

Algorithms for Intelligent Systems

Series Editors: Jagdish Chand Bansal · Kusum Deep · Atulya K. Nagar

Teena Sharma
Nishchal K. Verma

Artificial Intelligent Algorithms for Image Dehazing and Non-Uniform Illumination Enhancement

 Springer

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Series Editors

Jagdish Chand Bansal, Department of Mathematics, South Asian University,
New Delhi, Delhi, India

Kusum Deep, Department of Mathematics, Indian Institute of Technology Roorkee,
Roorkee, Uttarakhand, India

Atulya K. Nagar, School of Mathematics, Computer Science and Engineering,
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Teena Sharma
Mehta Family School of Data Science
and Artificial Intelligence
Indian Institute of Technology Guwahati
Guwahati, Assam, India

Nishchal K. Verma
Department of Electrical Engineering
Indian Institute of Technology Kanpur
Kanpur, Uttar Pradesh, India

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Preface

Artificial Intelligence (AI) has introduced a range of effective image processing tools that play a pivotal role in fortifying vision-based applications. The success of these applications hinges on the quality of input images, particularly those containing intricate textural details. The merit of an image is typically gauged through visible aspects such as illumination, color, and shapes, all of which can be adversely impacted by atmospheric factors like haze and uneven illumination.

When haze particles are present, they impede the transmission of reflected light rays to the observer, resulting in an elevation of airlight and causing the image to exhibit a hazy appearance. Conversely, non-uniform illumination conditions contribute to a darkened depiction of the captured scene, leading to the obscuring of visible features. Consequently, image enhancement emerges as a crucial preliminary step, aiming to revive textural intricacies and refine image details. This enhancement process proves indispensable in bolstering the resilience of vision-based applications, ensuring their optimal performance even in challenging environmental circumstances.

This book provides a detailed explanation of AI algorithms for image dehazing and non-uniform illumination enhancement. It outlines unsupervised and supervised methods with their advantages and limitations. The structure of this book will be helpful for a reader first to understand the unsupervised methods considering the scenario when it is impractical to have a large set of datasets for training an AI algorithm for image enhancement. Since there have been extensive advancements in deep learning methods and the availability of resources, this book provides a detailed insight into the run-time and accuracy adjustments of deep learning-based AI algorithms to learn the pattern better while performing enhancement. It also introduces the fuzzy set theory-based decision-making tools to deal with uncertainties

present in a digital image. The content presented in this book will open research pathways to increase the robustness of various vision-based applications like object detection, vehicle tracking, security, medical diagnostics, etc.

Guwahati, India
Kanpur, India
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Teena Sharma
Nishchal K. Verma

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About the Authors

Dr. Teena Sharma is an Assistant Professor at the Mehta Family School of Data Science and Artificial Intelligence (MFSDS&AI), Indian Institute of Technology Guwahati, India. Dr. Sharma worked as a Postdoctoral Scholar at the University of Tennessee, Memphis, Tennessee, USA. Dr. Sharma received her Ph.D. degree in Electrical Engineering from the Indian Institute of Technology Kanpur, India. Dr. Sharma's research interests are Artificial Intelligence, Machine Learning, and Deep Learning Algorithms and their applications to Computer Vision: Object detection, Classification, Identification, Recognition, Image enhancement, and Image matching; Equitable Precision Medicine: Transfer learning, Meta-learning, Few-shot learning; and Condition-based Monitoring: Fault diagnosis and Remaining useful life prediction. Dr. Sharma is also serving as an Associate Editor for the IEEE Transactions on Artificial Intelligence.

Dr. Nishchal K. Verma (SM'13) is a Professor in the Department of Electrical Engineering at the Indian Institute of Technology Kanpur, India. He obtained his Ph.D. in Electrical Engineering from the Indian Institute of Technology Delhi, India. Dr. Verma's research expertise falls under Artificial Intelligence (AI) related theories and its applications to many inter-disciplinary domains but not limited to machine learning, deep learning, computer vision, prognosis and health management, bioinformatics, cyber-physical systems, complex and highly non-linear systems modeling, etc. He has published more than 250 research papers and four Books (edited/co-authored) in the field of AI. He has successfully completed 23 projects from various funding agencies such as The BOEING Company, USA, DST, DRDO, JCB CAT, MHRD, SERB, CSIR, IIT Kanpur, MCIT, SFTIG, VTOL, etc. He has been serving as Associate Editor of IEEE Transactions on Artificial Intelligence and IEEE Transactions on Neural Networks and Learning Systems.

Acronyms

AHE	Adaptive Histogram Equalization
AI	Artificial Intelligence
AIPNet	Atmospheric Illumination Prior Network
AIT2FF	Adaptive Interval Type-2 Fuzzy Filter
AOD-Net	All-in-One Dehazing Network
AUC	Area Under Curve
BCCR	Boundary Constraint and Contextual Regularization
BM3D	Block Matching and 3D
CAP	Color Attenuation Prior
CLAHE	Contrast Limited Adaptive Histogram Equalization
CNN	Convolutional Neural Network
CSIDNet	Compact Single Image Dehazing Network
CVC	Contextual and Variational Contrast
DCP	Dark Channel Prior
DICM	DIGital CaMeras
ENR	Efficient Naturalness Restoration
FFA-Net	Feature Fusion Attention Network
FL	Fuzzy Logic
FST	Fuzzy Set Theory
GFN	Gated Fusion Network
GMAN	Generic Model-Agnostic Network
GMF	Gaussian Membership Function
GT2	General Type-2
HDR	High Dynamic Range
HE	Histogram Equalization
HSTS	Hybrid Subjective Testing Set
IT2FL	Interval Type-2 Fuzzy Logic
LDR	Layered Difference Representation
LECARM	Low-light image Enhancement CAMERA Response Model
LIME	Low-light IMAGE Enhancement
LMF	Lower Membership Function

LOE	Lightness Order Error
MAE	Mean Absolute Error
MF	Membership Function
MSCNN	Multi-Scale Convolutional Neural Network
MSE	Mean Square Error
MSR	Multi-Scale Retinex
NIQE	Naturalness Image Quality Evaluator
OTS	Outdoor Training Set
PSNR	Peak Signal-to-Noise Ratio
ReLU	Rectified Linear Unit
RESIDE	REAlistic Single Image DEhazing
ROC	Receiver Operating Characteristic
ROI	Region Of Interest
RTTS	Real-world Task-driven Testing Set
SCN	Supply Chain Network
SIFT	Scale Invariant Feature Transform
SOTS	Synthetic Objective Testing Set
SSIM	Structural SIMilarity
SSR	Single Scale Retinex
SURF	Speeded Up Robust Features
T1FF	Type-1 Fuzzy Filter
T2FF	Type-2 Fuzzy Filter
UMF	Upper Membership Function
Zero-DCE	Zero-reference Deep Curve Estimation
ZSWFM	Z-Score Weighting Function Map

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