录

31 DSLR: Deep Stacked Laplacian Restorer for Low-Light Image Enhancement

Lim, S and Kim, W
2021 | IEEE TRANSACTIONS ON MULTIMEDIA 23 , pp.4272-4284

被引参考文献深度分析

Full Text Finder 查看全文 •••

在文献中引用: 11

30 被引频次

50 参考文献

相关记录

32 Learning to See in the Dark

Chen, C; Chen, QF; (...); Koltun, V
31st IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2018 | 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.3291-3300

Full Text Finder 出版商处的全文 •••

在文献中引用: 8

474 被引频次

42 参考文献

相关记录

33 Progressive Neural Architecture Search

Liu, CX; Zoph, B; (...); Murphy, K
15th European Conference on Computer Vision (ECCV)
2018 | COMPUTER VISION - ECCV 2018, PT I 11205 , pp.19-35

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

484 被引频次

41 参考文献

在文献中引用: 1

相关记录

34 Perceptual Quality Assessment of Smartphone Photography

Fang, YM; Zhu, HW; (...); Wang, Z
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2020 | 2020 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.3674-3683

Full Text Finder 出版商处的全文 •••

在文献中引用: 2

64 被引频次

42 参考文献

相关记录

35 Deep Photo Enhancer: Unpaired Learning for Image Enhancement from Photographs with GANs

Chen, YS; Wang, YC; (...); Chuang, YY
31st IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2018 | 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.6306-6314

Full Text Finder 出版商处的全文 •••

在文献中引用: 3

168 被引频次

25 参考文献

相关记录

36 Fast Image Processing with Fully-Convolutional Networks

Chen, QF; Xu, J and Koltun, V
16th IEEE International Conference on Computer Vision (ICCV)
2017 | 2017 IEEE INTERNATIONAL CONFERENCE ON COMPUTER VISION (ICCV) , pp.2516-2525

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

137 被引频次

79 参考文献

相关记录

37 Naturalness Preserved Enhancement Algorithm for Non-Uniform Illumination Images

Wang, SH; Zheng, J; (...); Li, B
Sep 2013 | IEEE TRANSACTIONS ON IMAGE PROCESSING 22 (9) , pp.3538-3548

Full Text Finder 出版商处的全文 •••

在文献中引用: 4

546 被引频次

35 参考文献

相关记录

38 Denoising Convolutional Neural Network

Xu, QY; Zhang, CJ and Zhang, L
IEEE International Conference on Information and Automation 2015
2015 | 2015 IEEE INTERNATIONAL CONFERENCE ON INFORMATION AND AUTOMATION , pp.1184-1187

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

18 被引频次

6 参考文献

相关记录

39 Deep Image Prior

Ulyanov, D; Vedaldi, A and Lempitsky, V
31st IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2018 | 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.9446-9454

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

993 被引频次

33 参考文献

相关记录

40 Seeing Motion in the Dark

Chen, C; Chen, QF; (...); Koltun, V
IEEE/CVF International Conference on Computer Vision (ICCV)
2019 | 2019 IEEE/CVF INTERNATIONAL CONFERENCE ON COMPUTER VISION (ICCV 2019) , pp.3184-3193

Full Text Finder 出版商处的全文 •••

在文献中引用: 8

56 被引频次
47 参考文献
相关记录

41 EEMEFN: Low-Light Image Enhancement via Edge-Enhanced Multi-Exposure Fusion Network

Zhu, MF; Pan, PB; (...); Yang, Y
34th AAAI Conference on Artificial Intelligence / 32nd Innovative Applications of Artificial Intelligence Conference / 10th AAAI Symposium on Educational Advances in Artificial Intelligence
2020 |
THIRTY-FOURTH AAAI CONFERENCE ON ARTIFICIAL INTELLIGENCE, THE THIRTY-SECOND INNOVATIVE APPLICATIONS OF ARTIFICIAL INTELLIGENCE CONFERENCE AND THE TENTH AAAI SYMPOSIUM ON EDUCATIONAL ADVANCES IN ARTIFICIAL INTELLIGENCE
34 , pp.13106-13113

Full Text Finder •••

在文献中引用: 10

48 被引频次
29 参考文献
相关记录

42 The Perception-Distortion Tradeoff

Blau, Y and Michaeli, T
31st IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2018 | 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.6228-6237

