APPLICATION OF THE FILTRATION PROCESS IN STUDYING THE PERCEPTION OF IMAGES AND THEIR INTERPRETATION IN THE FIELD OF ART

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Summary

The work presents the impact of selected image properties, such as colour, brightness, contrast, tone, and shadow, as well as the observer's suggestion or persuasion, on the perception and interpretation of the said image, and consequently on the results of the observations.
However, the visual interpretation of the original image does not always reveal all its properties and details. Therefore, the author proposes image processing, for the purpose of research and analysis, using filtration.
Image analysis methodology, which applies the filtration process using dedicated edge filters with properties that isolate the boundaries of adjacent areas within that image, can be a helpful tool when conducting research in various fields of science, technology, architecture, and art.
The article presents examples of analysing image properties in the field of art.

Keywords

photointerpretation of images • filtration • image properties

1. Introduction

It is difficult to overestimate the role that the way images are interpreted plays in the recognition of objects, and in determining their properties within the painting [Świątkiewicz 1977].

Image parameters such as colour, luminance (surface vividness), contrast, tone, and shadow can affect the perception and, as a result, also the results of the observations, as well as the photointerpretation of photograms [Kwoczyńska et al. 2014].

The influence of the subconscious and the observer's suggestion or persuasion is not without significance, either.

Also, the phenomenon of dichotomy of vision has an impact on the way people perceive the image or the picture. The aforementioned phenomenon was used with skill and precision by the most famous artists painters of the past millennium, such as Leonardo da Vinci or Claude Monet, whose works served as representative, sample material for the analysis included in the present publication.

In turn, the image analysis methodology employed by the author, based on the use of a filtration process applying edge filters, can become a great tool for research in various fields of science and art.

2. Visual observations and visual testing

For an experimental investigation of the problem, as posed in the title of the work, the author of this publication has performed visual tests of two outstanding, well-known works of art [Osińska 1986], namely the reproductions of Leonardo da Vinci's canvas of "Mona Lisa" and Claude Monet's "Sunrise", selected as the most representative for the studies in question.

The tests were carried out by two groups of people (one counting seventeen, and the other, sixteen persons), all students of geodesy.

We asked the first group of respondents, after looking at the reproduction of Claude Monet's painting, in full colour (Figure 1), that they indicate the brightest object in the picture, that is, one that has the highest surface luminance. The answers were varied; some pointed to the sky, others to the glare of water reflecting light, others still to the sun, and so forth.

The second group of respondents was specifically asked the following question: "Is the sun the brightest object in the picture?"

Statistically, as many as 7 respondents in the second group answered "yes" (including 6 women).

It can be inferred that the variety of responses and some indecision of the first group of respondents testifies to the impression evoked in the observer by the image with similar (relatively even) surface luminance values. The observer tries to extract the object that is in this case the brightest, but it is difficult because they all have in fact a similar value.

However, when the level of suggestion or persuasion of the observers was increased by specifying the question and suggesting the guided answers, then almost half of the respondents pointed to the sun as the brightest object, probably because in their consciousness, reinforced throughout their whole lives, the sun is associated with clarity, and because the sun suggested itself as one of the answers in the multiple choice test.

From the above studies, the significance of the observer's suggestion or persuasion, and the manner of interpreting the image depends on the "interplay of colours", and more precisely, from the interpretation that our brain makes under the influence of a particular, precise juxtaposition of colours.

Therefore, when the interpreted colour image has surface luminance of little differentiation, certain objects can be read as brighter than others (although reality indicates otherwise), merely thanks to the juxtaposition (or interaction) of colours. This can cause errors in photointerpretation, both in terms of quality, and in extreme cases, it can lead to incorrect recognition of the object, as well as causing decreased accuracy and precision of the observation.

