

健康快拍

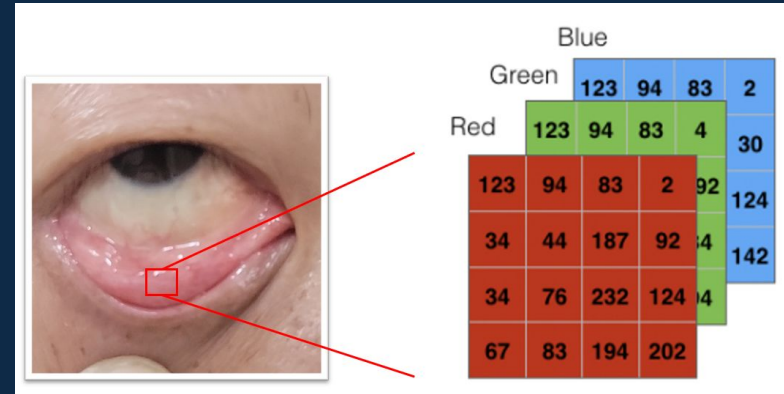
Health Gather

Give you 24 hours of silent companionship

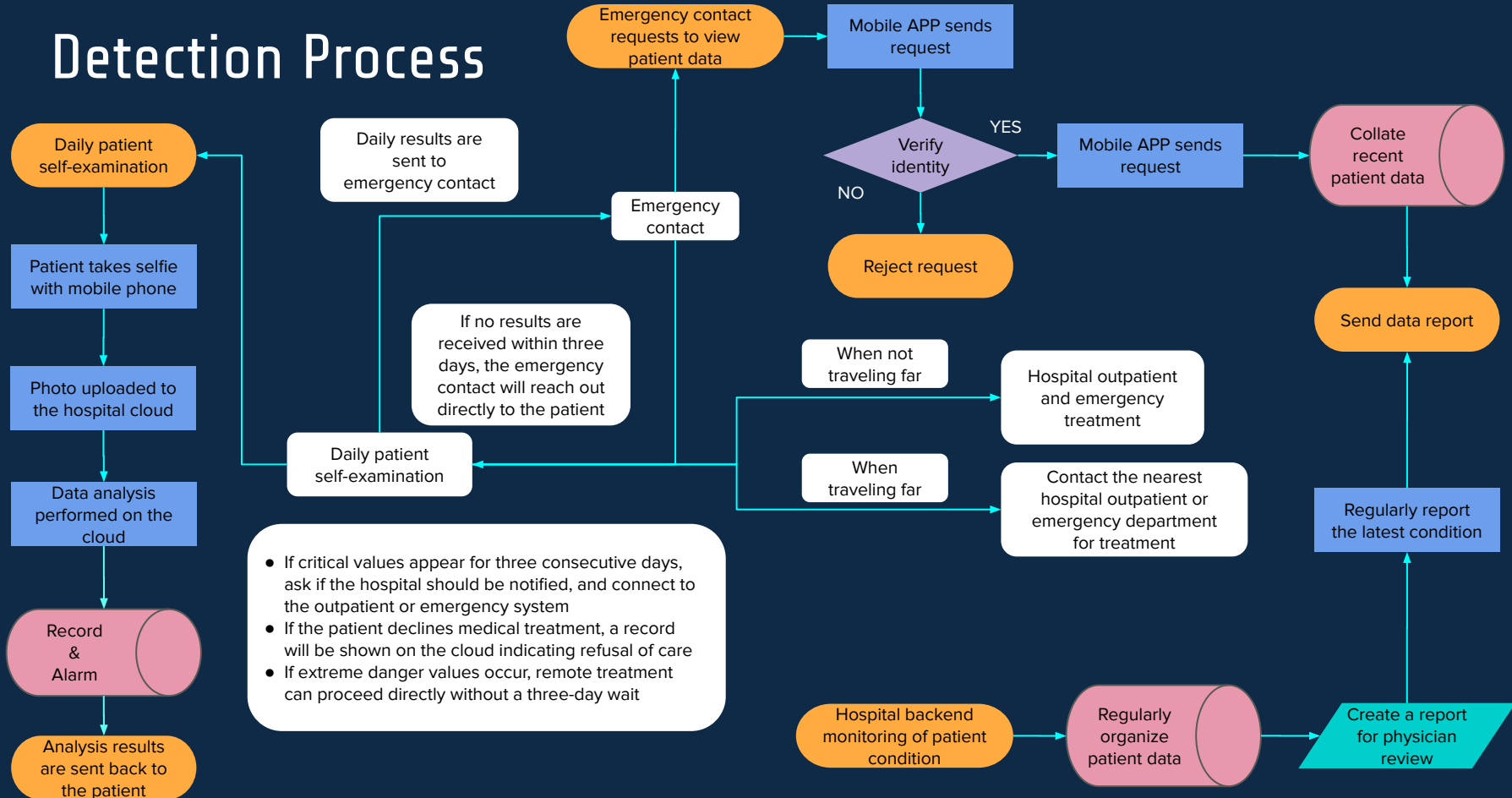
Principles of Pathology

In anemia diagnosis, the color characteristics of the eyelid, particularly the degree of pallor, are key indicators. In healthy individuals, the eyelid appears reddish, reflecting sufficient levels of hemoglobin in the blood. However, when anemia occurs, hemoglobin levels drop, and the color of the eyelid tends to become pale, as the blood's oxygen-carrying capacity decreases, affecting oxygen supply to tissues.

Technically, changes in eyelid color can be captured using image processing methods. Specifically, the image processing system can decompose the eyelid image into red, green, and blue channels, and compare the value of the red channel against other color channels. Studies have shown that anemic patients often exhibit lower red channel values, with RGB channel values being similar, causing the eyelid to appear pale or pinkish. This phenomenon serves as a potential indicator for quantifying hemoglobin levels, providing a non-invasive approach for evaluating anemia.