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 2

292 被引频次
55 参考文献
相关记录

43 Learning a no-reference quality metric for single-image super-resolution

Ma, C; Yang, CY; (...); Yang, MH
May 2017 | COMPUTER VISION AND IMAGE UNDERSTANDING 158 , pp.1-16

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 2

223 被引频次
44 参考文献
相关记录

44 Imagenet: A large-scale hierarchical image database

Deng, J.; Dong, W.; (...); Fei-Fei, L.
2009 IEEE conference on computer vision and pattern recognition
2009 | 2009 IEEE C COMPUTER , pp.248-255
IEEE

在文献中引用: 1

1,258 被引频次
0 参考文献

45 GLEAN: Generative Latent Bank for Large-Factor Image Super-Resolution

Chan, KCK; Wang, XT; (...); Loy, CC
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2021 | 2021 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION, CVPR 2021 , pp.14240-14249

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

41 被引频次
46 参考文献
相关记录

46 Low Light Video Enhancement Using Synthetic Data Produced with an Intermediate Domain Mapping

Triantafyllidou, D.; Moran, S.; (...); Slabaugh, G.
Computer Vision - ECCV 2020. 16th European Conference
2020 | Computer Vision - ECCV 2020. 16th European Conference. Proceedings. Lecture Notes in Computer Science (LNCS 12358) , pp.103-19

4 被引频次
0 参考文献

在文献中引用: 2

47

Exposure: A White-Box Photo Post-Processing Framework

Hu, YM; He, H; (...); Lin, S
Jul 2018 | ACM TRANSACTIONS ON GRAPHICS 37 (2)

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

70
被引频次

54
参考文献

相关记录

Full Text Finder 查看全文 •••

在文献中引用: 2

相关记录

55

LLNet: A deep autoencoder approach to natural low-light image enhancement

Lore, KG; Akintayo, A and Sarkar, S

Jan 2017 | PATTERN RECOGNITION 61 , pp.650-662

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 15

531
被引频次

32
参考文献

相关记录

56

Successive Graph Convolutional Network for Image De-raining

Fu, XY; Qi, Q; (...); Paisley, J

May 2021 | Mar 2021 (在线发表) | INTERNATIONAL JOURNAL OF COMPUTER VISION 129 (5) , pp.1691-1711

被引参考文献深度分析

Full Text Finder 查看全文 •••

在文献中引用: 1

11
被引频次

102
参考文献

相关记录

57

Auto-DeepLab: Hierarchical Neural Architecture Search for Semantic Image Segmentation

Liu, CX; Chen, LC; (...); Li, FF

32nd IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)

2019 | 2019 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2019) , pp.82-92

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

444
被引频次

92
参考文献

相关记录

58

Towards Unsupervised Deep Image Enhancement With Generative Adversarial Network

Ni, ZK; Yang, WH; (...); Kwong, S

2020 | IEEE TRANSACTIONS ON IMAGE PROCESSING 29 , pp.9140-9151

Full Text Finder 知识库中的免费已提交文章 查看全文 •••

在文献中引用: 1

26
被引频次

34
参考文献

相关记录

59

Removing rain from single images via a deep detail network

Fu, XY; Huang, JB; (...); Paisley, J

30th IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)

2017 | 30TH IEEE CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2017) , pp.1715-1723

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

454
被引频次

35
参考文献

相关记录

60 Learning a Deep Single Image Contrast Enhancer from Multi-Exposure Images

362 被引频次

Cai, JR; Gu, SH and Zhang, L
Apr 2018 | IEEE TRANSACTIONS ON IMAGE PROCESSING 27 (4) , pp.2049-2062

60 参考文献

Full Text Finder 出版商处的全文 •••

在文献中引用: 4

相关记录

61 Learning Temporal Consistency for Low Light Video Enhancement from Single Images

19 被引频次

Zhang, F; Li, Y; (...); Fu, Y
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2021 | 2021 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION, CVPR 2021 , pp.4965-4974

33 参考文献

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 2

相关记录

62 Blind Face Restoration via Deep Multi-scale Component Dictionaries

35 被引频次

Xiaoming Li; Chaofeng Chen; (...); Lei Zhang
Computer Vision - ECCV 2020. 16th European Conference
2020 | Computer Vision - ECCV 2020. 16th European Conference. Proceedings. Lecture Notes in Computer Science (LNCS 12354) , pp.399-415

