Do Artificial Neural Networks understand what they are doing?
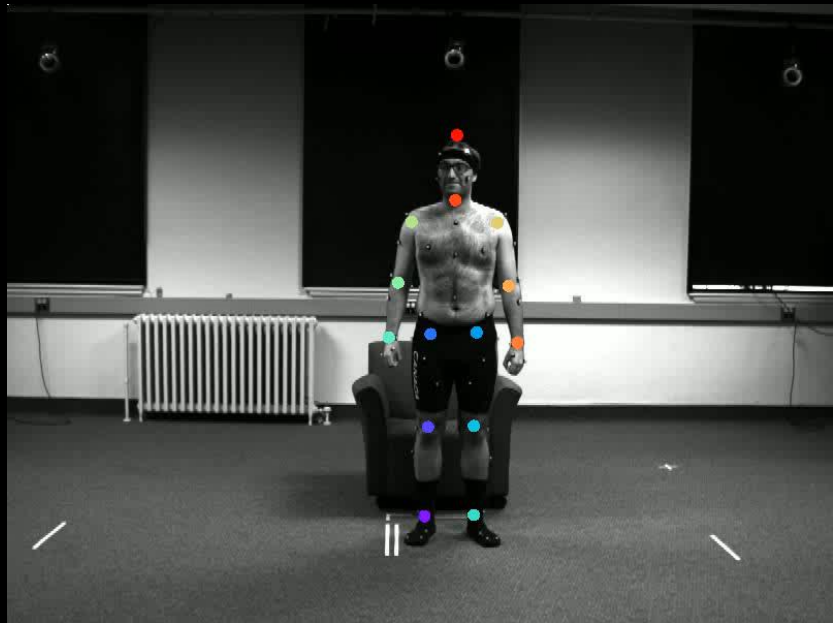
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1. Project one: movement classification
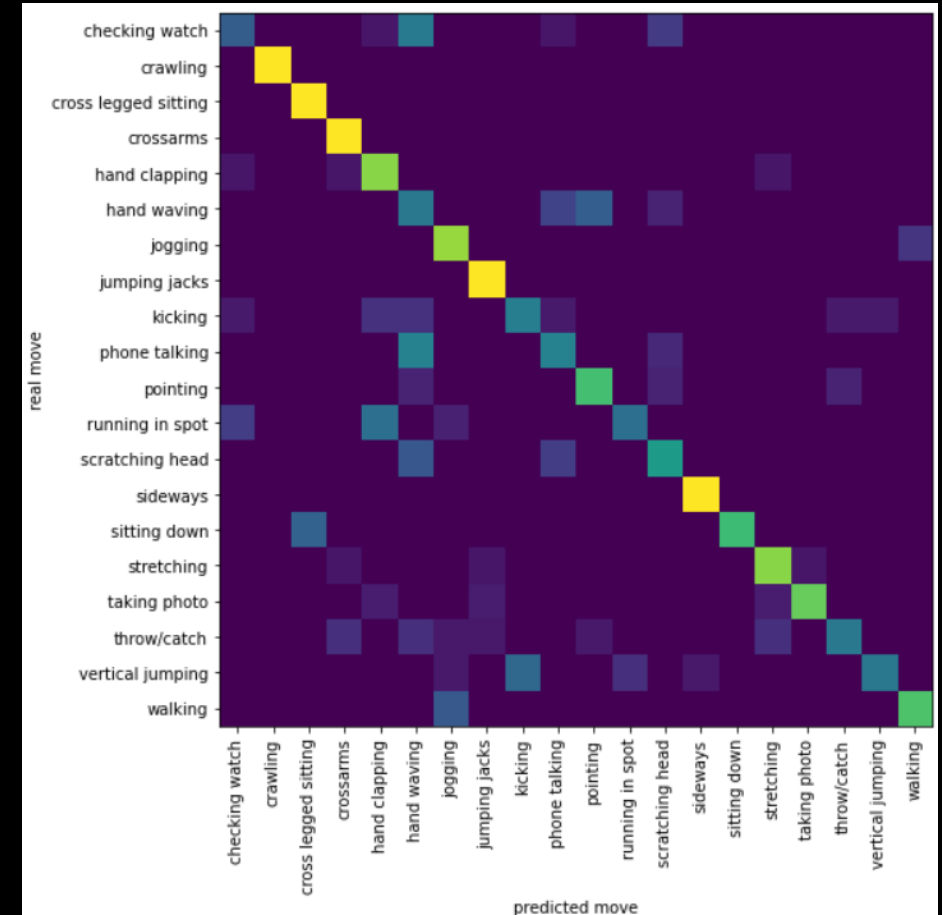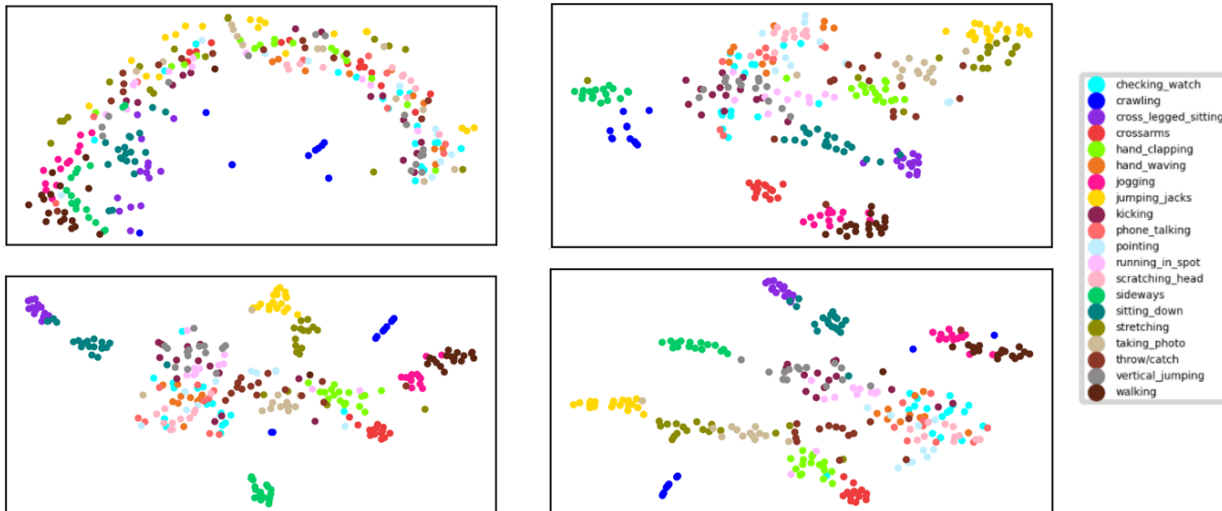
Question: Does the model comprehend the movements as humans do?