Detection Process



Detection Process

Selecting a picture from your gallery or taking a new photo with the device's camera



Use our app to crop the eye area

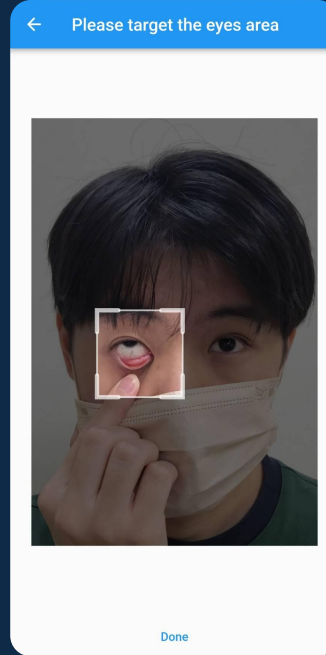
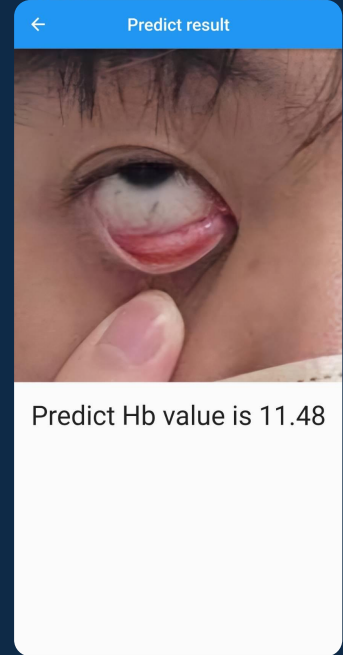


Image-based symptom detection



Application Principles

Data Preprocessing



To address the issue of glare in the images, we implemented two methods. First, we used the HSV color space to filter out glare points with excessively high brightness or low saturation. The second method involved converting the image to grayscale and using threshold operations to detect and correct over-bright areas.

During the image segmentation stage, the UNet model was employed to automatically segment the eyelid region, allowing for precise extraction of anemia-related features. The UNet architecture consists of an encoder and a decoder: the encoder progressively captures critical features within the image to locate the eyelid, while the decoder restores these features to accurately mark the eyelid area.

