# The use of DeepLabCut to detect and quantify mirror movements in children with unilateral cerebral palsy

Brice Berclaz[1]; Helga Haberfehlner[2], Katrijn Klingels[3,4]; Hilde Feys[3]; Pieter Meyns[4]; Henning Müller[1,5]; Cristina Simon-Martinez[1]

[1] Institute of Information Systems, University of Applied Sciences Western Switzerland (HES-SO) Valais-Wallis, Sierre, Switzerland

[2] Department of Rehabilitation Sciences, KU Leuven Campus Bruges, Belgium

[3] Department of Rehabilitation Sciences, KU Leuven - University of Leuven, Leuven, Belgium

[4] Rehabilitation Research (REVAL), faculty of rehabilitation sciences, Hasselt University, Diepenbeek, Belgium

[5] Medical Faculty, University of Geneva, Geneva, Switzerland

**Background**

Mirror Movements (MM) are clinically evaluated with the ordinal scale Woods&Teuber. Although reliable, it lacks the ability to quantify MM. Here, we developed a video-based detection and quantification of MM using the pose estimation software DeepLabCut.

**Materials & Methods**

We included three healthy participants (mean age = 14y; SD=8.5y) and three children with unilateral CP (mean age = 10y; SD=1y). We used DeepLabCut (an open-source toolbox for 2D markerless pose estimation based on transfer learning with deep neural networks) to track user-defined points of interest on the hands during a finger tapping task (sequentially lifting fingers from the table) to quantify the finger movements from an in-house developed hand model. We extracted the coordinates of selected key points tracked on the fingers and hand and normalized the data between hands. We used cross-correlation methods between hands to quantify MM. We implemented this model in a web version of a graphical user interface to be used by clinicians.

**Results**

In both healthy participants and the children with unilateral CP, the model can track the hand points with low errors (train-error 1.98 pixels; test-error 3.40 pixel) and provide quantification in form of correlation coefficients that can be related to Woods&Teuber scores. The graphical user interface is simple to use and warrants the data protection regulations.

**Conclusion**

This proof-of-concept algorithm detects and quantifies MM using low-cost 2D video analysis. After validation in different manual ability levels of children with unilateral CP, this method can be easily used in the clinics and research.