

An Open Data Infrastructure for Bodily Expressed Emotion Understanding (#2234195)

Mining Human Perception for Symbolic Representation and Annotation of Bodily Movement



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PennState

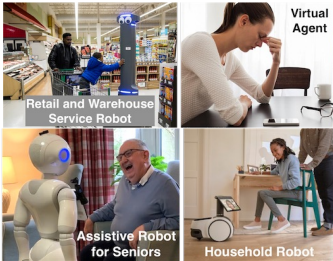


UNIVERSITY OF ILLINOIS CHICAGO



LABAN / BARTENIEFF
Institute of Movement Studies

6 months
of 3 years



Some of our greatest challenges, especially in robotics, rely on understanding bodily movements. These applications require embodied responses to embodied queries.

"Write me a paragraph."

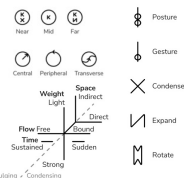


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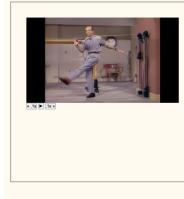
Despite exciting advances in AI, we lack symbolic understanding of subtle bodily movement. AI systems require inputs and a large training corpus in the same tokenized (or symbolic) format, e.g., text, in order to supply reasonable symbolic outputs.

Body Movement Collection and Annotation (BMCA) System

We are building a system for collecting expert (symbolic annotation) and lay (situated meaning) human observations of bodily movement.



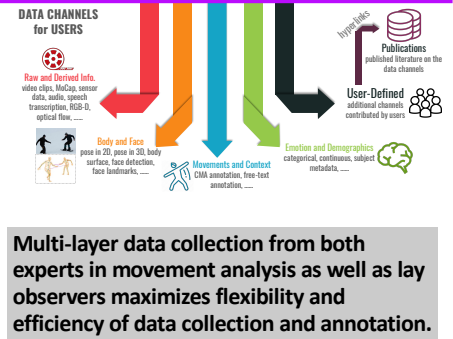
Symbolic system of movement notation will enable symbolic reasoning about human movement in future AI systems.



Time	Annotation	Notes
0:00	Posture	...
0:05	Gesture	...
0:10	Travel	...
0:15	Impulsive	...
0:20	Even	...
0:25	Inactive	...
0:30	Becoming	...
0:35	Vibratory	...
0:40	Control	...
0:45	Peripheral	...
0:50	Transverse	...
0:55	Space	...
1:00	Weight	...
1:05	Light	...
1:10	Flow	...
1:15	Time	...
1:20	Sustained	...
1:25	Strong	...
1:30	Including	...
1:35	Generating	...

Novel notation system, extending Labanotation and Motif, allows for more expressive and detailed annotations to be captured quickly.

Video source materials from produced media (e.g., movies) are mined from online repositories (e.g., YouTube) and cut into shorter clips of salient action. Pilot studies are being extended to create a very large and scalable system.

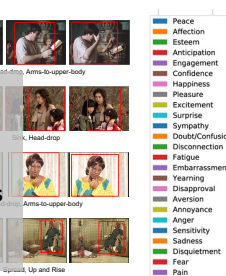


Multi-layer data collection from both experts in movement analysis as well as lay observers maximizes flexibility and efficiency of data collection and annotation.

Annotated Bodily Expression & Emotion (ABE²) Dataset

The first, pilot dataset on the BMCA (ABE²) will extend an existing pilot dataset (BoLD) allowing researchers to study relationships between bodily movement and expressed emotion.

Bodily action is labeled with symbolic system based on Laban Movement Analysis and Bartenieff Fundamentals.

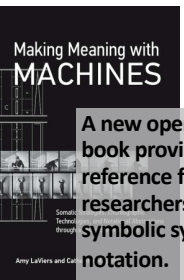


Categorical and continuous systems of emotion description are being leveraged.

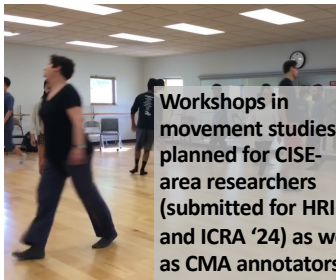
Benchmarks for fairness (e.g., demographic composition) and quality (e.g., explanatory power) are planned.

We have an interdisciplinary PI team and are advised by members of industry and academia to help ensure this infrastructure follows state-of-the-art knowledge across fields and serves broad needs for years to come.

Annotator & Researcher Education Efforts

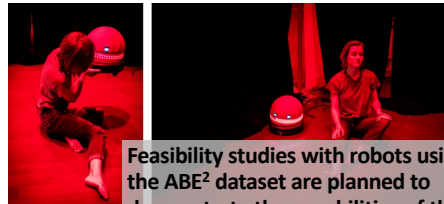


A new open-access book provides a reference for researchers on the symbolic system of notation.



Workshops in movement studies planned for CISE-area researchers (submitted for HRI and ICRA '24) as well as CMA annotators.

Future HRI Demonstration



Feasibility studies with robots using the ABE² dataset are planned to demonstrate the capabilities of the BMCA system to enable embodied and emotionally-informed AI systems.



- LaViers, Amy, and Catherine Maguire. *Making Meaning with Machines: Somatic Strategies, Choreographic Technologies, and Notational Abstractions Through a Laban/Bartenieff Lens*. The MIT Press, 2023.
- Wang, James Z., Sicheng Zhao, Chenyan Wu, Reginald B. Adams Jr., Michelle G. Newman, Tal Shafir, and Rachele Tsachor. "Unlocking the Emotional World of Visual Media: An Overview of the Science, Research, and Impact of Understanding Emotion." *Proceedings of the IEEE*. 2023.
- Wortman, Benjamin, and James Z. Wang. "HICEM: A high-coverage emotion model for artificial emotional intelligence." *IEEE Transactions on Affective Computing*. (accepted, to appear)
- Wu, Chenyan, Dolzodmaa Davaasuren, Tal Shafir, Rachele Tsachor, and James Z. Wang. Bodily expressed emotion understanding through integrating Laban movement analysis. *Patterns*, Cell Press. 4:10. 2023 (cover article)
- Zhang, Sitao, Yimu Pan, and James Z. Wang. "Learning emotion representations from verbal and nonverbal communication." In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*, pp. 18993-19004. 2023.

