

(54) Title of the invention : SMART PHONE BASED MALARIA PARASITE DETECTION IN THICK BLOOD SMEARS USING DEEP LEARNING

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(57) Abstract :

This work investigates the possibility of automated malaria parasite detection in thick blood smears with smartphones. We are developing the first deep learning method that can detect malaria parasites in thick blood smear images and can run on smartphones. Our method consists of two processing steps. First, we apply an intensity-based Iterative Global Minimum Screening (IGMS), which performs a fast screening of a thick smear image to find parasite candidates. Then, a customized Convolutional Neural Network (CNN) classifies each candidate as either parasite or background. Together with this invention, we make a dataset of 1819 thick smear images from 150 patients publicly available to the research community. We used this dataset to train and test our deep learning method, as described in this work. A patient-level five-fold cross-evaluation demonstrates the effectiveness of the customized CNN model in discriminating between positive (parasitic) and negative image patches in terms of the following performance indicators: accuracy (93.46%±0.32%), AUC (98.39%±0.18%), sensitivity (92.59%±1.27%), specificity (94.33%±1.25%), precision (94.25%±1.13%), and negative predictive value (92.74%±1.09%). High correlation coefficients (>0.98) between automatically detected parasites and ground truth, on both image level and patient level, demonstrate the practicality of our method. Conclusion: Promising results are obtained for parasite detection in thick blood smears for a smartphone application using deep learning methods. Significance: Automated parasite detection running on smartphones is a promising alternative to manual parasite counting for malaria diagnosis, especially in areas lacking experienced parasitologists.

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