

# Single Retinal Image Restoration

Citation for published version (APA):

Zhang, S. (2023). *Single Retinal Image Restoration*. [Doctoral Thesis, Maastricht University]. Maastricht University. <https://doi.org/10.26481/dis.20231211sz>

## Document status and date:

Published: 01/01/2023

## DOI:

[10.26481/dis.20231211sz](https://doi.org/10.26481/dis.20231211sz)

## Document Version:

Publisher's PDF, also known as Version of record

## Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

## General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.umlib.nl/taverne-license](http://www.umlib.nl/taverne-license)

## Take down policy

If you believe that this document breaches copyright please contact us at:

[repository@maastrichtuniversity.nl](mailto:repository@maastrichtuniversity.nl)

providing details and we will investigate your claim.

# Single Retinal Image Restoration

Shuhe Zhang

1. Retinal image formation described by the double-fundus reflection process is well-formulated in the optics community but hitherto ignored in the community of retinal image processing. (*This thesis*)
2. A general framework of retinal image enhancement/restoration consists of two procedures: illumination correction and dehazing. (*This thesis*)
3. The Center-surrounded Retinex theory is the bridge between retinal image illumination correction and retinal image dehazing and is unified under the framework of image denoising. (*This thesis*)
4. Non-learning-based cataract retinal image enhancement algorithms outperform deep-learning methods and a more comprehensible and reliable. (*This thesis*)
5. Illumination correction and blind-deconvolution are unified into a single framework—the Richardson-Lucy deconvolution to achieve retinal image blind deblurring. (*This thesis*)
6. Retinal image enhancement/restoration will benefit society by providing easier access to healthcare, and promoting better surgical outcomes. (*Impact*)
7. With the advent of image processing equipment, digital recording and processing of retinal images have replaced standard film-based fundus photography. (*Eli Peli, Neuroscience & Biobehavioral Reviews*)
8. Philosophers defined the eye as a window to the soul long before scientists addressed this cliché to determine its scientific basis and clinical relevance. (*Anat London, Inbal Benhar, Michal Schwartz, Nature Reviews Neurology*)
9. Ears cannot speak, lips cannot hear, but eyes can both signal and perceive. For human beings, this dual function makes the eyes a remarkable tool for social interaction. (*Matthias S. Gobel, Heejung S. Kim, Daniel C. Richardson, Cognition*)
10. A mathematical formulation of an often crude experience leads in an uncanny number of cases to an amazingly accurate description of a large class of phenomena. (*Physicist Wigner Jenő Pál*)