A chosen example of such a painting is "Sunrise" by Claude Monet (Figure 1). Here, in the case of monochrome visualization, some objects are hardly visible or they even

disappear. It is almost impossible to distinguish the boundaries of an object. However, the use of filtration (for instance, the construction or selection of an appropriate filter from the Ilwis software), and in particular the application of a dedicated edge filter, will sharpen the boundaries (edges) of the object, thus making it more visible [Dorozhynskyy and Tukaj 2009].
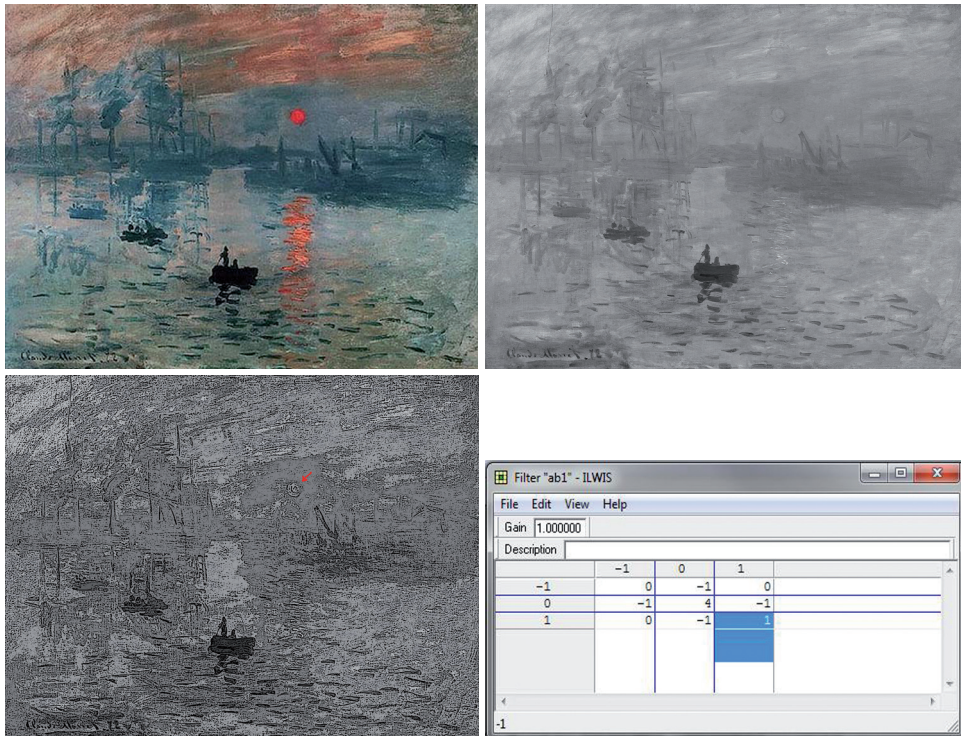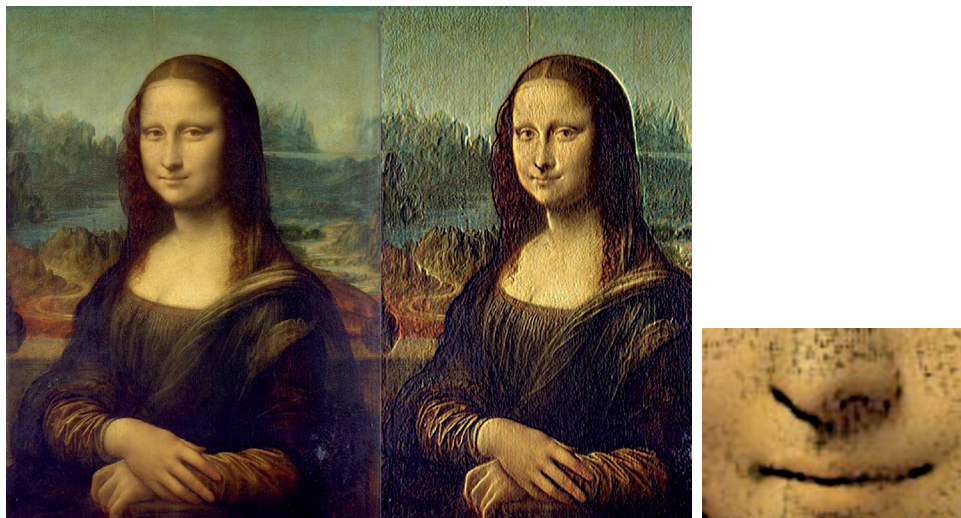

