AI-Assisted Performance Analysis: Deep Learning for Live and Archival Theater

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This poster presents the motivations, methods and preliminary findings of an ongoing inquiry into the uses of deep learning-based pose estimation technologies for analyzing and augmenting archival and live theatrical performances. This work contributes to and builds upon the steadily increasing range of research uses of technologies for "distant viewing" of audiovisual materials (Arnold / Tilton 2019), including the detection, analysis and indexing of human poses and gesture (Impett / Moretti 2017) and the study of both the physical proclivities of theatrical performances (Escobar Varela 2021) and their digital archival traces (Bardiot 2021). Furthermore, by incorporating techniques and expressive modes first applied to choreography via motion-capture technologies (deLahunta 2016) as well as in the development of pioneering multimedia artworks in virtual reality (Krueger et al. 1985), this work has the potential both to document and to participate in the creation of new works of theater and performance art.

Pose estimation technology, powered by emergent deep-learning methods for inference of body positions and motions from standard visual-light camera images, unlocks for archival and live footage methods previously only available for use in constrained environments with expensive motion-capture suits and equipment. The overall goal of the AI-Assisted Performance Analysis project therefore is to develop a set of software tools and documented best practices for accomplishing the above while addressing previously unexplored research questions related to theatrical pose and gesture.
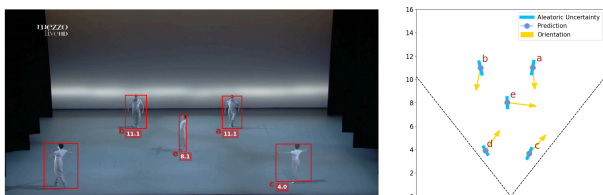

The project thus far has focused upon a few specific research inquiries that involve analyzing different aspects of archival videos and rehearsal footage through the lens of pose estimation:

1. Using pose data to determine a "directorial signature," finding and examining highly patterned relationships between the poses of actors in order to define the ways in which the director and performer create characterization and choreography. The oeuvre of recorded productions by the pioneering director Robert Wilson constitutes the core materials for this inquiry (Figure 1).

2. Applying pose estimation to a corpus of rehearsal videos filmed throughout the preparation of a new theatrical production, selecting scenes that have at least two or three actors interacting on stage, and tracing the evolution of the actors' poses from the beginning of the rehearsal period through the final performance (Figure 2).
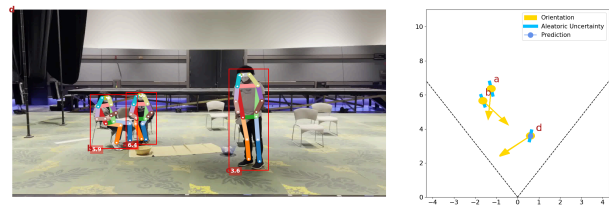

Figure 1: Visualization of detected figures, positions and orientations through pose-based inference via the monoloco software (https://github.com/vita-epfl/monoloco).

Figure 2: Pose estimation and monocular position estimation from rehearsal video of a student production.

A longer-term goal of the project is to relate the output of the above experiments to Henri Lefevre's influential conception of rhythm-analysis (Lefevre 2004). Specifically, we seek through the close and distant analysis of pose data streams to operationalize Lefevre's evocative philosophical definitions of rhythm as multifarious repetition, interference of linear processes and cyclical processes, and a trajectory of birth, growth, decline and conclusion.

The outcomes and findings of this ongoing work will be of particular significance to theater and performance studies and their growing footprint in the digital humanities, and also will have applications in video archive augmentation through the generation of supplemental metadata.

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