-Deeplabcut(14 joints, 21 movement)

Result

-Classification performance
-RDMs
-Confusion matrix
-Clustering
-XAI:Perturbation-based models
(Amplitude, Frequency)

Purposes to be covered:

- allow extracting detailed poses from videos in naturalistic environments without any wearable sensors

- not only to classify abnormality, but also to gain insight regarding what aspects of movements are characteristic of movement disorders

- Neurological disorders assessment and diagnosis: Can we provide a pattern or score for each movement, so it will distinguish normal and abnormal movements

- explanatory artificial intelligence (XAI): we can achieve specific tools that can help to interpret AI and machine learning pipelines.

2. Project two: Multisensory Integration

Question: Can ANN solve this problem? How does ANN handle that?

→ implicit approximate normalization: IAN
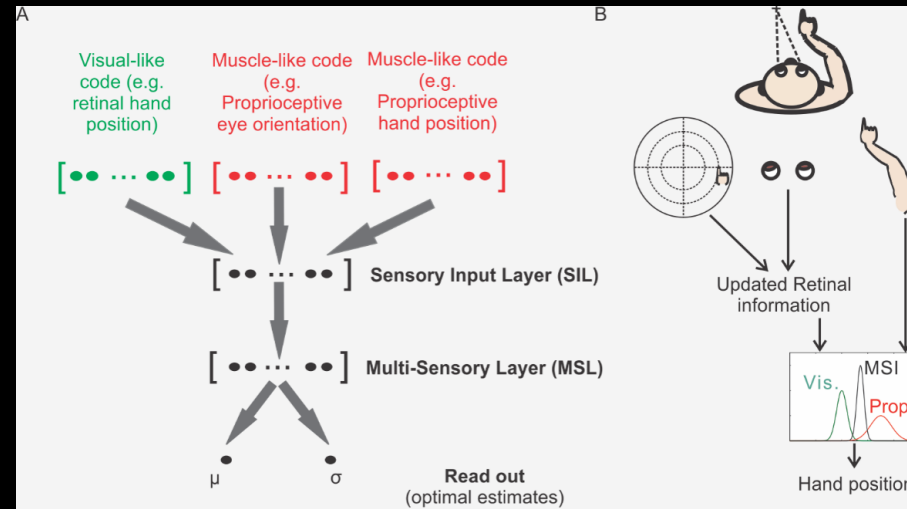
Results

- The performance is comparable to a probabilistic population code network, but without requiring non-linear or divisive operations

- Produces a wide range of behaviors similar to recorded activity in the brain. Performs well with a fraction of the neurons required by explicit methods.

- Doesn't require a neat preconfigured connectivity structure between neurons or explicitly matching population codes for individual neurons

Results

- Produces a wide range of behaviors similar to recorded activity in the brain. These behaviors include inverse effectiveness, gain-like modulations, super-additivity, and multi-sensory suppression.

- Accounts for quantitative features of cue combination: modulation of neural activity by varying the cue reliability, similar to area MSTd.