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Imaging
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Vision Models for High Dynamic Range and Wide Colour Gamut Imaging Techniques and Applications

Marcelo Bertalmío



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A Luis, Jose, Mónica y Milagros.

A Vera, Lucas, Serrana y Graciela.

En recuerdo de mi padre.

Advance Praise for “Vision Models for High Dynamic Range and Wide Colour Gamut Imaging: Techniques and Applications”

Dr. Bertalmío has written a very useful text that connects key perceptual phenomena to image reproduction. His text nicely explains the scientific and engineering foundations for many image computations, including gamut mapping, tone mapping, and image quality metrics. The material is a thoughtful reference for people who wish to understand how analyses of human visual perception have been transformed into applications that measure image quality. I am particularly enthusiastic about his call for new vision models to guide the future generation of displays and rendering!

Professor Brian A. Wandell, Director of the Center for Cognitive and Neurobiological Imaging, Stanford University, USA

A lot of our colour science relies on experiments done decades ago, in viewing conditions that have very little to do with how we consume dramatic content today. Marcelo Bertalmío’s book manages to move the discussion forward into the 21st century – by describing in detail how we see and process visual content, and the huge role that adaptation and efficient encoding of the visual signal play within it. But also by directly relating this knowledge to modern high dynamic range display technology. This book is essential reading for anyone who is interested in colour science for visual media, and I will keep bugging my colleagues at FilmLight to read it and to apply the wealth of knowledge contained in it towards our advancement of visual storytelling technology.

Wolfgang Lempp, founder and director, FilmLight Ltd, UK

A comprehensive and rare synthesis of vision science and imaging technology. This book is the go-to source for those wishing to learn more about the neuroscience and psychophysics of vision and its implications for the design of imaging and display pipelines to achieve highest quality for the human observer. Such a book is long overdue.

Professor Bruno Olshausen, Helen Wills Neuroscience Institute and School of Optometry, UC Berkeley, USA

This book provides an in-depth background on vision science for engineers working on imaging applications. It clearly explains how HDR imaging must essentially utilize the adaptation characteristics of the human visual system, and covers

practical solutions for HDR/SDR and WCG production based on a deep knowledge of vision models.

Dr. Kenichiro Masaoka, NHK (Japan Broadcasting Corporation) Science & Technology Research Laboratories, Japan

This is a great book for anyone interested in tone and gamut mapping. But this is also a great book for vision scientists in general, linking our basic understanding of human vision gained through neuroscience, psychophysics and the theory of efficient coding to applications in imaging and cinema — and it nicely highlights the fundamental limitations of our current understanding of the human visual system. I thoroughly enjoyed reading Marcelo Bertalmío's book and I hope it finds the wide readership it deserves.

Professor Felix Wichmann, Tübingen University and Max Planck Institute, Germany

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About the author

Marcelo Bertalmío (Montevideo, 1972) is a full professor at Universitat Pompeu Fabra, Spain, in the Information and Communication Technologies Department. He received the B.Sc. and M.Sc. degrees in electrical engineering from the Universidad de la República, Uruguay, and the Ph.D. degree in electrical and computer engineering from the University of Minnesota in 2001. He was awarded the 2012 SIAG/IS Prize of the Society for Industrial and Applied Mathematics (SIAM) for co-authoring the most relevant image processing work published in the period 2008–2012. Has received the Femlab Prize, the Siemens Best Paper Award, the Ramón y Cajal Fellowship, and the ICREA Academia Award, among other honours. He was Associate Editor for SIAM-SIIMS and elected secretary of SIAM’s activity group on imaging. Has obtained an ERC Starting Grant for his project “Image processing for enhanced cinematography” and two ERC Proof of Concept Grants to bring to market tone mapping and gamut mapping technologies. He’s co-coordinator of two H2020 projects, HDR4EU and SAUCE, involving world-leading companies in the film industry. Has written a book titled “Image Processing for Cinema”, published by CRC Press in 2014, and edited the book “Denoising of Photographic Images and Video” published by Springer in 2018. His current research interests are in developing image processing algorithms for cinema that mimic neural and perceptual processes in the visual system, and to investigate new vision models based on local histogram equalization, with fine-tuning by movie professionals.

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