Knuckle Input

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ABSTRACT

Abstracts should be about 150 words. Required. See: https://users.ece.cmu.edu/~koopman/essays/abstract.html

CCS CONCEPTS

• **Human-centered computing** → **User studies**; **Ubiquitous and mobile devices**;

KEYWORDS

Touch Input; Knuckle Input; Gestures; HCI

ACM Reference Format:
Robin Schweigert, Simon Hagenmayer, and Jan Leusmann. 2018. Knuckle Input. In *Proceedings of Fachpraktikum Interaktive Systeme (FIS'18).* ACM, New York, NY, USA, 4 pages.

INTRODUCTION

The structure of the final submission is only a suggestion, feel free to change if it needed. Final a example publication under: http://sven-mayer.com/wp-content/uploads/2017/03/le2016placement.pdf. How to report machine learning? See: http://sven-mayer.com/wp-content/uploads/2018/01/

FIS'18, July 2018, Stuttgart, Germany

le2018palmtouch.pdf or http://sven-mayer.com/wp-content/uploads/2017/08/mayer2017orientation.pdf.

Motivate your project by reporting about related work and common goals.

Random example citation [1].

RELATED WORK

DATA COLLECTION STUDY

In order to be able to train a model, which can detect if users used their smartphone with their knuckle or finger, we did a data collection study, in which the users had to perform 17 different gestures on a smartphone so we could collect the capacative images.

Gesture Survey

To get some input, which gestures we should use for our data collection study, we conducted a small survey, in which we presented 20 different gestures and suiting real world applications for each. In this survey we found, that users did not like gestures with two knuckles, but generally all gestures were rated equally. This is why we took 17 of the 20 gestures for our data collection study.

Apparatus

Our apparatus consisted out of a Nexus 5, with a specific kernel, an android application, and a laptop with a python 3.6 application.

The custom kernel for the Nexus 5 allowed us to gather approximately 25 capacitive images per second, but because of this the touch input of the smart-phone is very unresponsive. This is why we chose to have no interaction with the UI in our data collection android application, and instead do all interaction with our laptop, which had an UDP connection to the smart-phone. With the python application on the laptop we could iterate through the study procedure, and see the current capacitive image in real time.

In our android application we first had to input some demographic data of the current participant. The task application was a screen, which displayed information about the current task, participants had to perform. This consisted out of the current input method(finger, knuckle), the current gesture, a progress bar, and an image for an example application for the current gesture.

Data

We collected every capacitive image we got from the smartphone, beginning when the task application was started. The resolution of this capacitive image was 27 by 15 pixels. We saved our data in an csv file. Next to the capacitive image for every entry we saved the following data: User ID, Task ID,

Time-stamp, Version ID, Repetition ID, isPause boolean. Every user got his user ID when starting the study, starting by 1. As we used 17 gestures, the task ID ranged from 1 to 34, as every gesture was performed with each the finger and the knuckle. The version ID states which iteration of one task was performed by the participant. The repetition ID was set higher, when we pressed the revert button in our python application when the gesture was not performed correctly by the participants. We later took only the data with the highest repetition ID, for every user ID, task ID and version ID.

Tasks

The study duration was split into two parts. The first part was a small tutorial where the participants had to do each of the 17 gestures once with the finger and knuckle each. The real task began as soon as they finished this tutorial. All of the 17 gestures had to be executed 20 times by the participants with their finger and knuckel each, resulting in 340 $/times$ 2 gestures. We randomized the order of these 17 gestures but divided the task into two halfs, one part where all the finger gestures and one all the knuckle gestures. We did this division into two halfs to not overload the participants mentally as this would most likely result in a high error rate, because they always had to check which input method they had to use and which gesture they had to perform with it.

The task activity can be seen in (FIGURE). The participant then had to perform the current gesture anywhere on the screen. If the gesture was performed correctly, we iterated to the next task, if it was performed incorrectly we asked the participants to perform it again.

Procedure

We conducted the study in a lab environment to have as little distraction for the participants as possible. The participants were first handed out a consent form, which they had to read and sign and then we gave them a quick overview about the study. Every participant was told he could take a break or quit the study at any point.

The study started with a tutorial, where participants had to perform every gesture with the finger and knuckle once. Here we also explained each application for each gesture. After they were done with the tutorial we started the data collection part. Depending on if the user ID was even or odd, the participant had to do every finger gesture or knuckle gesture first. After the 340 gestures with the first input method, the participant had to do every gesture with the other input method.

Participants

Participants were either invited within the course or orally. The XX participants were XX years old on average and we had XX male participants. No participant was forced to do the study. No participant had any impairments and every participants' dominant hand was their right hand.

Good Utilization of the Side Bar
Preparation: Do not change the margin dimensions and do not flow the margin text to the next page.
Materials: The margin box must not intrude or overflow into the header or the footer, or the gutter space between the margin paragraph and the main left column.
Images & Figures: Practically anything can be put in the margin if it fits. Use the `\marginparwidth` constant to set the width of the figure, table, minipage, or whatever you are trying to fit in this skinny space.

Sidebar 1: This is the optional caption

Figure 1: In this image, the cats are tessellated within a square frame. Images should also have captions and be within the boundaries of the sidebar on page 4. Photo: ⓒⓞ jofish on Flickr.

Table 1: A simple narrow table in the left margin space.

	First	Location
Child	22.5	Melbourne
Adult	22.0	Bogotá
Gene	22.0	Palo Alto
John	34.5	Minneapolis

RESULTS

Report about your model. No source code!
Report about the validation dataset / validation study.

DISCUSSION

Disuses why it is still not awesome and how this could be improved. Why this is still awesome? Think about: Nobody has done this before.

CONCLUSION

Two sentences wrap up what you have done. Than report what you achieved.

REFERENCES

[1] Huy Viet Le, Thomas Kosch, Patrick Bader, Sven Mayer, and Niels Henze. 2018. PalmTouch: Using the Palm as an Additional Input Modality on Commodity Smartphones. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (2018-04-21) *(CHI'18)*. ACM, New York, NY, USA, 360:1–360:13. https://doi.org/10.1145/3173574.3173934