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Sparse Coding of Natural Human Motion Yields Eigenmotions Consistent Across People[1] ANDREAS THOMIK, Dept. of Bioengineering, Imperial College London, SW7 2AZ London, UK, A. ALDO FAISAL, Dept. of Bioengineering, Dept. of Computing, Imperial College London, SW7 2AZ London, UK — Providing a precise mathematical description of the structure of natural human movement is a challenging problem. We use a data-driven approach to seek a generative model of movement capturing the underlying simplicity of spatial and temporal structure of behaviour observed in daily life. In perception, the analysis of natural scenes has shown that sparse codes of such scenes are information theoretic efficient descriptors with direct neuronal correlates. Translating from perception to action, we identify a generative model of movement generation by the human motor system. Using wearable full-hand motion capture, we measure the digit movement of the human hand in daily life. We learn a dictionary of "eigenmotions" which we use for sparse encoding of the movement data. We show that the dictionaries are generally well preserved across subjects with small deviations accounting for individuality of the person and variability in tasks. Further, the dictionary elements represent motions which can naturally describe hand movements. Our findings suggest the motor system can compose complex movement behaviours out of the spatially and temporally sparse activation of "eigenmotion" neurons, and is consistent with data on grasp-type specificity of specialised neurons in the premotor cortex.

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