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ELEVENTH ANNUAL MEETING

HEMONITOR: MACHINE LEARNING-BASED NONINVASIVE ESTIMATION OF HEMOGLOBIN (HB) VALUE IN PATIENTS WITH HEMATOLOGICAL MALIGNANCIES

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INTRODUCTION

- Patients with hematological malignancies require regular hemoglobin (Hb) measurements as part of clinical monitoring
- Laboratory-based Hb checks potentially affect a patient's quality-of-life.
- Non-invasive, point-of-care Hb measurements might offer significant advantages for these patients due to a potential reduction of clinic visits

OBJECTIVE, DESIGN, METHODS

- Our Aim: To develop a non-invasive Hb level prediction model based on photographs of the ocular conjunctiva and fingernails using machine learning (ML)
- Fingernail and eyelid colour have served physicians as an anemia indicator for a long time
- Two cohorts:
  - 1) Patients with hematological malignancies undergoing regular hemoglobin measurements (n=373)
  - 2) Voluntary, healthy blood donors (n=188)
- Generation of training and testing image data under laboratory conditions – e.g., individual white balancing, adequate lighting and using a professional high-resolution camera
- Gathered patients' clinical data along with an invasively determined Hb level measured on the same day
- Processed the gathered images by manually extracting average RGB (Red, Green, Blue) and HSL (Hue, Saturation, Light) values of significant areas
- Trained a Bayesian Ridge Regression model using the SciKit-Learn Python framework with the laboratory-derived Hb measure as the target feature

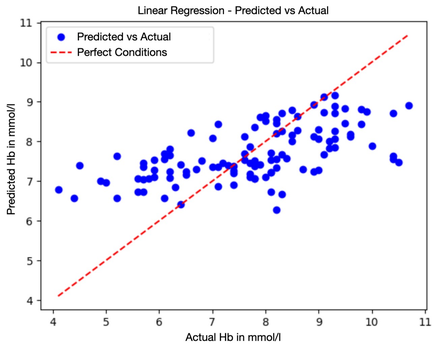
RESULTS

- We reached the following mean Hb deviations compared to invasive hemoglobin measurement methods using different approaches as the basis for the training of our model:
  - **1.32 mmol/L** using solely photographs of conjunctiva
  - **1.62 mmol/L** using photographs of
  - **1.42 mmol/L u**sing photographs from conjunctiva in combination with fingernails in a sequential prediction pipeline
- We observed lower accuracy in patients below the anemia threshold (7.4 mmol/L) with frequent deviations of 4 mmol/L

CONCLUSIONS

- Initial promising outlook, but still missing accuracy
- Especially low precision below the anemia threshold challenges clinical applicability
- Validation of our model is currently ongoing within a larger, prospective study
- By providing a way to monitor Hb levels regularly at home, these measurements can contribute to better management of anemia and more personalized cancer care

IMAGES



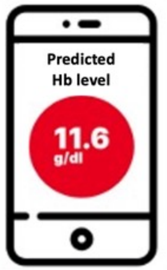
Predicted values of our regression model opposed to the actual measured Hb values.



Example picture of a probands ocular conjunctiva



Example picture of a proband's fingernail



Exemplary illustration of our prospected point-of-care use case



Photographing Set-Up

REFERENCES

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