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pH scale recognition by RGB color using machine learning models: A review

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Abstract

This paper uses an optical method to measure the color change of pH paper in accordance with pH. All the time it measures by using traditional manual method. Our goal in this study was to gather objective data by using Red, Green, and Blue values to represent the pH change of the paper. In order to support the claim and provide evidence, this paper will specifically explore the parameters of an intelligent colorimetric test that satisfies the ASSURED standards. This paper provides a demonstration of the idea for a microfluidic, which is based on dry chemicals, stable, and semi-quantitative assay using a larger dataset with a variety of conditions. The system under investigation is an intelligent image-based system that performs automatic paper-based colorimetric tests in real-time. This paper explores the recognition and investigation of pH scale in great detail.

Keywords: Image processing; pH paper image data; Machine Learning; Deep Learning.

1. Introduction

A measurement called pH is used to show which solution is more basic or acidic. Definition is the numerical value of the concentration of hydrogen ions (H +) in a given volume of solution. It is the exponent for hydrogen ion concentration. The number of pH changes according to how much of the substance dissolves in water and releases hydrogen ions. In this instance, more hydrogen ions are produced at lower pH values. Consequently, the acid becomes stronger the lower the pH value. To differentiate between acid and base, pH is measured for the most fundamental purpose. All acidic materials are aqueous solutions that typically dissolve in water to release hydrogen ions (H +) and have a pH of less than 7 (pH 1 - 6.9). This nature gives rise to the sour taste characteristic. Conversely, all bases dissolve in water to produce hydroxide ions (OH-) and have values greater than pH 7 (pH 7.1–13). It tastes bitter and is slippery as a result. Neutral pH is 7 [1,2].

This article explains the initial attempts to explore the pH scale identification using machine learning algorithms. Section 3 concludes by classifying the pH s of machine learning algorithms in an effort to offer a better solution.

2. Literature Review

In over 44% of the member states of the World Health Organization (WHO), there is fewer than one physician per thousand people (World Health Organization, 2017). For every 1000 people, there are only 2.806 doctors, even in a developed nation like the UK. Because people are living longer, our knowledge of age-related illnesses and disabilities has grown, which could put a heavy strain on healthcare systems that are already understaffed and underfunded. The elderly population's growing needs may also be met by the user-friendly system. Thus, the industry of mobile phone-based microscopy, assays, and sensing platforms for Point-of-Care (POC) diagnostics is being influenced by the early diagnosis facility, the disproportionate ratio of health professionals (staff, experts, doctors) to patients, and the advancement of technology. [1-3].

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Using a pH paper that changes color based on pH is an easy way to measure pH. These methods are quick and easy to use, but they are not quantitative values; rather, they are subjective results of the measure, which makes it difficult to objectively distinguish minute differences in color and results in poor accuracy.

Hue-saturation-value (HSV) colorspace was used to process the water images for colorimetric analysis of potassium [4] and chlorine [5]. The non-linear analyte function was then fitted to the color ratio. Beer-Lambert law [6, 7] can also be used to quantitatively analyze color, much like spectrophotometers.

This article explored to obtain objective data by indicating the change of pH paper according to pH as Red, Green, and Blue values. Here, pH scale recognition using machine learning model based upon the color model RGB (RED, GREEN, BLUE). The details of machine learning and some models discussed in these papers [8-37].

We describe the use of machine learning for pH value colorimetric detection using a smartphone. The Least Squares-Support Vector Machine (LS-SVM) classifier algorithms were trained on the strip images, and they were successful in classifying the various pH values [38].

In paper [39], described the pH Color Recognition to monitor the Chronic Kidney Disease by using Machine Learning-models.

3. Conclusion

Here, a computational system for paper-based lateral flow tests was presented that can operate independently on the POC platform without the need for server integration. We have used multi-object/sample universal pH indicator papers to prove the concept because they are both technically and financially feasible. In future, this problem will use various machine learning model to classify the coloured pH papers.

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