Using IR-RGB thermographic cameras
for diagnosing leprosy in Nepal

TUDelft

Why?

Objective

Since leprosy causes damage to the peripheral nervous system, a dysfunction in the temperature regulatory system of the hand can be observed.

Novel techniques by Cavalheiro et al. [1] propose to use IR thermography to observe these irregularities in hand temperature regulation.

This method relies on manually detecting hand landmarks in IR, making the technique infeasible at scale.

This research will compare different technologies for skin temperature measurement at specific points on the hand, to investigate which technolgy suits diagnosis of leprosy at INFs Green Pastures Hospital in Nepal best.

200.000 in 2018

Background

Leprosy is a tropical disease that infects the peripheral nervous system. This infection can cause anything from minor complications to disabilities in hand or feet.

If diagnosed early, the disease can be treated well and patients will sustain limited permanent damage.

It is now the WHO's (World Health Organisation) aim to decrease new cases by 70% in 2030 from 200.000 new cases in 2018 to only 70.000 new cases in 2030. For this early diagnosis forms a crucial part of the strategy.

70.000 in 2030
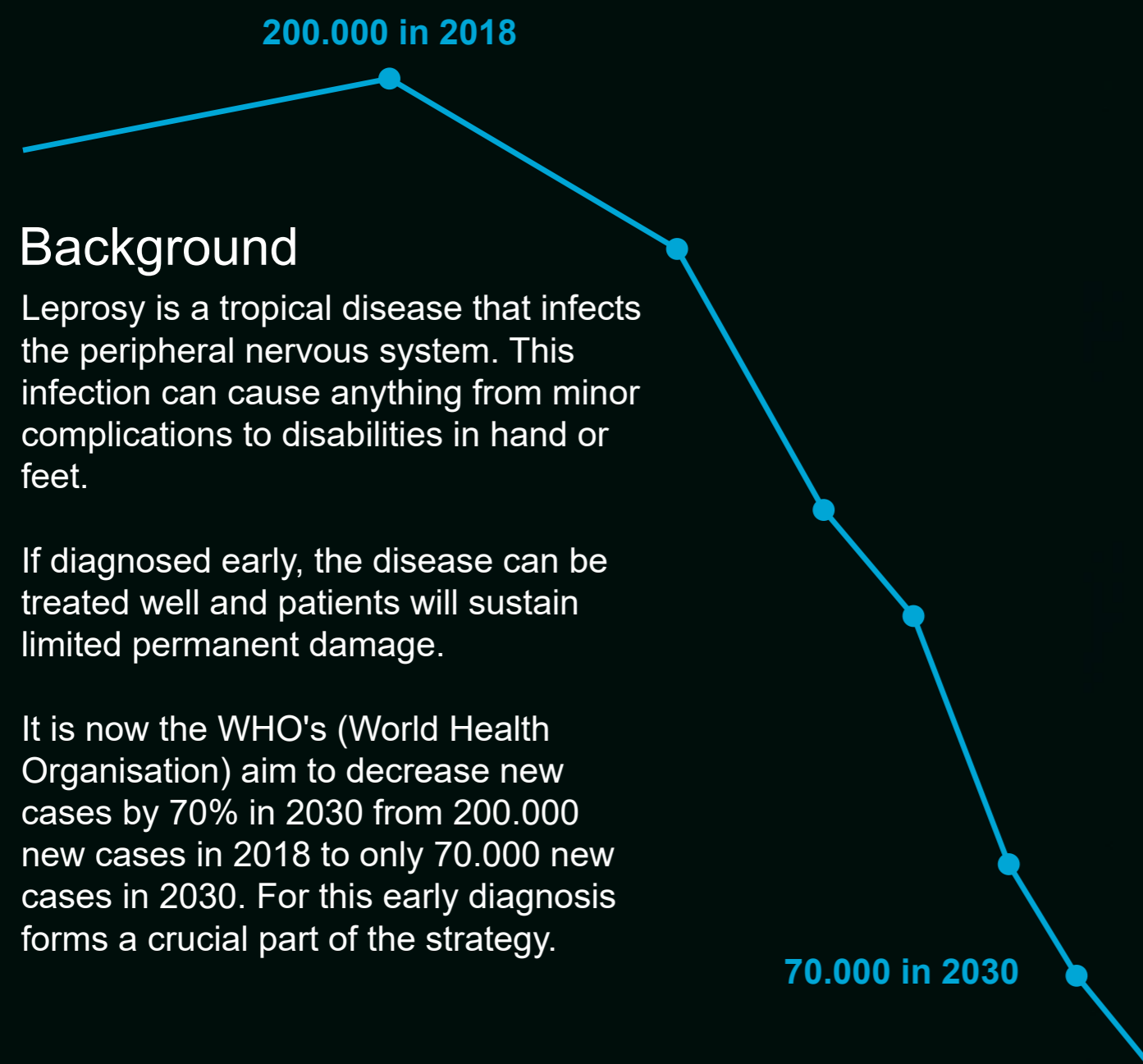
How?

