



A vision based anthropometric Scanner

Project Management and Software Development
for Medical Applications

General Info

Project Title: A vision based anthropometric Scanner for dynamic Scenes

Contact Person: Benjamin Busam

Contact Email: b.busam@framos.com

Project Abstract

The goal of this project is to develop a software prototype that helps to avoid the most common cycling injuries by reducing the medical risk caused by incorrect posture on the bike. This is done by means of a computer vision based software tool that extracts anthropometric data from videos.

Background and Motivation

Every year, more than 1.3 million people are medically treated due to bicycle-related injuries. Besides accidents, a large part of patients suffers from particular orthopaedic disorders such as Achilles Tendonitis, Patellar Tendonitis or lower back (or neck) pain.

Many of these long lasting problems are difficult to treat efficiently in short time or the diagnosis to facilitate a full recovery had had to be at a much earlier stage. A proper adjustment of the bicycle parts and the individual fit of the cycle geometry to the anthropometric measures of the cyclists can avoid most of these injuries.

However, currently the adjustment process is often a matter of trial and error and especially the unexperienced cyclist does not know whether a position can be improved or is potentially non-ergonomic. The project partner FRAMOS now

wants to bridge this gap by using a computer vision based approach to extract the relevant anthropometric data and adjust the bicycle according to the individual measurements of both unexperienced cyclists and athletes.

Student's Tasks Description

The first target for the student is to establish a (semi-) automatic software tool to dynamically extract the anthropometric data of a person based on an acquisition of several images with an industrial camera. A second step – for which also a graphical user interface exists – is the processing of the anthropometric data and the calculation of the bicycle adjustment that fits the best to the individual proportions of the cyclist.

An image based static anthropometric scanner applying a recent algorithm from the field of deep learning is already implemented and a general detector architecture is trained on two common datasets. Since the extrinsic geometry of the scene has to be mapped to a measurable geometry, the task now is to apply this scanner to video data and to facilitate a context-aware procedure for automatic calibration and a fully dynamical bike fit. The video data for the project is acquired in the FRAMOS lab during the project.

After this project, the student is able to understand and work with a modern deep learning library and can organise different software elements which are integrated into a bigger software framework. Moreover, the constant coordination with FRAMOS gives some insight into the working procedures in the industry.

Please send the completed document to benjamin.frisch@tum.de before the project proposal deadline on April 1st, preferably earlier. Please note that this proposal will be evaluated by the BMC coordinators and will be assigned to a student only in case of acceptance.



Technical Prerequisites

- Basic knowledge of MATLAB / C++
- Basic skills in linear algebra

Optional requirements that can also be learned during the project are:

- Basic knowledge of video processing
- 2D/3D computer vision expertise
- Experience with the use of a library for convolutional neural nets (CNNs) such as MatConvNet / Caffe
- Some basic understanding of projective geometry
- Ability to work with versioning tools such as SVN / GIT

References

Toshev, Szegedy. "DeepPose: Human Pose Estimation via Deep Neural Networks". CVPR 2014

Zhang, Zhengyou. "A flexible new technique for camera calibration." PAMI 2000.

Silberman, Marc R., et al. "Road bicycle fit." Clinical Journal of Sport Medicine 15.4 (2005): 271-276.