# De-Linearization Enhancement in Image Fidelity

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***Abstract -*** ***T*****he process of increasing or decreasing the intensity values of an RGB image is known as de-linearization. The main goal of this paper is to use software automation to analyze the quality of paints in manufacturing industries. In this paper, a MATLAB simulation tool for analyzing paint quality is presented. For all images, a Modified Simple Resistivity Technique (MSR) and its architecture with spatial filtering are proposed. When compared to previous techniques, the simulation results show an effective quality analysis.**

***Keywords - De*****-linearization, Spatial filtering, Intensity**

## I. INTRODUCTION

Quality assurance is any systematic process of checking to see if a product or service being developed is meeting specified requirements when it comes to product and service development. Many businesses have a separate quality assurance department. A quality assurance system is said to boost customer confidence and credibility, improve work processes and efficiency, and help a company compete more effectively. During World War II, Quality Assurance was first used to inspect and test munitions for defects after they were manufactured. Today's quality assurance systems place a premium on catching flaws before they make their way into the finished product.

Quality Assurance (QA) is a method of preventing errors or defects in manufactured products and avoiding problems when delivering solutions or services to customers, as defined by ISO 9000 as "a component of quality management aimed at ensuring that quality requirements are met." This defect prevention in quality assurance differs slightly from defect detection and rejection in quality control, and it's been dubbed a "shift left" because it puts quality first in the process.

Quality assurance refers to the administrative and procedural activities carried out in a quality system to ensure that a product's, service's, or activity's requirements and goals are met. Error prevention is achieved through systematic measurement, comparison to a standard, process monitoring, and an associated feedback loop. Quality control, on the other hand, is concerned with the output of the process. "Fit for purpose" (the product should be suitable for the intended purpose) and "right first time" are two quality assurance principles (mistakes should be eliminated). Quality assurance encompasses the management of the quality of raw materials, assemblies, products, and components, as well as production-related services, as well as the management, production, and inspection processes.

Nowadays, colour is acquired using a simulation technique known as "Color Laser Photolithography." Photolithography, also known as optical lithography or UV lithography, is a microfabrication technique for patterning parts of thin films or the bulk of a substrate. A geometric pattern is transferred from a photo mask to a light-sensitive chemical "photo resist," or simply "resist," on the substrate using light. A series of chemical treatments then either engraves the exposure pattern into the material beneath the photo resist or allows the deposition of a new material in the desired pattern. A modern CMOS wafer, for example, will go through the photolithographic cycle up to 50 times in complex integrated circuits. The remainder of the paper is laid out as follows: Section II covers previous work, Section III covers proposed work, Section IV covers results and comparisons, and Section V covers conclusions and future work.

## II. PREVIOUS WORK

Paint quality analysis can be done using a variety of techniques. Destructive testing is usually carried out during the development of a new formulation. The tester sprays customized panels made of aluminium, brass, or steel that are tailored to a customer's needs [5]. After that, the panels are exposed to ultraviolet rays in a salt spray chamber, a humidity chamber, and sometimes a box. The Taber abrasion test, the falling sand test, and cross-hatch adhesion tests are some of the other tests used by paint and coating manufacturers.

Producers with customers in green markets, or in more tightly regulated markets based on geography, perform a variety of environmental tests to check for volatile organic compounds. The Leadership in Environmental Design programme [LEED] is a green building certification programme developed by the United States Green Building Council for the green home construction market in the United States. Paints must be tested for a variety of characteristics in order to comply with the Leadership in Environmental Design programme, which are primarily driven by water efficiency, materials used, indoor environmental quality, sustainability, and factors related to energy use and atmosphere. To become Leadership in Environmental Design compliant, you must conduct extensive testing for a variety of factors and work closely with the USGBC or consultants to fully comprehend the scope of testing required.

We focused on [1] the natural ageing of well-defined macroscopic samples of paint media; [2] the modifying effects of typical artists' pigments on the ageing of these media; and [3] the utility of these findings in the characterization of unknown media samples in order to distinguish aged paint media by FTIR spectroscopy. Our key findings are that linseed oil, egg yolk, and a linseed oil and egg yolk emulsion prepared by R. J. Gettens in the 1930s have diagnostic IR spectral features that are well resolved from common inorganic pigment absorptions, allowing us to distinguish between these materials and detect their presence in authentic, renaissance paintings. Furthermore, thermally accelerated ageing of freshly prepared linseed oil films produces FTIR spectral features that are very similar to those found in naturally aged Gettens samples with similar initial composition. Our findings also show that the chemical changes associated with natural or thermally accelerated ageing of oil films differ significantly depending on the inorganic pigment used. The findings present a spectroscopic characterization of the dramatic, pigment-dependent chemical changes that have previously hampered the identification of linseed oil on aged paint samples. In subsequent publications, the successful extension of these results to the spectroscopic analysis of dimensionally resolved layers of paint will be discussed.

