Ergonomic Posture Detection

Business model documentation

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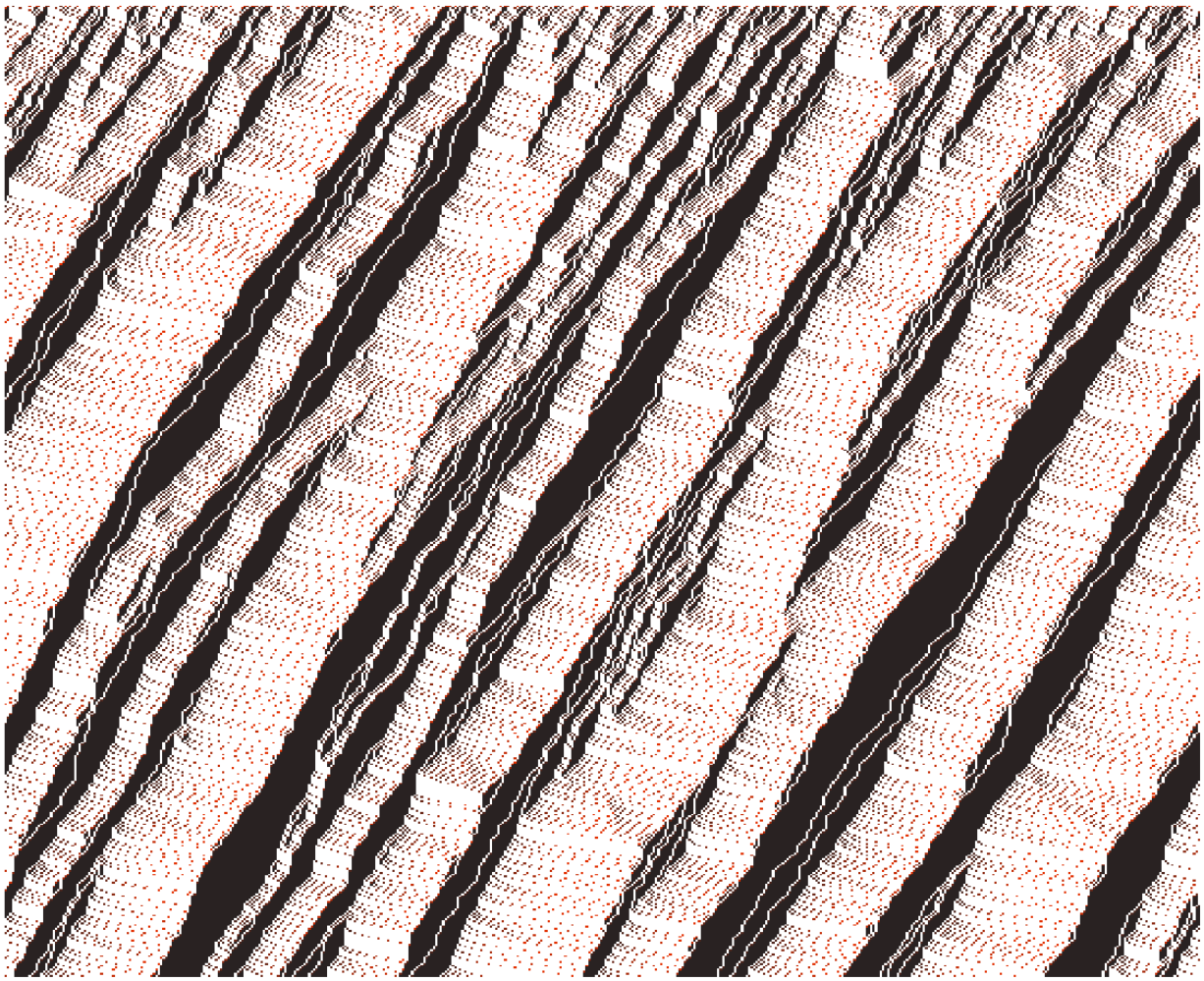

Business Values - Prof. Dr. Sandra Dressler
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Abstract

Test[1]

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Chapter 1

Introduction

During the COVID-19 pandemic, a lot of people startet to work remotely from their homes instead of working in their offices. Their new workplaces were not ergonomically designed for long-term work. This can lead to health problems.