We compared three different technologies on measurement quality, usability and cost in a systematised review: contact sensors, infrared (IR) and hybrid IR-RGB thermographic cameras.

We found that IR or IR-RGB thermography shows great potential over contact thermometry. This is because of their low cost, ease-of-use and high flexibility.

With IR-RGB thermography the accuracy of region of interest detection could be improved over IR-RGB.
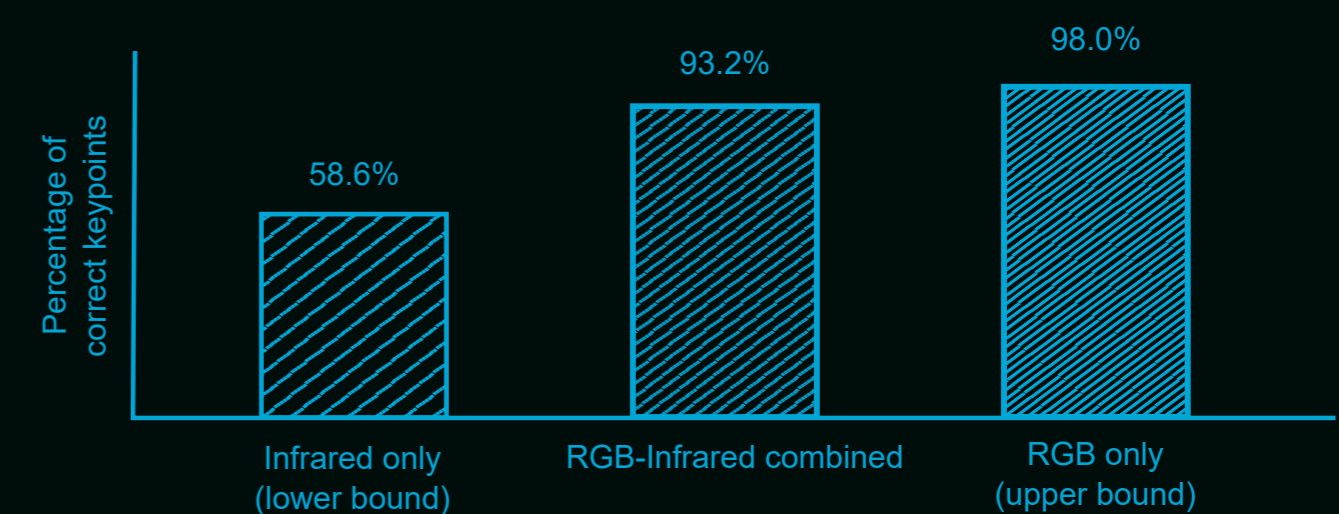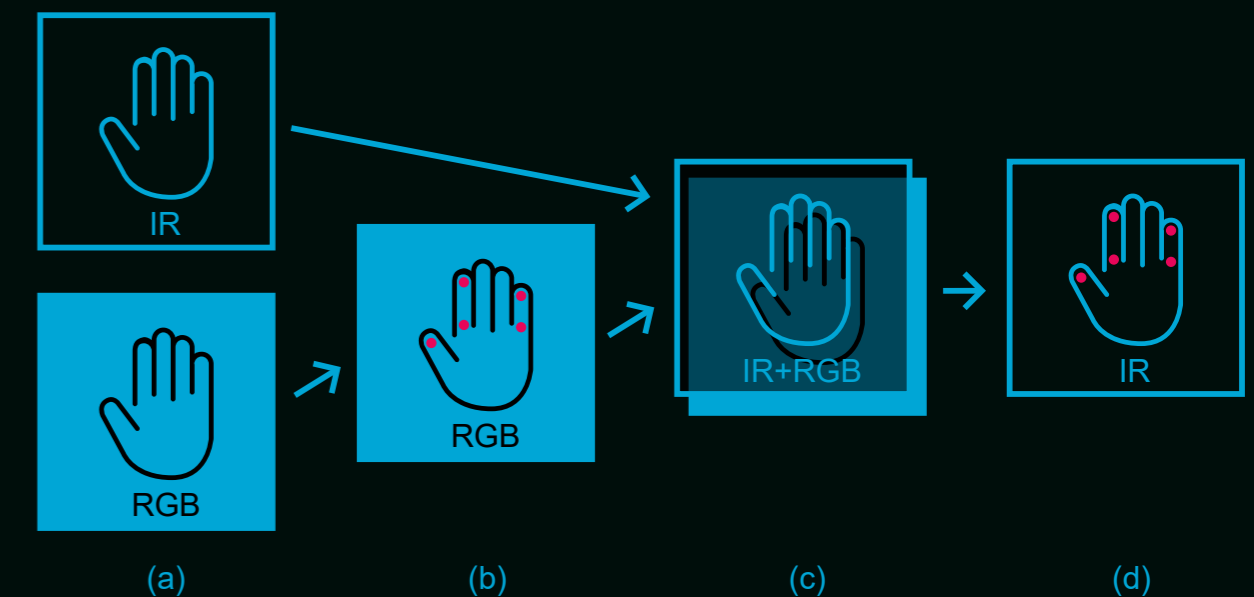
What now?
IR-RGB registration

To improve the accuracy of hand landmark detection in infrared only, we created a pipeline based on IR-RGB images. We use a set of infrared-RGB images (a) to extract regions of interest (ROIs) in RGB (b). We align both images (c) and calculate the corresponding ROIs in IR (d).

This pipeline shows an improvement in accuracy of about 25% over IR only ROI detection.

PIPELINE & RESULTS

IR

RGB

(a)   (b)   (c)   (d)

RGB   IR+RGB   IR

Percentage of correct keypoints

58.6%   93.2%   98.0%

Infrared only (lower bound) | RGB-Infrared combined | RGB only (upper bound)

Conclusions and further research

Infrared-RGB cameras are best for leprosy diagnosis due to flexibility, ease, and cost.

Future work should improve the image registration algorithm, expand datasets, and explore other sensor options.

References:
[1] Cavalheiro, A.L., D.T. da Costa, A.L.F. de Menezes, J.M. Pereira, and E.M. de Carvalho. 2016. 'Thermographic Analysis and Autonomic Response in the Hands of Patients with Leprosy'. Anais Brasileiros de Dermatologia 91 (3): 274–83. https://doi.org/10.1590/abd1806-4841.20164612.

Author: Daniel Cédric Posthumus (d.c.posthumus@student.tudelft.nl)
Supervisors: T.C. Markhorst & Z. Lin
Responsible professor: Dr. J.C. van Gemert