Deep Learning Classification



In deep learning classification, a deep learning model is employed to classify anemia images, using a hemoglobin (Hb) concentration threshold of 12 g/dL to determine anemia presence. The model leverages multi-level feature extraction to automatically identify anemia-related features, such as color variations in the eyelid area. To improve the model's generalization, data augmentation techniques are applied during training to diversify the dataset, enhancing the model's performance on new data and strengthening the stability and accuracy of the classification results. The model achieved an accuracy of 85% to 90% on the test set, demonstrating its reliability in anemia detection.

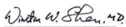
Regression Analysis



Regression analysis is used to quantify the severity of a patient's anemia by examining trends in hemoglobin levels. This analysis selects features closely related to eyelid color—such as hue, saturation, brightness, the R channel, the difference between R and GB channels, and grayscale—to estimate hemoglobin levels. Linear and polynomial regression models are employed to precisely predict hemoglobin fluctuations, while mean squared error (MSE) and the coefficient of determination (R^2) are used to assess model performance, ensuring both predictive accuracy and interpretability.

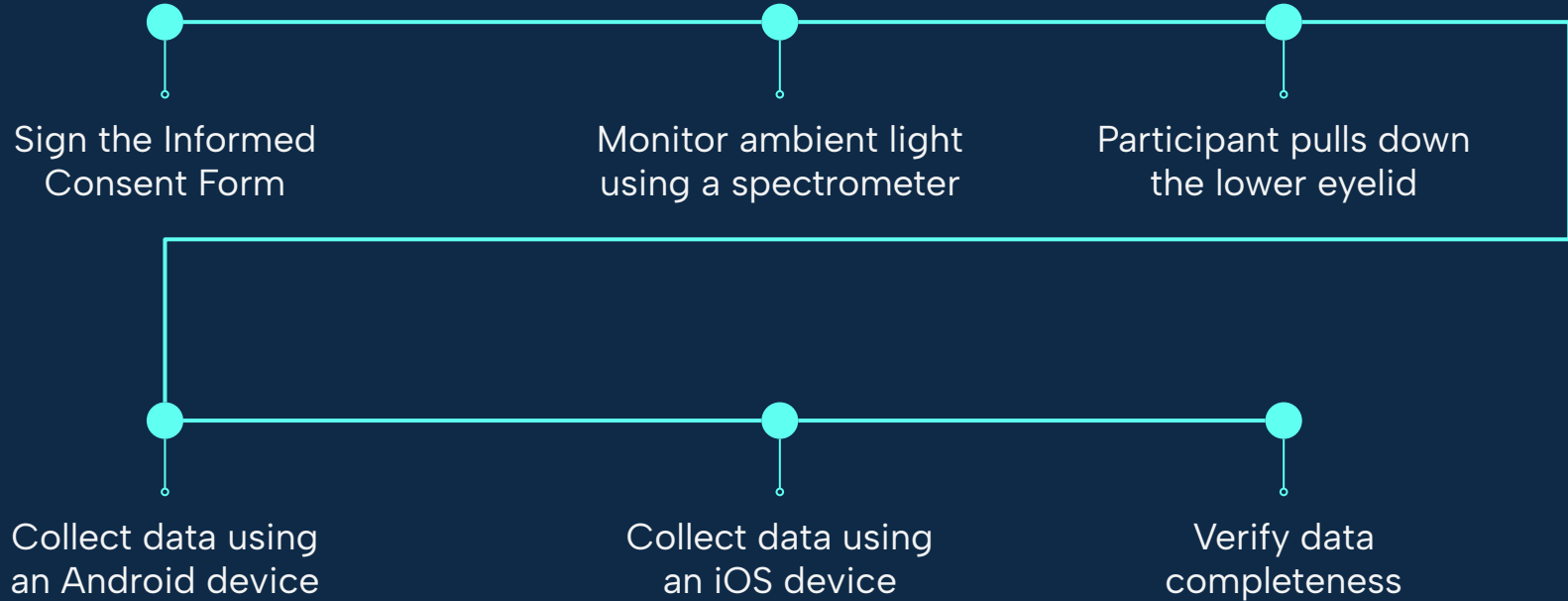
Our team, having received approval from the Institutional Review Board, has initiated clinical trials at Shuang Ho Hospital and the Hemodialysis Center of New Civil Hospital.



