Challenges of Trustable AI and Added-Value on Health
B. Séroussi et al. (Eds.)

doi:10.3233/SHTI220591

Assessment of the Body Posture of Interventional Radiologists

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Abstract. Physicians in interventional radiology are exposed to high physical stress. To avoid negative long-term effects resulting from unergonomic working conditions, we demonstrated the feasibility of a system that gives feedback about unergonomic situations arising during the intervention based on the Azure Kinect camera. The overall feasibility of the approach could be shown.

Keywords. Ergonomics, Human Factors, Interventional Radiology, Body Posture

1. Introduction

Physicians in interventional radiology are exposed to high physical stress. During interventions, they must spend long periods of time in static postures [1] while wearing heavy radiation protective clothing. Due to the required concentration during such interventions, the interventionist may not notice if he or she is working in an unergonomic body posture. This can lead to diseases such as disc herniations, which can limit the ability of those affected to perform their occupation [2]. Therefore, we aim on developing a system that can distinguish between ergonomic and unergonomic body postures. This information can be given to the interventionist to increase the awareness and maybe trigger a re-positioning of either patient, instruments, or interventional radiologist.

2. Methods

We did a use case analysis together with experienced interventional radiologists and derived 16 functional and non-functional requirements for such a system.

To describe a posture, a kinematic skeleton model can be used. We evaluated the following established methods for body posture analysis in working environments regarding their applicability to our project: DIN EN 1005-4 [4], PERA [5], work of Hellig [6], Ray [7], EAWS [8], and the work of Snook, NIOSH, RULA, REBA, MTM, and OWAS [9]. For the first iteration of the system, we implemented a decision table based on DIN EN 1005 combined with the criteria of the PERA system. In a second iteration, the RULA system was implemented as a second assessment option.

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Due to the COVID-19 pandemic, pre-clinical tests were restricted to the research-OR at Reutlingen University. The testing clinician performed a simulated intervention wearing a lead protection (weight 10 kg) under a surgical gown.

3. Results

The system was successfully implemented (see Figure 1). The detection of the relevant joints was sufficient to demonstrate the general applicability of the approach. Nonetheless, we experienced many miss-detections, mainly caused by occlusions of the interventional radiologist or by the shape of the surgical gown.

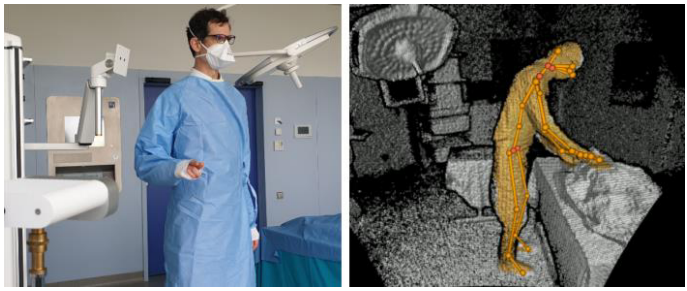

Figure 1. Setting in the research-OR (left), visualization of the skeleton model during the procedure (right).

4. Discussion and Conclusion

We were able to demonstrate the feasibility of body posture tracking in an interventional radiology setting for assessing the ergonomic situation of the interventional radiologist.

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