**Table 1.Disadvantages of proposed technique**

| TECHNIQUES | LIMITATIONS |
|---|---|
| **CHEMICAL TEST KITS** | -May damage the surface<br>-Difficult to observe color change for dark paints |
| **PORTABLE X-RAY FLUORESCENCE SPECTROMETRY** | -High purchase cost<br>-Requires some training<br>-Potentially larger margin of errors |
| **LABORATORY ANALYSIS** | -Too expensive<br>-Results are not readily available |
| **FAAS** | -Sample throughout is approximately one sample every 2 to 3 minutes |
| **R & D testing** | -Less flexibility<br>-Limited storage |

## III. PROPOSED WORK

The MSR technique is a framework for determining the resistivity of their respective colours based on the intensity values of the colour to be studied. The degree of freedom from admixture with its complementary colour determines the strength or sharpness of a colour. Our paper proposes the most effective method for automatically evaluating colour quality by analysing the relationship between colour intensity and resistivity.

**Table 2.Intensities of RGB image**

| Intensity | R | G | B | Intensity | R | G | B |
|---|---|---|---|---|---|---|---|
| 161.1 | 0 | 255 | 0 | 201.7 | 128 | 255 | 128 |
| 162.2 | 8 | 255 | 8 | 204.9 | 136 | 255 | 136 |
| 164.9 | 16 | 255 | 16 | 208.3 | 144 | 255 | 144 |
| 167.7 | 24 | 255 | 24 | 212.4 | 152 | 255 | 152 |
| 169.8 | 32 | 255 | 32 | **216.6** | **160** | **255** | **160** |
| 173.5 | 40 | 255 | 40 | 220.6 | 168 | 255 | 168 |
| 176.5 | 48 | 255 | 48 | 224.6 | 176 | 255 | 176 |
| 179.7 | 56 | 255 | 56 | 228.6 | 184 | 255 | 184 |
| 182.9 | 64 | 255 | 64 | 233.2 | 192 | 255 | 192 |
| 184.9 | 72 | 255 | 72 | 236.7 | 200 | 255 | 200 |
| 187.0 | 80 | 255 | 80 | 239.9 | 208 | 255 | 208 |
| 189.3 | 88 | 255 | 88 | 242.9 | 216 | 255 | 216 |
| 192.1 | 96 | 255 | 96 | 247.0 | 224 | 255 | 224 |
| 195.1 | 104 | 255 | 104 | 251.2 | 232 | 255 | 232 |
| 197.2 | 112 | 255 | 112 | 253.4 | 240 | 255 | 240 |
| 200.3 | 120 | 255 | 120 | 254.7 | 248 | 255 | 248 |

### 3.1. The Relative luminance in colorimetric spaces

The letter Y stands for relative luminance in colour spaces like XYZ, xyY, and so on. When relative luminance is explicit in a colour representation in such spaces, no computation is required. Relative luminance can be calculated from linear RGB components in RGB colour spaces that use the ITU-R BT.709 primaries (or RGB, which defines the same primaries):

$$Y = 0.2126\ R + 0.7152\ G + 0.0722\ B \quad (1)$$

The luminosity function is reflected in the formula: green light contributes the most to the intensity perceived by humans, while blue light contributes the least, as shown in Table 3. To calculate relative luminance for other sets of primary chromaticity [defined by their x and y chromaticity coordinates], different linear coefficients are required. The coefficients are all positive in general, with the green coefficient being the highest and the blue coefficient being the lowest, and the three forming the middle row of the RGB-to-XYZ colour transformation matrix. Before the linear combination of nonlinear gamma-compressed R'G'B' spaces, which are commonly used for computer images, the R'G'B' components must be linearized to RGB. The L* component of L*a*b* space is lightness, which is a perceptual scale of brightness as a nonlinear function of relative luminance Y.

**Table 3.Resistivity of Blue**

| INTENSITY | RESISTIVITY | INTENSITY | RESISTIVITY |
|---|---|---|---|
| 161.1 | 17.5 | 201.7 | 14.0 |
| 162.2 | 17.3 | 204.9 | 13.5 |
| 164.9 | 17.1 | 208.3 | 10.3 |
| 167.9 | 16.9 | 212.4 | 9.8 |
| 169.8 | 16.7 | 216.6 | 9.5 |
| 173.5 | 16.5 | 220.6 | 9.3 |
| 176.5 | 16.3 | 224.6 | 9.1 |
| 179.7 | 16.1 | 228.6 | 8.9 |
| 182.9 | 15.9 | 223.2 | 8.5 |
| 184.9 | 15.7 | 236.7 | 8.1 |
| 187.0 | 15.5 | 239.9 | 7.4 |
| 189.3 | 15.3 | 242.9 | 6.3 |
| 192.1 | 15.0 | 247.0 | 5.6 |
| 195.1 | 14.9 | 251.2 | 4.6 |
| 197.2 | 14.7 | 253.4 | 2.9 |
| 200.3 | 14.4 | 254.7 | 1 |

