

Camera - and viewpoint-agnostic evaluation of axial postural abnormalities in people with Parkinson's disease through augmented human pose estimation

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Introduction: Axial postural abnormalities (APA) are common features of Parkinson's disease (PD) and manifest in over 20% of patients during the course of the disease. APA form a spectrum of functional trunk misalignment, ranging from a typical parkinsonian stooped posture to progressively greater degrees of spine deviation [1-2].

Objective: There is a lack of agreement on validated, user-friendly, automatic tools for measuring and analyzing the differences in the degree of PA in different moments of the day, according to patients' therapeutic conditions and tasks. In this context, human pose estimation (HPE) software based on deep learning could be a valid support as it automatically extrapolates spatial coordinates of the human skeleton keypoints from images or videos.

Methods: AutoPosturePD is a software that augments the human skeleton extrapolated by HPE software at the state of the art from RGB pictures with exact bone points for posture evaluation through computer vision post-processing primitives. It doesn't require any calibration and can be coupled with images taken using commercially available sensors, like the one found in smartphones.

Results: The software is tested for robustness and accuracy on the processing of 76 RGB images with different resolutions and sensor-subject distances from 55 PD patients with different degrees of anterior and lateral trunk flexion, showing accordance within a tolerance of 5 degrees with respect of virtual palpation.

Conclusions: AutoPosturePD is a novel low-cost software-based automatic and portable tool for the evaluation of axial postural abnormalities in people with Parkinson's Disease, which only relies on the use of off-the-shelf RGB cameras.

References:

[1] Tinazzi, M.; Geroin, C.; Bhidayasiri, R.; Bloem, B.R.; Capato, T.; Djaldetti, R.; Doherty, K.; Fasano, A.; Tibar, H.; Lopiano, L.; et al. 364 Task Force Consensus on Nosology and Cut-Off Values for Axial Postural Abnormalities in Parkinsonism. *Movement Disorders* 365 Clinical Practice 2022.

[2] Artusi, C.A.; Geroin, C.; Tinazzi, M.; Imbalzano, G.; Camozzi, S.; Aldegheri, S.; Bombieri, N. Assessment of Axial Postural 402 Abnormalities in Parkinsonism: Software for An Automatic Picture Analysis. *Movement Disorders Clinical Practice* 2023, in press.