Taipei Medical University Certificate of TMU-JIRB Approval		JIRB Date: 2023/06/18
TMU-JIRB No.: N20230187		
Protocol Title: Detect the patient's judgement and ascenia with a smartphone		
Principal Investigator: Po Wu Lu		
Co-Investigator: Chang-cheng-chia, Chie-Lin Chou		
Study Member: Xiang Jin, Xiang		
Study Site: TMU-Shuang Ho Hospital; TMU-Jin-Kao Min Hospital; TMU-Jin-Kao-Min Hospital		
Protocol Version/Date: Study Number: 9/02/2023/058		
Inform Consent Form: Version: 9/02/2023/067		
Case Report Form: Version: 2/02/2023/048		
The above study will be approved by expedited review process of the TMU-Joint Institutional Review Board in meeting #11-07-2024/2023/0712, duration of validity is from 2024/06/18 to 2023/06/17, and must be monitored by TMU-JIRB.		
According to Ministry of Health and Welfare and the relevant regulations, follow-up procedures and monitoring reports are as below:		
1. Continuing Report: Continuous report frequency is every 12 months. The report should be submitted 12 months before the end of validity (2023/04/17). The study can't continue going if the continuous report not approve yet.		
2. Final Report: The report should be submitted when the study/entry complete. TMU-JIRB will withdraw the approval of this study/entry if the report is not submitted final report within three months from the date of validity of this study/entry. Also suspend principal investigator's right of new study/entry application in accordance with TMU-JIRB SOP for three months.		
3. Serious Adverse Event(SAE) Report: The investigator is required to report in accordance with "Regulations for Clinical Practice" and "Procedures for Reporting Serious Adverse Drug Reaction".		
Chairman:		
		
<div>臺北市立聯合醫院 婦人婦人研究倫理委員會 Date: 2023/06/18 Date Institutional Review Board</div>		
本審查報告僅供內部參考，不得對外公開。 The TMU-Joint Institutional Review Board performs its functions according to its mission, purpose, and procedures and complies with ICF and all the applicable regulatory requirements. 68/17119903/2023/058/2023/018		
TMU-JIRB 2023/06/18		

[illegible]

Clinical Trials



Phase Results



- To date, we have successfully enrolled over 350 participants, and recruitment is actively ongoing.
- A preliminary design for the measurement mobile application has been completed.
- An anemia detection model was initially developed with an accuracy of over 94%.

Activity

2023/07 創新創業激勵計畫 FITI



2024/03 Smart City 智慧城市展



2023/05 中科新創回娘家 暨生醫學研團隊技術發表



2023/10 諾薩克百萬美金挑戰 新創 Demo Day



2024/06 InnoVex



Call for support our projects

We have secured for multiple patents for the relevant technologies to further ensure the legality and commercial applicability of our research findings, while protecting our intellectual property rights under the law.

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UNITED STATES
PATENT AND TRADEMARK OFFICE

Page 1 of 2
P.O. Box 1452
Alexandria, VA 22313-1452
www.uspto.gov

ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #
18/398,320

RECEIPT DATE / TIME
04/16/2024 08:04:37 AM Z ET

ATTORNEY DOCKET #
8507-330

Title of Invention
EYE IMAGE CAPTURING AND PROCESSING DEVICE

Application Information

APPLICATION TYPE
Utility - Nonprovisional Application
under 35 USC 111(a)

PATENT # -

CONFIRMATION #
6287

FILED BY
SU YU

PATENT CENTER #
65106515

FILING DATE
12/28/2023

CUSTOMER #
65358

FIRST NAMED INVENTOR
CHENG-CHUN CHANG

CORRESPONDENCE ADDRESS
-

AUTHORIZED BY
JUSTIN KING

Documents

TOTAL DOCUMENTS: 2

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
poa1.pdf	1	Power of Attorney	2601 KB
poa2.pdf	1	Power of Attorney	4643 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
poa1.pdf	D464BFD67367C5880B1BC4C8D04A693E8C8FED44C3ED180976393526FFF7408CF6F92FE19A4A9B2EE5621DFFA3C0C0D482C5365999B7C0471C91B386CDD3CA2EA4