Source: author's study

Fig. 1. "Sunrise" by Claude Monet is a typical example of the effect of colours on a complex system of human perception – the surface luminance of the image is practically the same, which is most easily seen by observing a monochrome image; then, the sun is virtually invisible (in upper right corner). However, the use of a dedicated edge filter on this reproduction slightly distinguishes the indicated object: the sun (photo below with the filter mask shown in the ILWIS software)

It would seem that the sun and the surface of the water, which is surrounding boat and which is shining with the reflected light of the sun, are disappearing in the black and white image of Claude Monet's painting. This is proof for a particular way of photointerpretation, where the colour in the image plays a fundamental role in perception.

On the other hand, in the spatial interpretation of the object, a shadow plays a significant role in the context of the dichotomy of vision, resulting in a specific effect

in perception. Professionals involved in photogrammetry often deal with that effect in the case of aerial photographs of the earth's surface, which are used in the measurements they are conducting; hence, it is impossible to overestimate its role in spatial photointerpretation of the object.

Therefore, the impression of the depth and shape of the object may turn out to be far removed from reality, precisely because of the dichotomy of vision. A model example of this might be the interpretation of the masterpiece by Leonardo da Vinci, the "Mona Lisa" (Figure 2).

Source: author's study

Fig. 2. Gioconda's mysterious smile disappears as we move our vision from her eyes to her lips. This phenomenon has attracted attention and is pointed out by almost every guide in the Louvre museum in Paris. Here is one of the best examples of the significance of seen shadow (in the lower part of the face) in the painting, and its influence on the spatial interpretation of the object. After the author has applied, as before, the edge filter (shown on the right), the image became more "sharpened", allowing a deeper analysis of the work

To recapitulate, we might say that the dichotomy of our vision consists of two functions. The first one only allows three-dimensional vision and the perception of motion, while the second one is responsible for recognizing 2D objects, namely, their shapes and colours.

The above examples, therefore, show what the process of photointerpretation looks like in humans, and what are its consequences.

3. Methodology of image analysis using edge detection of images

In general, depending on the way of image processing (type of correlation), two ways of using filtration can be distinguished:

1. the detection of edges occurring in the structure of the image,
2. the ability to remove noise.

In the cases described above, the first method had been used.

As follows from the analysis of the two works (shown in Figures 1 and 2), filtration with the use of a dedicated edge filter is a useful tool for the study of image interpretation, enabling the shaping of the reconstruction of a selected part of the image.

By applying edge filtration and its properties, it is possible to analyse digital images more effectively than by using standard interpretation [Kędzierski 2002]. For example, selective extraction (underlining, highlighting) of specific areas of the image from a "useless" background, that is the noise and the artefacts, is facilitated here.

4. Conclusions

The research shows that surface luminance with similar values of the presented objects, depicted in images and photographs, may not only affect the accuracy and precision of the observations, but also lead to their wrong interpretation (specifically, photointerpretation), which implies the application of specific methods of processing the original image in the research. A certain solution to the problem of interpretation can therefore be provided by the use of edge filtration.

In turn, a shadow can cause disturbances in the spatial relationships between the objects in the image, which can cause specific disturbances when observing and measuring in the pictures.

The phenomena listed above result from the dichotomy of our perception as well as the activation of the subconscious.

In addition, there is the observer's suggestion or persuasion, which should be resisted; we should not be susceptible to it, while it is necessary to turn off the information noise

Image analysis after filtration supports the process of interpreting a painting as a work of art, by contributing a lot of additional, valuable information about it.

In conclusion, it is worth quoting Claude Monet's statement, which in a sense is the quintessence of the problem under discussion: "I only observed what the world showed me, so that I could testify about it with my brush (...)".

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