

Measurement Data Recognition from Seven- Segment Indicator by Mobile Device

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Problem Statement

Recognize measurement data from tonometer display by using mobile device camera



Related Works & Tools

- Tesseract OCR (optical character recognition)

<https://code.google.com/p/tesseract-ocr/>

- Seven Segment Optical Character Recognition (SSOCR)

<http://www.unix-ag.uni-kl.de/~auerswal/ssocr/>

- Bonačić I. et al. Optical Character Recognition of Seven–segment Display Digits Using Neural Networks

<http://morgoth.zemris.fer.hr/people/Marko.Cupic/files/2009-SP-MIPRO.pdf>

Problem: do not work with photos

Training Set and Test Set

- We took 374 pictures of 9 different tonometers with the use of 7 mobile devices
 - 322 pictures in the training set
 - 52 pictures in the test set
- Objective function is number of fully recognized pictures

Classes of Defects (1/2)

Shadow on the
right border



Gradient
illumination



Classes of Defects (2/2)

Highlight of
image fragments

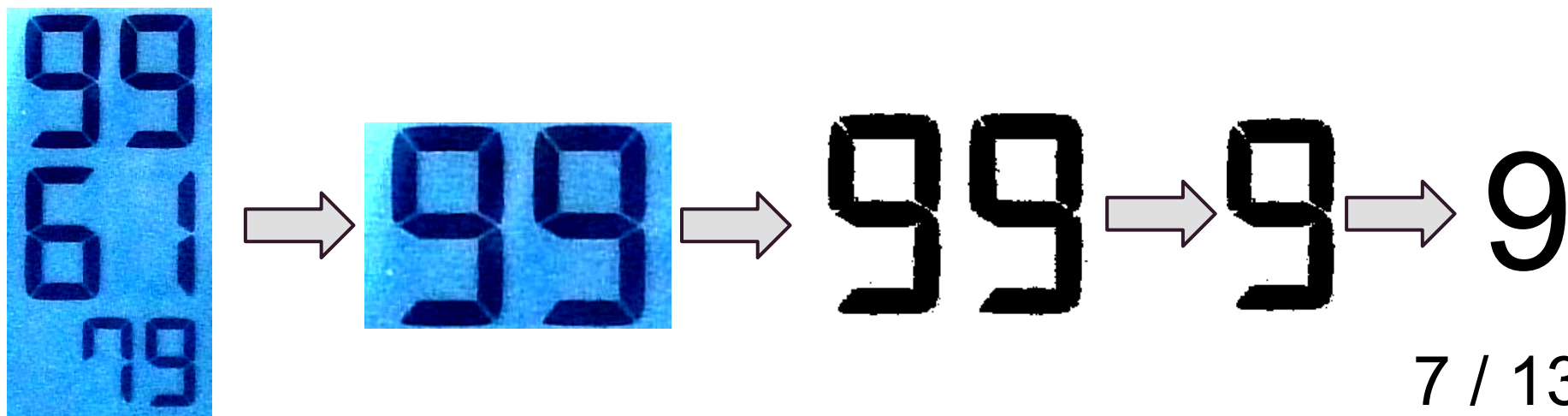


Incline of the indicator
or of whole image

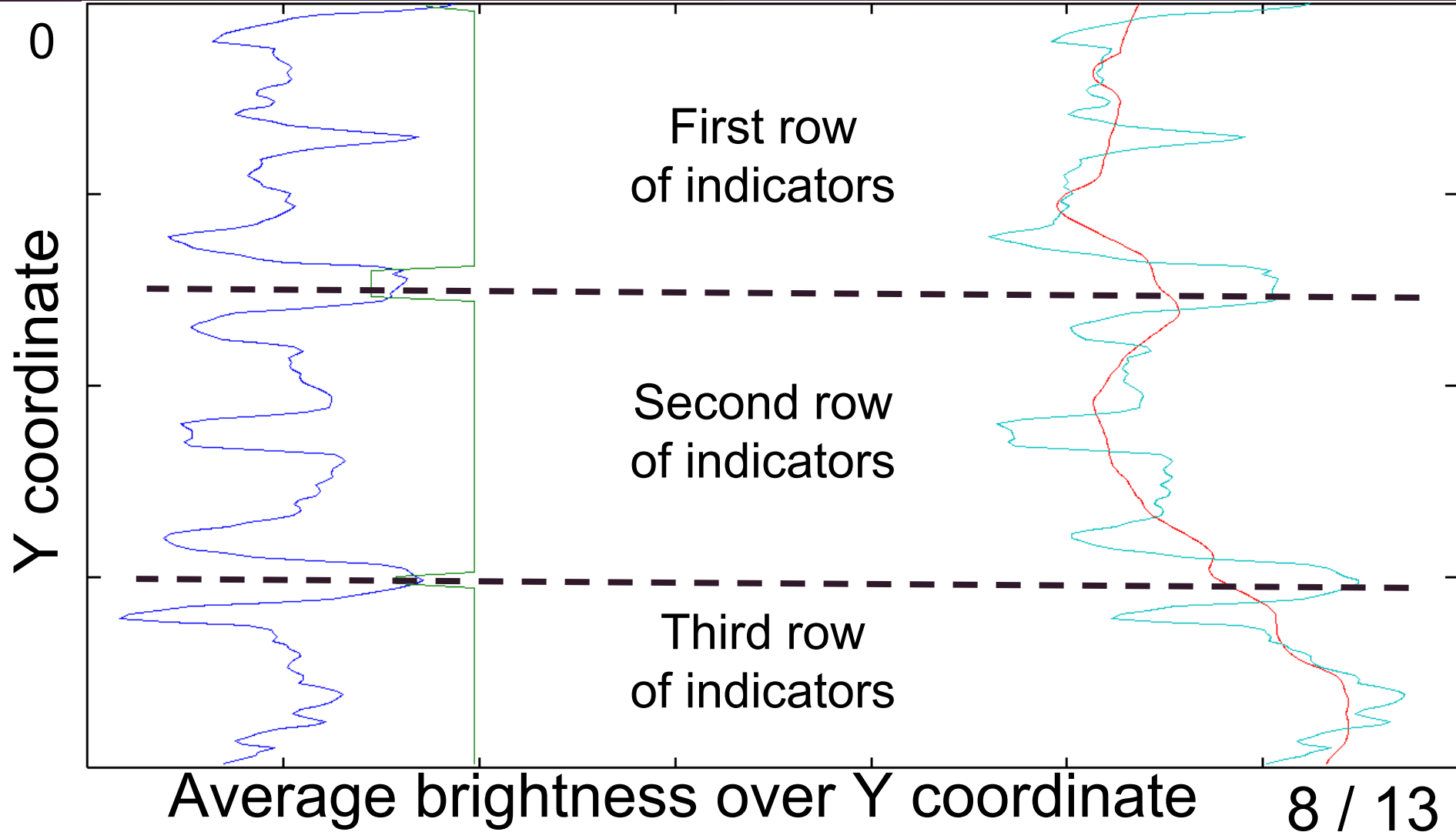


Algorithm Steps

1. Horizontal segmentation to determine indicator row borders
2. Convert the image to monochrome
3. Vertical segmentation of each row to determine the digit borders
4. Recognition of each digit