【19】中華民國

【12】專利公報 (B)

【11】證書號：I836827

【45】公告日：中華民國 113 (2024) 年 03 月 21 日

【21】Int. Cl.：A61B3/14 (2006.01)
A61B5/298 (2021.01)
G06F48/10 (2022.01)

A61B5/45 (2006.01)
G06T1/00 (2006.01)
G06B21/18 (2006.01)

發明 全 8 頁

【54】名 稱：眼部影像擷取處理裝置

【21】申請案號：111150633

【22】申請日：中華民國 111 (2022) 年 12 月 29 日

【72】發明人：張正春 (TW) CHANG, CHENG-CHUN; 盧柏文 (TW) LU, PO-WEN

【71】申請人：國立臺北科技大學 NATIONAL TAIPEI UNIVERSITY OF TECHNOLOGY

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【74】代理人：楊代雄

【56】參考文獻：
CN 1838909A CN 111048210A CN 106061373A
CN 207492754D CN 114938932A US 2022/0361744A1

審查人員：王仁佑

【57】申請專利範圍

1. 一種眼部影像擷取處理裝置，該裝置包含：一可攜式使用者裝置主體，其上設置有一影像拍攝模組，該影像拍攝模組用以拍攝一使用者之一眼部而產生一部影像資料；以及一應用程式，安裝於該可攜式使用者裝置主體中，用以接收該眼部影像資料並進行一資料處理，用以根據一眼部狀態檢測滿足時完成自拍並產生一指示信號來指示該使用者完成自拍，進而產生對應該眼部的一待診斷影像。

2. 如請求項 1 所記之影像擷取處理裝置，其中該應用程式中包含一色彩校正演算法，用以將自拍完成之一原始影像處理成接近真實顏色的該待診斷影像。

3. 如請求項 2 所記之影像擷取處理裝置，其中更包含一光譜感測晶片，該感測晶片可攜式使用者裝置主體，用以收集拍攝時的環境光之光譜分布狀況，而該色彩校正演算法為一環境光影響消除光譜法，其包含下列步驟：接收自拍完成之該原始影像；接收該光譜感測晶片收集之該光譜分布狀況；以及利用該光譜分布狀況來對該原始影像之色澤進行調整，進而達到將環境光對該原始影像之色偏影響消除而處理成接近真實顏色的該待診斷影像。

4. 如請求項 3 所記之影像擷取處理裝置，其中更包含一光源，該光源連接至該可攜式使用者裝置主體，用以對該使用者之該眼部發光照射，使得該光譜感測晶片或該影像拍攝模組收集到至少包含有兩種狀態：一第一狀態與一第二狀態，該第一狀態為該光源對該眼部照射，而該第二狀態為未向該光源對該眼部照射，而將該第一狀態的影像資訊減去一第二狀態的影像資訊，便可得到該原始影像之色偏影響進行消除的效果，而將該原始影像處理成接近真實顏色的該待診斷影像。

5. 如請求項 2 所記之影像擷取處理裝置，其中該色彩校正演算法則為一環境光影響消除之自動色偏校正演算法，其包含下列步驟：接收自拍完成之該原始影像；以及利用一標準

- 11686 -

中華民國專利證書

發明第 I836827 號

發明名稱：眼部影像擷取處理裝置

專利權人：國立臺北科技大學、臺北醫學大學

發明人：張正春、盧柏文

專利期間：自 2024 年 3 月 21 日至 2042 年 12 月 28 日止

上開發明案經專利人依專利法之規定取得專利權

經濟部智慧財產局 局長

廖承威

中華民國 113 年 3 月 21 日

注意：專利權人依專利法第 97 條規定，應自該案公告後即依規定繳納年費。