PLENARY SESSION

Identifying and Quantifying Movement Signatures

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Human movement has been studied for decades, and dynamic laws of motion that are common to all humans have been derived. Yet, every individual moves differently from everyone else (faster/slower, harder/smoother, etc.). We propose a measure of such variability, namely an individual motor signature (IMS) able to capture the subtle differences in the way each of us moves. We show that the IMS of a person is time-invariant and that it significantly differs from those of other individuals [1]. We then used IMS to measure objectively the level of the person's motor deficits, relative to their normal counterparts in several case studies.

In an effort to establish reliable indicators of schizophrenia we developed a method that could detect deficits in movement and social interactions, both characteristics of the disorder. We asked people to perform movements alone, and to mirror the movements of a computer avatar or a humanoid robot. Using statistical learning we were able to distinguish people with schizophrenia from healthy participants with accuracy and specificity slightly better than clinical interviews and comparable to tests based on much more expensive neuroimaging methods [2].

Children with developmental coordination disorder (DCD) struggle with the acquisition of coordinated motor skills. We assessed how individual coordination solutions might emerge following an intervention that trained accurate gaze control in a throw and catch task. Kinematic data were collected from six upper body sensors from twenty-one children with DCD, using a 3D motion analysis system, before and after a 4-week training intervention. The gaze trained group revealed significantly higher total coordination following training than a technique-trained control group. Additionally, the gaze trained group revealed individual coordination patterns for successful catch attempts that were different from all the coordination patterns before training, whereas the control group did not [3]. Finally, I will present some unpublished results related to movement 'signatures' of the eye, arms, and hands which might underpin DCD.

[1] Słowiński P, Zhai C, Alderisio F, Salesse R, Gueugnon M, Marin L, Bardy BG, di Bernardo M, Tsaneva-Atanasova K. (2016) Dynamic similarity promotes interpersonal coordination in joint action, Journal of The Royal Society Interface, volume 13, no. 116

[2] Słowiński, P., Alderisio, F., Zhai, C., Shen, Y., Tino, P., Bortolon, C., ... & Tsaneva-Atanasova, K. (2017). Unravelling socio-motor biomarkers in schizophrenia. npj Schizophrenia, 3(1), 1-10.

[3] Słowiński P, Baldemir H, Wood G, Alizadehkhaiyat O, Coyles G, Vine S, Williams G, Tsaneva-Atanasova K, Wilson M. (2019) Gaze training supports self-organization of movement coordination in children with developmental coordination disorder, Scientific Reports, volume 9, no. 1, pages 1712-171