1. Horizontal Segmentation



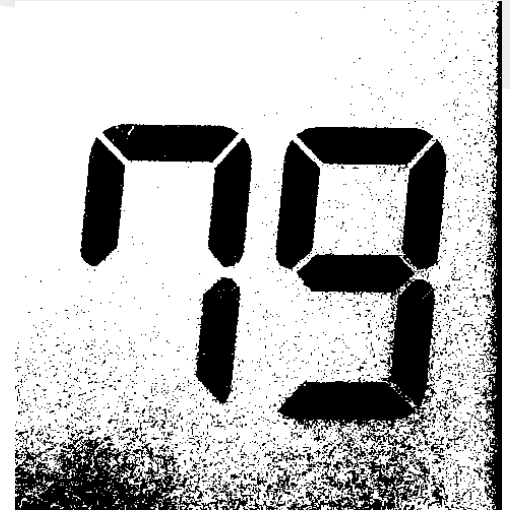
2. Convert to Monochrome



Original image

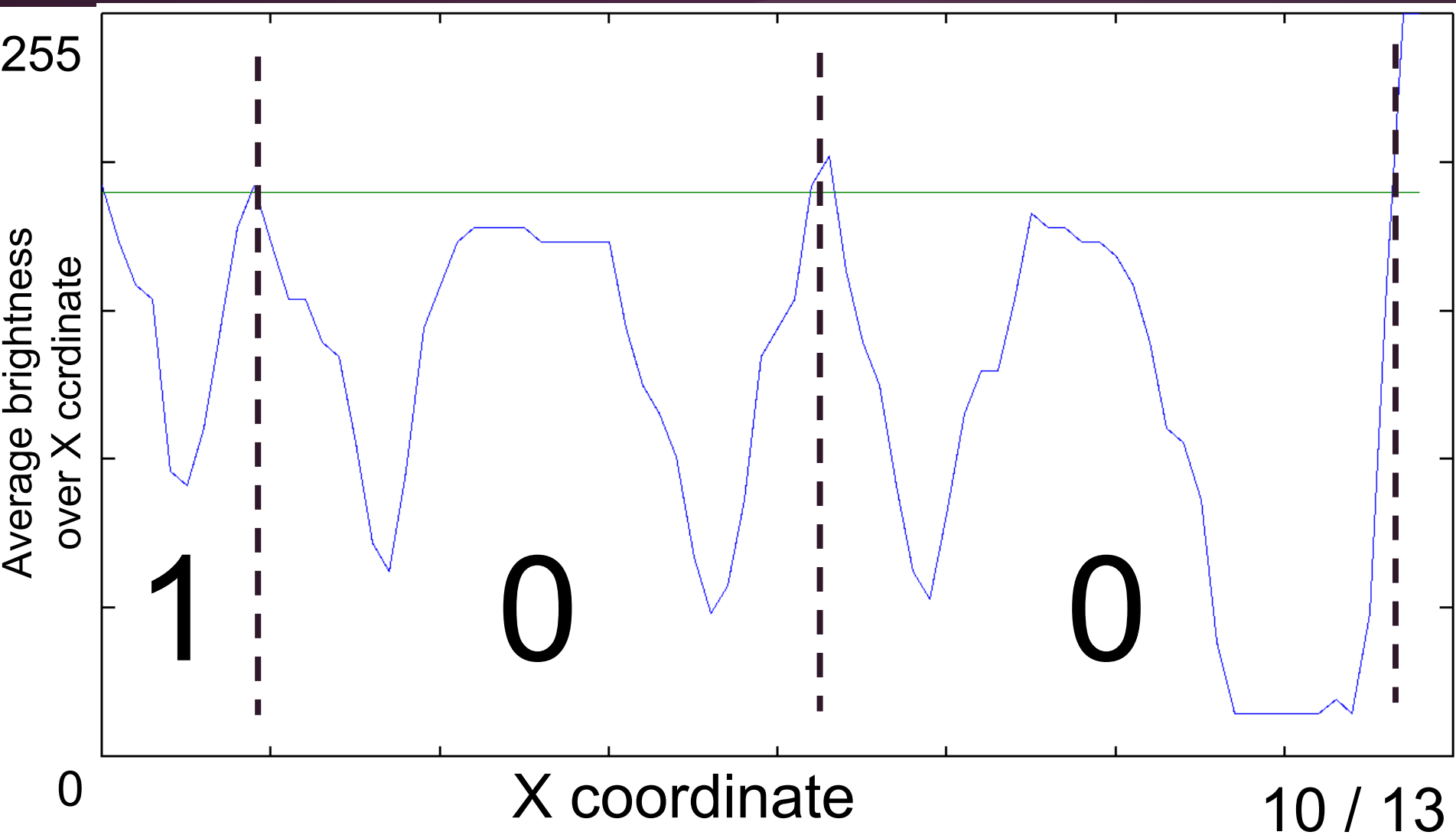


Global adaptive
thresholding
(Otsu method)



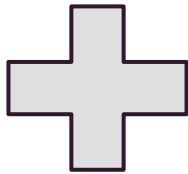
Local adaptive
thresholding

3. Vertical Segmentation

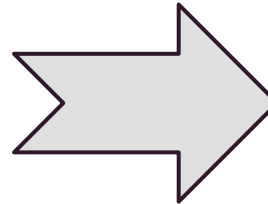
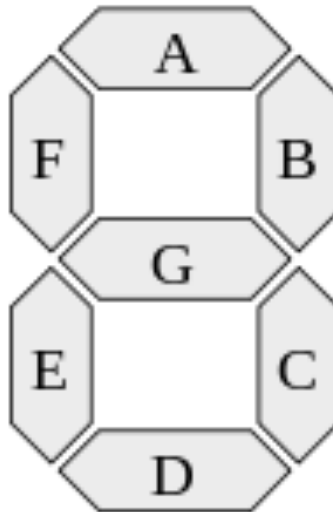


4. Digit recognition

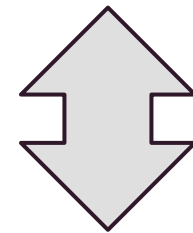
Extracted
indicator



Template



All
segments
present,
except "E"



The "9" digit

Results

Minimized operation time:

- around 0.3 seconds per one photo

Algorithm quality:

- 99% of rightly recognized images from training set
- 96% of rightly recognized images from test set

Blood Pressure Diary

We implement the recognition algorithm in **Blood Pressure Diary** which published at **Google Play**:
<https://play.google.com/store/apps/details?id=org.fruct.yar.bloodpressurediary>

