



Hydration Status Prediction through Automated Urine Colour Analysis

Project Management and Software Development
for Medical Applications

General Info

Project Title:

Hydration Status Prediction through Urine Colour Analysis

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Project Abstract

At topathI EAT we work with athletes and patients to optimize their diet for sport performance and health. The hydration status is a key performance indicator for training and competition.

Your task is to develop a user-friendly assessment tool to predict the hydration status through image-based colour analysis of a urine sample.

Background and Motivation

De-hydration can be a limiting factor for the training success. Acute dehydration during physical activity can lead to impairments in cognitive and motor performance and increase feelings of tension, fatigue, and anxiety. Hydration is multi-factorial and can vary in patients. The individual hydration status is oftentimes unknown and to access objectively, expert medical hardware is necessary.

As dehydration increases, the concentration of yellow urochrome in urine increases as less water is being voided [1]. A typical measurement process follows a spectral analysis of each wavelength within the visible color spectrum using a spectrophotometer. Manual urine colour analysis is an inexpensive and convenient method of identifying whole-body hydration status. This is important as monitoring of hydration is essential for the maintenance of essential physiological

function and performance. This allows for a quick field assessment of an athlete's hydration status using pre-defined colour schemes and subjective comparison. As in all subjective procedures, reliability may vary and the process requires additional manual labour.

We want to overcome this with an automated process using objective image analysis and colour comparison of a urine sample to democratize the process and allow patients to analyse samples easily at home with their mobile phone.

Student's Tasks Description

The goal of this project is to provide a pipeline that automatically analyses an image of a urine sample taken from a smartphone to determine the hydration status of the user.

For this, you have two tasks which are interdisciplinarily discussed with the topathI EAT team: Firstly, you determine the mean urine colour from an image in comparison to a reference colour and secondly, the data is integrated into the topathI EAT user database.

In the first phase, the student extracts the urine colour from the image. A white-balancing is used to calibrate the colour of the smartphone camera [2]. A marker board is printed out to place the transparent urine container on top. A reference marker on the board is detected and the urine container pixels are extracted and compared in comparison to a given colour-hydration scheme upon which the hydration level is calculated.

The second part of the project concentrates on the interface of the image processing pipeline to the existing topathI EAT database where the goal is to integrate the result seamlessly into the user database e.g. using a web-interface.



Throughout the project, you gain experience in project management working in an interdisciplinary team also with non-technical experts which requires pragmatic solutions. The interaction offers insights in nutrition science and the possibility to learn how hydration and nutrition influences muscular performance and health.

Technical Prerequisites

- Ideally experience in Python and OpenCV for image processing (can also be gained throughout the project)
- Willingness to use e.g. HTML5 to access the mobile phone camera feed

References

[1] Belasco, Rebekah, Tory Edwards, A. J. Munoz, Vernon Rayo, and Michael J. Buono. "The effect of hydration on urine color objectively evaluated in CIE L* a* b* color space." *Frontiers in Nutrition* (2020): 211.

[2] Hernandez-Juarez, Daniel, Sarah Parisot, Benjamin Busam, Ales Leonardis, Gregory Slabaugh, and Steven McDonagh. "A multi-hypothesis approach to color constancy." *CVPR 2020*.