Preface

Paintings are assumed to be a special class of image for the quality of their aesthetic appeal. In a painting, little is left to chance, with colour, form, composition and suchlike all being given careful consideration by the painter, who is a highly trained individual. In this way, a painting offers an aesthetic experience that is unlikely to be found in a photograph.

New generations of image capture devices, such as Google Goggles and the light field camera, promise a future in which the formal attributes of a captured scene may be made available for editing to a degree that has hitherto been the exclusive territory of painting. In this sense, paintings and photographs are converging, and it therefore seems an opportune time to address them in comparison to each other. This book details cutting-edge work demonstrating how some of the aesthetic attributes of a painting may be transferred to a photograph using the latest computational approaches.

The research described in this book was the result of a collaboration between engineers and an artist and was a substantial learning experience for all. For the artist, the engineering contributed an empirical dimension to the classic literature on the topic, most of which hails from a time before an image could be subject to such exact evaluation. For the engineers, the complex and multidimensional way that artists fabricate images was a source of constant surprise.

For its emphasis on technical process, this book will be of primary appeal to engineers. However, we can imagine it also being of relevance to artists seeking an empirical understanding of the aesthetic image.

A Quick Tour of the Contents

Part I (Part I on p. 1) discusses the image attributes and aesthetic aspects of paintings. Introduced in Chap. 1 on p. 3 are the two painting genres that are the focus of this book: the portrait and the landscape. In Chap. 2 on p. 9 the topic of colour is introduced. This introduces the six structural contrasts that are the

foundational core of our research: global contrast, local contrast, centre-corner contrast, regional contrast, neighbouring regional contrast and depth-aware contrast. In Chap. 3 on p. 33 is presented a summary of ways in which contrast may be computationally modelled. In Chap. 4 on p. 39 the topic of composition is addressed, with a special focus on vignetting.

Part II (Part II on p. 53) details a number of methods by which the aesthetic values of paintings may be transferred to photographs. These are as follows:

- **Transfer of the global contrast** (Chap. 5 on p. 55). In this early work, we analyse the global hue, saturation and lightness contrasts of paintings by two well-known artists: Vincent Van Gogh (Dutch 1853–1890) and Sir Lawrence Alma-Tadema (English 1836–1912). The style of a painting is considered as a high-level organisation of these contrasts. This organisation is transferred to a photographic image by histogram matching of saturation and lightness and also by dominant hue alignment and spread stretch along the RYB colour wheel.
- **Transfer of the atmospheric perspective effect** (Chap. 6 on p. 71). The atmospheric perspective effect is a natural phenomenon, relating to the effects of atmospheric distortion upon the appearance of distant objects. We show that artists exaggerate this phenomenon in order to improve the visual appeal of the painting and the illusion of depth. The contrast manipulation is formulated as an optimisation problem that simultaneously considers the desired inter-contrast, intra-contrast and specified gradient constraints.
- **Transfer of regional contrast from portrait paintings** (Chap. 7 on p. 107). The function of a portrait is to draw attention of the viewer to the sitter's face. We show that painters serve this function through attention to the inter- and intra-regional contrast values of the painting. In transferring this contrast structure from paintings to photographs, we employ a novel piecewise nonlinear transformation curve.
- **Transfer of the pose-related composition in portraits** (Chap. 8 on p. 137). Painters exhibit substantial discretion in the manner in which they frame a figure within a portrait. Pose, face direction and space around the figure are the main elements considered in portrait composition. A graph model is proposed that describes these attributes, the purpose of which is to select a painting with similar geometrical organisation. Space cropping technique is used to improve the composition of the photograph by aligning its composition to that of the selected painting.
- **Transfer of the vignetting effect** (Chap. 9 on p. 155). Emulating the natural fade-off of human vision, vignetting manifests as a darkening of the edges and corners of a painting, and a lightening of its centre. We compare the vignetting effect in paintings with that of photographs. The observation from the analysis shows that the vignetting effect in paintings is more purposely organised. Based on the observation, an algorithm is explored to transfer the lightness weighting from an example painting to a similar photograph.

- **Defining hue contrast** (Chap. 10 on p. 179). This chapter addresses the thorny subject of global hue contrast. There are well-understood methods to define global lightness and saturation contrast, which all reference such intensity-based values as average, least and most. Hue cannot be understood in such terms and is therefore not definable using the same approach. Using as reference Johannes Itten's colour contrasts, we present an approach by which the global hue contrast of an image may be quantified. It is particularly suitable to visualise the global hue contrast of large sets of images. We apply this definition on sets of aesthetically related images, thereby expressing their high-level hue organisation.
- **Interactive local hue contrast** (Chap. 11 on p. 191). Hue has an inherent semantic dimension, the hue of an object frequently being linked to its meaning. For this reason, it is very perilous to edit the hue of an image. This chapter proposes a way in which the hue of an image may be manipulated without its semantic meaning being damaged. The colour of an object frequently presents not as a single hue, but rather a range of hues. Hence a green tree may consist of yellow-greens and blue-greens. Taking the cue from the traditional painters practice of 'breaking' their colours, we present a means by which this range may be compressed or stretched. We develop a tool based on superpixels that can interactively select a range of hues, to make them available for this manipulation.

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