0 参考文献

在文献中引用: 1

63 Brightness preserving dynamic histogram equalization for image contrast enhancement

417 被引频次

Ibrahim, H and Kong, NSP
Nov 2007 | IEEE TRANSACTIONS ON CONSUMER ELECTRONICS 53 (4) , pp.1752-1758

10 参考文献

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

相关记录

64 Learning to Restore Low-Light Images via Decomposition-and-Enhancement

73 被引频次

Xu, K; Yang, X; (...); Lau, RWH
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2020 | 2020 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.2278-2287

49 参考文献

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

相关记录

65 Zero-Shot Restoration of Back-lit Images Using Deep Internal Learning

24 被引频次

Zhang, L; Zhang, LJ; (...); Zhao, SJ
27th ACM International Conference on Multimedia (MM)
2019 | PROCEEDINGS OF THE 27TH ACM INTERNATIONAL CONFERENCE ON MULTIMEDIA (MM'19) , pp.1623-1631

30 参考文献

Full Text Finder 出版商处的全文 •••

在文献中引用: 12

相关记录

66 Sparse Gradient Regularized Deep Retinex Network for Robust Low-Light Image Enhancement

41

Yang, WH; Wang, WJ; (...); Liu, JY
2021 | IEEE TRANSACTIONS ON IMAGE PROCESSING 30 , pp.2072-2086

Full Text Finder 查看全文 •••

在文献中引用: 2

被引频次

59
参考文献

相关记录

67

LIME: Low-Light Image Enhancement via Illumination Map Estimation

Guo, XJ; Li, Y and Ling, HB
Feb 2017 | IEEE TRANSACTIONS ON IMAGE PROCESSING 26 (2) , pp.982-993

Full Text Finder 出版商处的免费全文 •••

在文献中引用: 2

772
被引频次

45
参考文献

相关记录

68

BasicVSR: The Search for Essential Components in Video Super-Resolution and Beyond

Chan, KCK; Wang, XT; (...); Loy, CC
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2021 | 2021 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION, CVPR 2021 , pp.4945-4954

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

58
被引频次

39
参考文献

相关记录

69

Power-Constrained Contrast Enhancement for Emissive Displays Based on Histogram Equalization

Lee, C; Lee, C; (...); Kim, CS
Jan 2012 | IEEE TRANSACTIONS ON IMAGE PROCESSING 21 (1) , pp.80-93

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

102
被引频次

27
参考文献

相关记录

70

Getting to know low-light images with the Exclusively Dark dataset

Loh, YP and Chan, CS
Jan 2019 | COMPUTER VISION AND IMAGE UNDERSTANDING 178 , pp.30-42

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 3

140
被引频次

58
参考文献

相关记录

71

Structure-Revealing Low-Light Image Enhancement Via Robust Retinex Model

Li, MD; Liu, JY; (...); Guo, ZM
Jun 2018 | IEEE TRANSACTIONS ON IMAGE PROCESSING 27 (6) , pp.2828-2841

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

371
被引频次

43
参考文献

相关记录

72

MBLLEN: Low-light image/video enhancement using CNNs

Lv, F.; Lu, F.; (...); Lim, C.
Proc. Brit. Mach. Vis. Conf. (BMVC)
2018 | PROC BRIT MACH VIS C , pp.1-13

在文献中引用: 13

146
被引频次

0
参考文献

73 Lightening Network for Low-Light Image Enhancement

Wang, LW; Liu, ZS; (...); Lun, DPK
2020 | IEEE TRANSACTIONS ON IMAGE PROCESSING 29 , pp.7984-7996

Full Text Finder 查看全文 •••

在文献中引用: 2

60 被引频次

38 参考文献

相关记录

74 The psychophysics of contrast brightness

Whittle, P. and Gilchrist, A. L.
1994 | Brightness, Lightness, and Transparenc , pp.35-110
Lawrence Erlbaum Associates Inc., Mahwah, NJ, USA

在文献中引用: 1

76 被引频次

0 参考文献

75 WIDER FACE: A Face Detection Benchmark

Yang, S; Luo, P; (...); Tanal, XO
2016 IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
2016 | 2016 IEEE CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.5525-5533