Chapter 2

Solution: How to adress this need?

(by Ari Wahl)
The first goal of this project is to develop a software that helps people to work ergonomically correct. We will develop an application that will be able to detect the user's posture in real-time and give feedback to the user. The feedback should be given in a way that users can correct their posture if necessary. The software should be easy to use and should be able to run on different platforms and devices. It should be available and easily accessible to businesses and private users. Ideally, the user can just use the webcam of their device to use the software. The application will be able to run in the background and give the feedback in a subtle way. We propose a traffic light colored-scheme that will be displayed as a frame around the users screen. This means that the frame will be green if the user's posture is correct, yellow if the posture is not optimal and should be changed soon and red if the posture is bad and should be changed immediately. We will also provide an option to display the feedback as sound. There will be no sound if the posture is correct, a beep from time to time if the posture is not optimal and a continuous sound if the posture is bad. The user can choose if we will also provide a visual feedback in the form of a small window that will be displayed in the corner of the user's screen. This window will show the user's posture in real-time and in case of a bad posture highlights the regions that contribute most to the detection of a bad posture. So the user can know which parts of their posture they should correct. Eventually we will also display arrows in the image on how/which direction to correct the posture next to the highlighted parts.
As data privacy is an important issue with real-time video analysis, we will develop the software in a way that the raw video data will not leave the user's device. It will be processed locally in a first step on the user's device and only the processed data will be sent to the server.
To further develop our application we will (optionally) also analyse the data over time and give the user feedback about their posture in the form of a dashboard. This dashboard will show the user for example how much time they spent in a good, bad or neutral posture and which is their most used bad posture, etc. It will also show the user how much time they spent sitting in total.
As a further step, the application will be extended to optionally also give the user advice on how to compensate for long sitting periods. This will be done by suggesting the user different exercises once in a while after they have been sitting for a long time.
For further development we see the potential to grow into an ergonomic workout application branch. This means that we will have an additional model to detect the user's posture and movements during workout and give them feedback on how to do the exercises correctly.
Another possible area of growth will be physiotherapy applications. This means that we will have an additional model to detect the user's posture and movements during physiotherapy exercises and give them feedback on how to do the exercises correctly.
Since these further developments need additional resources and domain knowledge we will focus on the implementation of the first goal of this project.

Chapter 3

Technology: Why is it unique?

by Ari Wahl

For our Ergonomic Pose App "PostureFix" we will use YOLO v8 pose as a base model. It can also run on mobile devices (Android and Os) with 6-7 frames per second [2], which is more than enough for our application. For data protection and privacy we will send only the keypoints from the pose detection the be evaluated online on our classification layer or alternatively run the model as a lightweight application completely on the users devices. Either way, this ensures that there is no threat for businesses or private persons as customers to be victims of spy attacs. Just having keypoints would only allow for an extremely abstract representation and is therefore a perfect measure to protect the data and privacy of our customers. For the adaption of the YOLOv8 pose model for our application, we train a classification layer on basis of the keypoint representation. To evaluate, if a pose is ergonomic or not, we collected a dataset, which uses classification levels from the well established RULA (Rapid Upper Limb Assessment) employee assessment worksheed [**https://www.researchgate.net/publication/362455275˙Home˙office˙versus˙ergonomic˙workstation˙-˙is˙the˙erg**
Additional implementations that exceed the base model will be a dashboard for monitoring the posture over time and show long term improvements to the customer. Also we plan to optionally leverage Explainable AI methods to indicate which joint positions are problematic and show in which direction an improvement can be achieved most quickly. To establish more trust among our (potential) customers we will also aim to get some certification(s) that prove the health impact of our application, e.g. TÜV. For our applications we use the following modules and packages so far: ultralytics YOLO, openCV, Numpy, Pillow, Cocoa, Quartz, objc, PyObjCTools.

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References

[1] Dummy. *Dummy*.

[2] Ultralytics. *YOLOv8 Discussion*. Online; accessed 20 February 2022. 2022. URL: https://github.com/ultralytics/ultralytics/issues/4333.