It's important to distinguish relative luminance from luma, which is the weighted sum of the nonlinear gamma compressed R'G'B' components. Relative luminance can still be computed in colour spaces that use luma, such as Y'UV or Y'CbCr (where Y' represents luma). By undoing the gamma compression, the R'G'B' components can be transformed into linear light components, which can then be used to calculate luminance.

## IV. RESULTS AND COMPARISONS

The spectral wavelength and various geographic soil tests conducted by soil tomography experts are used to calculate resistivity.

**Table 4.Quality Assessment of Blue**

| RESISTIVITY | GRADE | QUALITY |
|---|---|---|
| 50-46 | A | EXCELLENT |
| 45-38 | B | VERY GOOD |
| 37-32 | C | GOOD |
| 31-26 | D | MEDIUM |
| 25-18 | E | LOW |

**Table 5.Quality Assessment of Green**

| RESISTIVITY | GRADE | QUALITY |
|---|---|---|
| 91-100 | A | EXCELLENT |
| 83-90 | B | VERY GOOD |
| 77-82 | C | GOOD |
| 61-76 | D | MEDIUM |
| 50-60 | E | LOW |

**Table 6.Quality Assessment of Red**

| RESISTIVITY | GRADE | QUALITY |
|---|---|---|
| 17.5-14.9 | A | EXCELLENT |
| 14.8-9.8 | B | VERY GOOD |
| 9.7-5.7 | C | GOOD |
| 5.6-2.9 | D | MEDIUM |
| 2.8-1 | E | LOW |

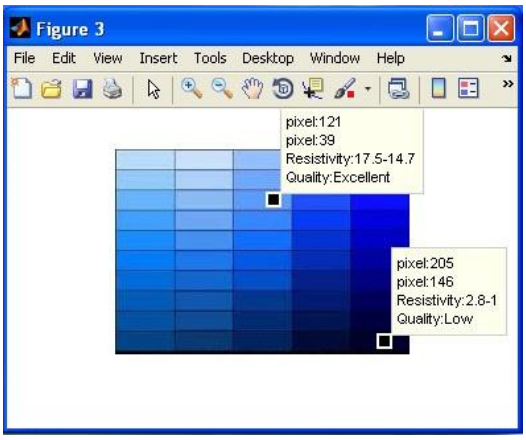


**Fig 1.Quality of different shades of Blue**

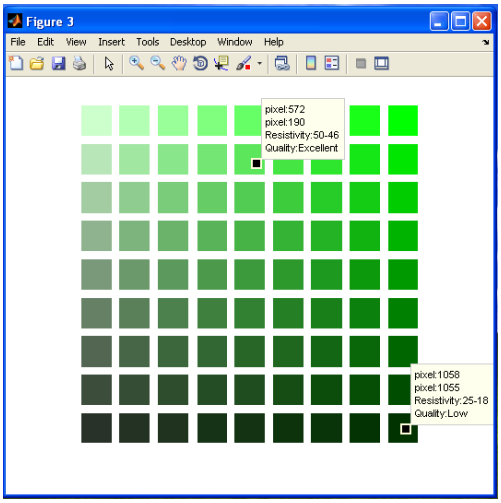


**Fig 2.Quality of different shades of Green**

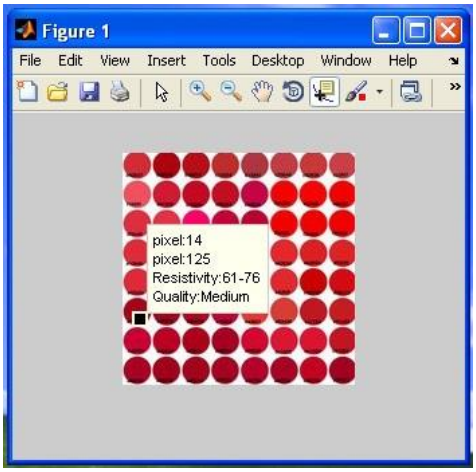


**Fig 3.Quality of different shades of Red**

## V. Conclusion And Future Work

The MSR technique efficiently assesses the quality of various colours. It is a useful tool for quality control in the paint manufacturing process when using software automation. This can also be used for efficient and effective quality control in the fabrication industry. Our proposed technique will also be a very useful tool in bio medical engineering in diagnosis of various stages of glaucoma using intensity calculation of images overcoming the disadvantages of CDR measurement.

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