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

461 被引频次

31 参考文献

相关记录

76 Recovering Realistic Texture in Image Super-resolution by Deep Spatial Feature Transform

Wang, XT; Yu, K; (...); Loy, CC
31st IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2018 | 2018 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.606-615

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

331 被引频次

51 参考文献

相关记录

77 Underexposed Photo Enhancement using Deep Illumination Estimation

Wang, RX; Zhang, Q; (...); Jia, JY
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2019 | 2019 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2019) , pp.6842-6850

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

238 被引频次

34 参考文献

相关记录

78 Improving Convolutional Networks With Self-Calibrated Convolutions

Jiang-Jiang Liu; Qibin Hou; (...); Jiashi Feng
2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2020 | 2020 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR). Proceedings , pp.10093-102

在文献中引用: 1

135 被引频次

0 参考文献

79 Very deep convolutional networks for large-scale image recognition

224

Simonyan, K. and Zisserman, A.
Int. Conf. on Learning Representations.
2015 | P ICLR

在文献中引用: 1

被引频次

0
参考文献

80 AN ALTERNATIVE TECHNIQUE FOR THE COMPUTATION OF THE DESIGNATOR IN THE RETINEX THEORY OF COLOR-VISION

LAND, EH
May 1986 | PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA 83 (10) , pp.3078-3080

Full Text Finder 知识库中的免费已发表文章 出版商处的全文 •••

在文献中引用: 2

374
被引频次

6
参考文献

相关记录

81 Loss Functions for Image Restoration With Neural Networks

Zhao, H; Gallo, O; (...); Kautz, J
Mar 2017 | IEEE TRANSACTIONS ON COMPUTATIONAL IMAGING 3 (1) , pp.47-57

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

959
被引频次

29
参考文献

相关记录

82 Low-Light Image Enhancement via a Deep Hybrid Network

Ren, WQ; Liu, SF; (...); Yang, MH
Sep 2019 | IEEE TRANSACTIONS ON IMAGE PROCESSING 28 (9) , pp.4364-4375

Full Text Finder 出版商处的全文 •••

在文献中引用: 4

181
被引频次

59
参考文献

相关记录

83 ECO: Efficient Convolution Operators for Tracking

Danelljan, M; Bhat, G; (...); Felsberg, M
30th IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2017 | 30TH IEEE CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2017) , pp.6931-6939

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

1,410
被引频次

39
参考文献

相关记录

84 Video Enhancement with Task-Oriented Flow

Xue, TF; Chen, BA; (...); Freeman, WT
Aug 2019 | INTERNATIONAL JOURNAL OF COMPUTER VISION 127 (8) , pp.1106-1125

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

365
被引频次

56
参考文献

相关记录

85 RetinexDIP: A Unified Deep Framework for Low-Light Image Enhancement

Zhao, ZJ; Xiong, BS; (...); Kuang, F
Mar 2022 | IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY 32 (3) , pp.1076-1088

Full Text Finder 查看全文 •••

在文献中引用: 2

40
被引频次

65
参考文献

相关记录

86 U-Net: convolutional networks for biomedical image segmentation

Ronneberger, O.; Fischer, P. and Brox, T.
Proceedings of 18th International Conference on Medical Image Computing and Computer-Assisted Intervention
2015 | LECT NOTES COMPUTER , pp.234-241
Springer

在文献中引用: 2

589 被引频次

0 参考文献

87 Deep retinex decomposition for low-light enhancement

Wei, C.; Wang, W.; (...); Liu, J.
Proc. Bril. Mach. Vis. Conf.
2018 | P BRIT MACH VIS C , pp.1-12

在文献中引用: 26

55 被引频次

0 参考文献

88 Properties and performance of a center/surround retinex

Jobson, DJ; Rahman, ZU and Woodell, GA
Mar 1997 | IEEE TRANSACTIONS ON IMAGE PROCESSING 6 (3) , pp.451-462

Full Text Finder 出版商处的全文 •••

在文献中引用: 2

1,206 被引频次

15 参考文献

相关记录

89 Online Video Deblurring via Dynamic Temporal Blending Network

Kim, TH; Lee, KM; (...); Hirsch, M
16th IEEE International Conference on Computer Vision (ICCV)
2017 | 2017 IEEE INTERNATIONAL CONFERENCE ON COMPUTER VISION (ICCV) , pp.4058-4067

