**Final Project Report: Plantar analysis GUI**

Matthias Gapp, Katja Korte and Lena Pett

Department of Sports Science, Justus-Liebig Universität Giessen

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Herman Mueller

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# Example Heading 1

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# Final Project Report: Footprint analysis GUI (Introduction)

Footprint analysis is the analysis of the foot plantar area, mostly derived from a 2D image, to obtain information about the person’s foot morphology. It is used in biomedical disciplines, such as orthopaedics, orthotic design, and sport sciences as well as footwear design or even forensic. (Mukhra et al., 2018; Domjanić et al., 2013). This report and the mentioned GUI in particular focus on the biomedical use of identifying pathological morphology in a person’s foot or stance. Common methods for footprint analysis are plantar pressure analysis or visual geometric analysis via a podoscope or even inked footprints on paper. The underlying GUI is designed to evaluate and perform calculations on True Color (RGB) images originating from a podoscope. With multiple settings to enhance the automated computations the app returns information about the arch length index (ALI), footprint index (FPI) and truncated arch index (TAI) of the uploaded foot. We would like to inform the user that poor-quality images might lead to poor-quality results and all resulting data is advised to be taken with rational consideration.

# Instructions

* Go through app and explain what each tab does.
* Add screenshots!

## Tab 1

…

## Tab2 – data Processing (Lena)

Rot – Weiß nicht, ob ich das so schreiben soll bzw. richtig ist

Background detection:

With the background detection tab, the preprocessing of the foot image for later quantification is initiated. By pressing the “Detect foot pixel”-button the images with a white background are cut out and the foot with no (black) background is displayed on the left side. With the slider, the user can adjust the threshold at which the differentiation between image and background should be made. (For Images with a black background this option is not needed). The separation from the background is not perfectly made with the detection of the foot pixel itself and a white boarder still remains around the foot. therefore, the “Refine detection”-button must be pressed. With the variable “Detection Window” the User can determine the size of the raster that will go thru the image again, looking at a single pixel and its nearby “neighbors” to determine, if the pixel belongs to the background or to the actual image. “Iterations” indicate how often this process should be done. The slider “Neighbor threshold” can be adjusted individually and sets a threshold at which percentage in the raster a pixel should be differentiated.

Contact detection:

At the same time, the intensity distribution of the default dimension – green is displayed in the contact detection tab. Indicating at which distribution a pixel has contact with the ground?) Displayed are also the confidence intervals, two maximum intensities (contact and no contact), minimum intensity (indicates where the intensities are changing), and modus. With the button group “RGB Dimension” the User can change the dimension of the intensity distribution and thereby select the adequate distribution for foot contact classification. By pressing the “Process”-button the intensity distribution in which the classification should be made is confirmed and the result is displayed on the left side. The variable “Band width” can be individually adjusted and thereby changes the confidence level of the distribution, which estimates that with the default setting of 0.5, 5% should not contain the parameter’s true value.

## Tab 3

…

# Functions

0.5 – 1 page each. Describe what the function does and how it’s implemented without using code snippets. Maybe use variable\_names if needed? In the end, add complications or earlier approaches and why they didn’t make it.

## Load-Button (+ use old path)

…

## Separate background from foot (lena)

The function “background\_removal” in the script, is based on a threshold which indicates at which pixel value, the value should be changed. As an input, the image matrix (double), background colour of the image and threshold value is required. The function goes thru every row, column, and dimension of the image, if the pixel is underneath the threshold value the pixel is set to 1 and vice versa. The output of the function is a logical matrix. By multiplying the logical matrix, designated as the cut out, with the image matrix (double), the result of the removal can be displayed. With the function “Neighborhood\_refinement” the remaining border of the background removal is adapted. The function requires a logical matrix as an input. The Raster is created based on the input value of the numeric field (Detection Window) and consists of ones. The conv2 function returns the two-dimensional convolution of the image matrix and the raster, which is used to determine the sum of the neighborhood pixels. By multiplying the slider value with the size of the raster and dividing it by 100, the cut-off for the refinement is calculated. If the pixel is underneath the cut-off threshold it is assigned to zero and vice versa. The output is a logical matrix. To display the result, the matrix is transformed with the cast function into its original data type (uint8) and multiplied with the unprocessed image.

## Detect Contact Area (Katja)

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## Index 1

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## Index 2

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## Index 3

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## Index 4

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# Literature

Domjanić, J., Fieder, M., Seidler, H., & Mitteroecker, P. (2013). Geometric morphometric footprint analysis of young women. *Journal of Foot and Ankle Research*, *6*(1). https://doi.org/10.1186/1757-1146-6-27

Mukhra, R., Krishan, K., & Kanchan, T. (2018). Bare footprint metric analysis methods for comparison and identification in forensic examinations: A review of literature. *Journal of Forensic and Legal Medicine*, *58*, 101–112. https://doi.org/10.1016/j.jflm.2018.05.006