Musculoskeletal disorder analysis using RGB-D data

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Near 80% of the world population is affected of back pain during his life. Current practices to analyze back problems are expensive, subjective, and invasive. We propose a novel semi-automatic tool for posture and range of movement estimation based on the analysis of 3D information from depth maps using the RGB-D data. The system is able to analyze postural abnormalities in order to support diagnostic and track the evolution in rehabilitation treatments, with the aim of preventing and correcting musculoskeletal disorders.

The system is composed by three main functionalities: a) static posture and musculoskeletal disorder analysis (SP), b) curvature analysis of the spine (SC), and c) range of motion analysis (RM) (Figure 1). Depth measurements often fluctuate and depth maps contain numerous holes where no readings were obtained. In order to obtain a valid and accurate depth map, we performed a preprocessing of it to eliminate erroneous information caused by noise, and to reconstruct surfaces not well defined. Some of these irregularities are solved by performing an statistical analysis [1] on each point's neighborhood, and trimming those which do not meet a certain criteria.

We have designed a system capable to obtain reliable 3D anthropometric data using low cost technology. The validation study on three-dimensional measurements on articulated bodies shows that it is possible to incorporate postural analysis in clinical routine. The designed system delivers high performance for diagnosis and treatment of musculoskeletal disorders avoiding invasive procedures. Because of the association of protocol analysis, the system allows a rapid analysis in the regions of interest desired by the therapist.
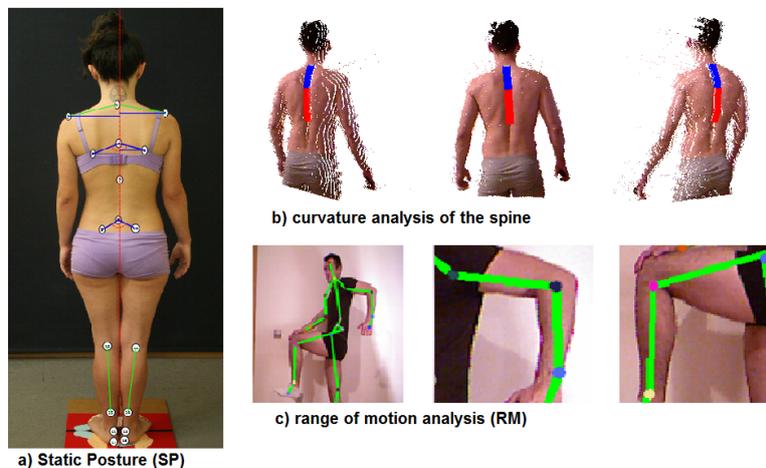

Figure 1: Main system functionalities.

References

[1] Du, Hao and Henry, Peter and Ren, Xiaofeng and Cheng, Marvin and Goldman, Dan B and Seitz, Steven M and Fox, Dieter, "Interactive 3D Modeling of Indoor Environments with a Consumer Depth Camera" *Science, ACM Press*, 75–84, 2011.