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 1

130 被引频次

39 参考文献

相关记录

90 Learning Image-Adaptive 3D Lookup Tables for High Performance Photo Enhancement in Real-Time

Zeng, H; Cai, JR; (...); Zhang, L
Apr 1 2022 | IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE 44 (4) , pp.2058-2073

被引参考文献深度分析

Full Text Finder 知识库中的免费已提交文章 查看全文 •••

在文献中引用: 1

17 被引频次

52 参考文献

相关记录

91 Zero-Reference Deep Curve Estimation for Low-Light Image Enhancement

Guo, CL; Li, CY; (...); Cong, RM
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2020 | 2020 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.1777-1786

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 13

299 被引频次

38 参考文献

相关记录

92 Low-Light Image Enhancement Using Variational Optimization-based Retinex Model

103

Park, S; Yu, S; (...); Paik, J
May 2017 | IEEE TRANSACTIONS ON CONSUMER ELECTRONICS 63 (2) , pp.178-184

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

被引频次

19
参考文献

相关记录

93

DSFD: Dual Shot Face Detector

Li, J; Wang, YB; (...); Huang, FY
32nd IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)
2019 | 2019 IEEE/CVF CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR 2019) , pp.5055-5064

Full Text Finder 知识库中的免费已提交文章 出版商处的全文 •••

在文献中引用: 3

148
被引频次

38
参考文献

相关记录

94

Integrating Semantic Segmentation and Retinex Model for Low Light Image Enhancement

Fan, MH; Wang, WJ; (...); Liu, JY
28th ACM International Conference on Multimedia (MM)
2020 | MM '20: PROCEEDINGS OF THE 28TH ACM INTERNATIONAL CONFERENCE ON MULTIMEDIA , pp.2317-2325

Full Text Finder 出版商处的全文 •••

在文献中引用: 2

13
被引频次

51
参考文献

相关记录

95

Learning a Convolutional Neural Network for Non-uniform Motion Blur Removal

Sun, J; Cao, WF; (...); Ponce, J
IEEE Conference on Computer Vision and Pattern Recognition (CVPR)
2015 | 2015 IEEE CONFERENCE ON COMPUTER VISION AND PATTERN RECOGNITION (CVPR) , pp.769-777

Full Text Finder 知识库中的免费已接受文章 出版商处的全文 •••

在文献中引用: 1

466
被引频次

32
参考文献

相关记录

96

A dynamic histogram equalization for image contrast enhancement

Abdullah-Al-Wadud, M; Kabir, MH; (...); Chae, O
May 2007 | IEEE TRANSACTIONS ON CONSUMER ELECTRONICS 53 (2) , pp.593-600

Full Text Finder 出版商处的全文 •••

在文献中引用: 1

565
被引频次

18
参考文献

相关记录

97

NIMA: Neural Image Assessment

Talebi, H and Milanfar, P
Aug 2018 | IEEE TRANSACTIONS ON IMAGE PROCESSING 27 (8) , pp.3998-4011

Full Text Finder 出版商处的免费全文 •••

在文献中引用: 1

322
被引频次

47
参考文献

相关记录

98

Parade: Passage representation aggregation for document reranking

Li, Canjia.; Yates, Andrew.; (...); Sun, Yingfei.
2020 | arXiv

5
被引频次

0
参考文献

99 [Not available]

YANG WH
2017 | PROC CVPR IEEE , pp.1685

82
被引频次

0
参考文献

100 Segmentation Transformer: Object-Contextual Representations for Semantic Segmentation

Yuan, Y.; Chen, X. and Wang, J.
2019 | arXiv

11
被引频次

0
参考文献

101 Bdd100k: A diverse driving video database with scalable annotation tooling

Yu, Fisher; Xian, Wenqi; (...); Darrell, Trevor
2018 | arXiv

17
被引频次

0
参考文献

102 Mobilenets: Efficient convolutional neural networks for mobile vision applications

Howard, A.G.; Zhu, M.; (...); Adam, H.
2017 | arXiv

3,788
被引频次

0
参考文献

103 An image is worth 16x16 words: Transformers for image recognition at scale

Dosovitskiy, A.; Beyer, L.; (...); Gelly, S.
2020 | arXiv

1,680
被引频次

0
参考文献