

Recurrence-based Vanishing Point Detection

Abstract

Classical Vanishing Point Detection (VPD) methods rely on explicit lines, while supervised deep learning approaches require labeled datasets. We propose a novel unsupervised approach, **R-VPD: Recurrence-based Vanishing Point Detection**, to detect vanishing points using the implicit lines obtained from feature correspondences of RPs in addition to explicit straight-line segments available in the image. Compared to two classical and two state-of-the-art deep learning methods, our approach outperforms all methods on synthetic data and matches supervised approaches on real-world images while exceeding classical methods.

Dataset Contributions

We contribute two benchmark datasets

- RPVP-Synthetic Dataset:** 3,200 images created in Blender with the ground truth VP and camera parameters (intrinsic and extrinsic matrices) used to create the 2D images.
- RPVP-Real Dataset:** 1,400 annotated real-world images containing RPs, where the ground truth VP is hand-labeled using a LabelMe tool.

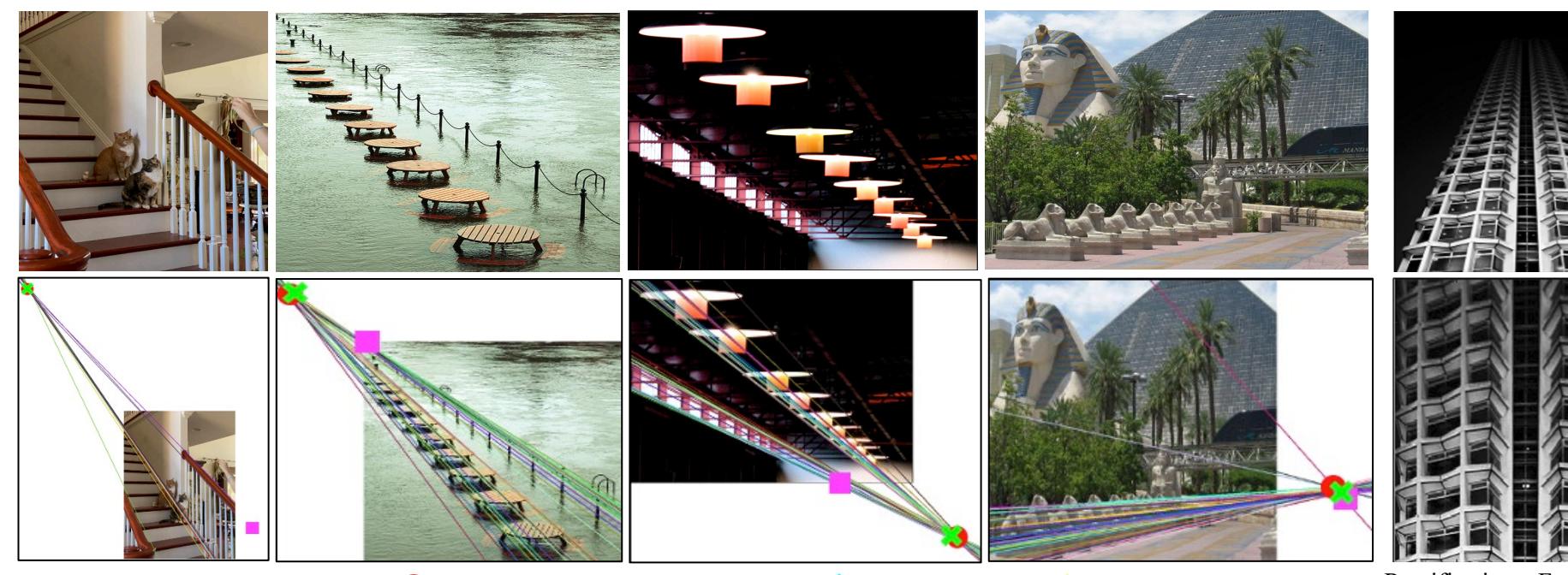


Sample Image from RPVP-Synthetic Dataset

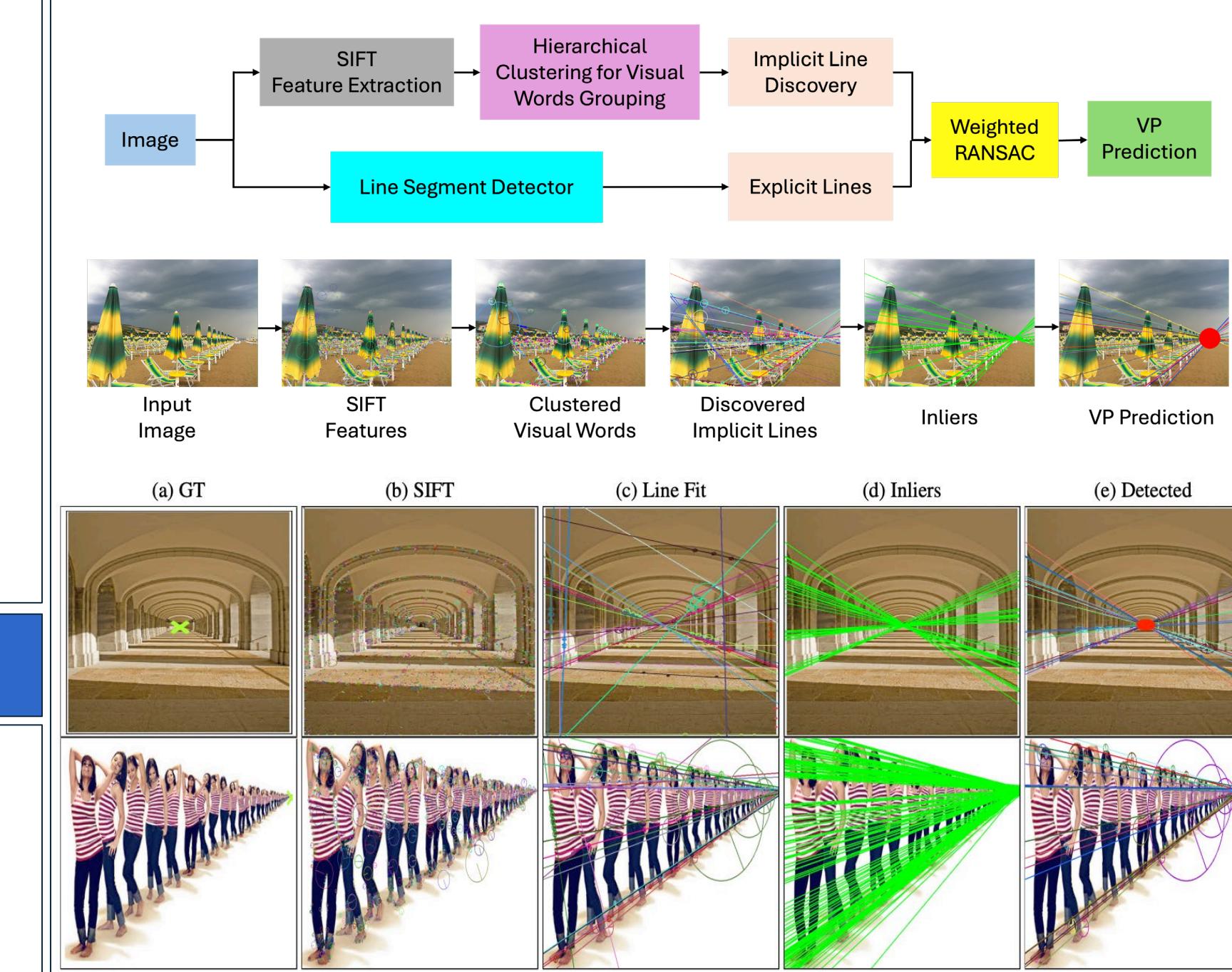


Sample Image from RPVP-Real Dataset

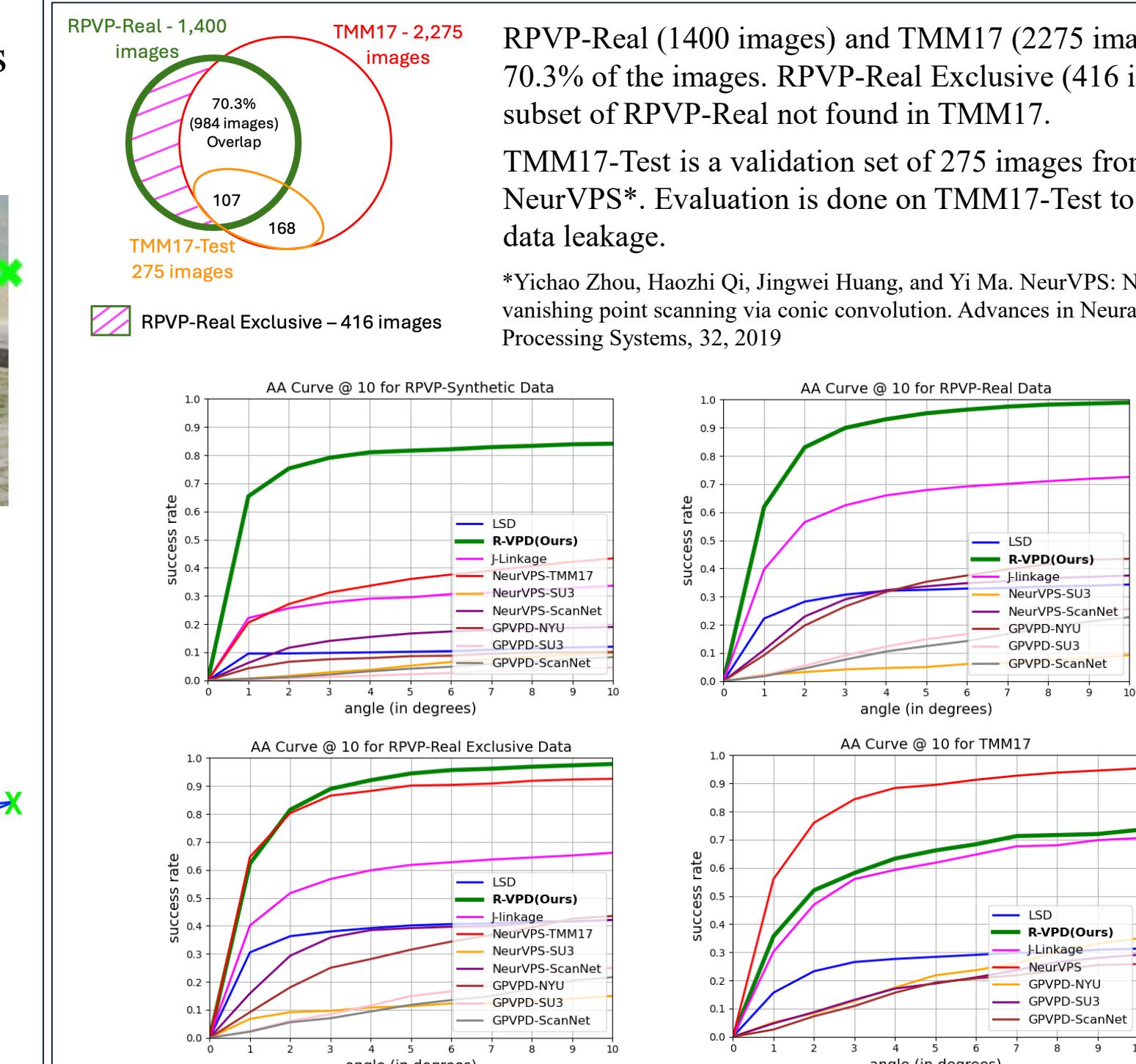
Qualitative Examples



R-VPD: An Overview

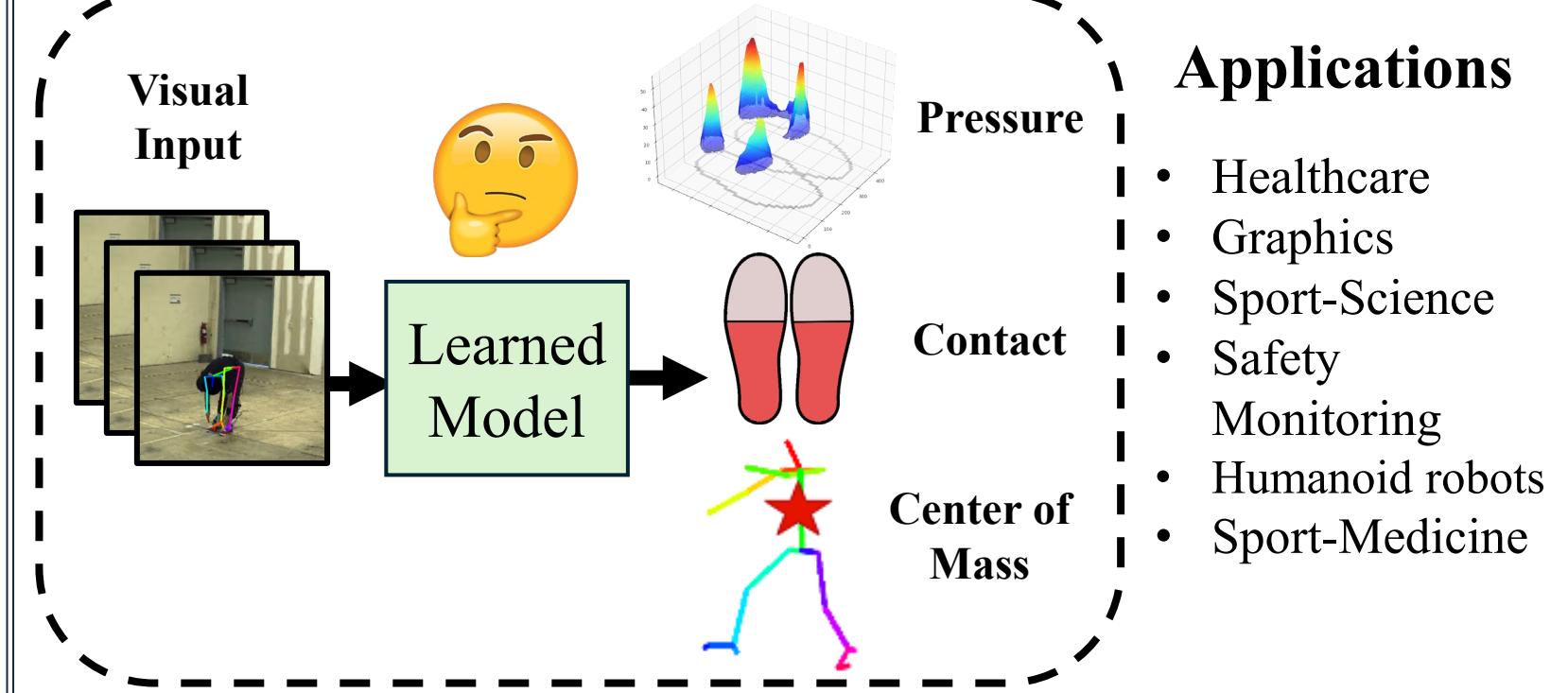


Evaluation



Vision To Dynamics

Abstract

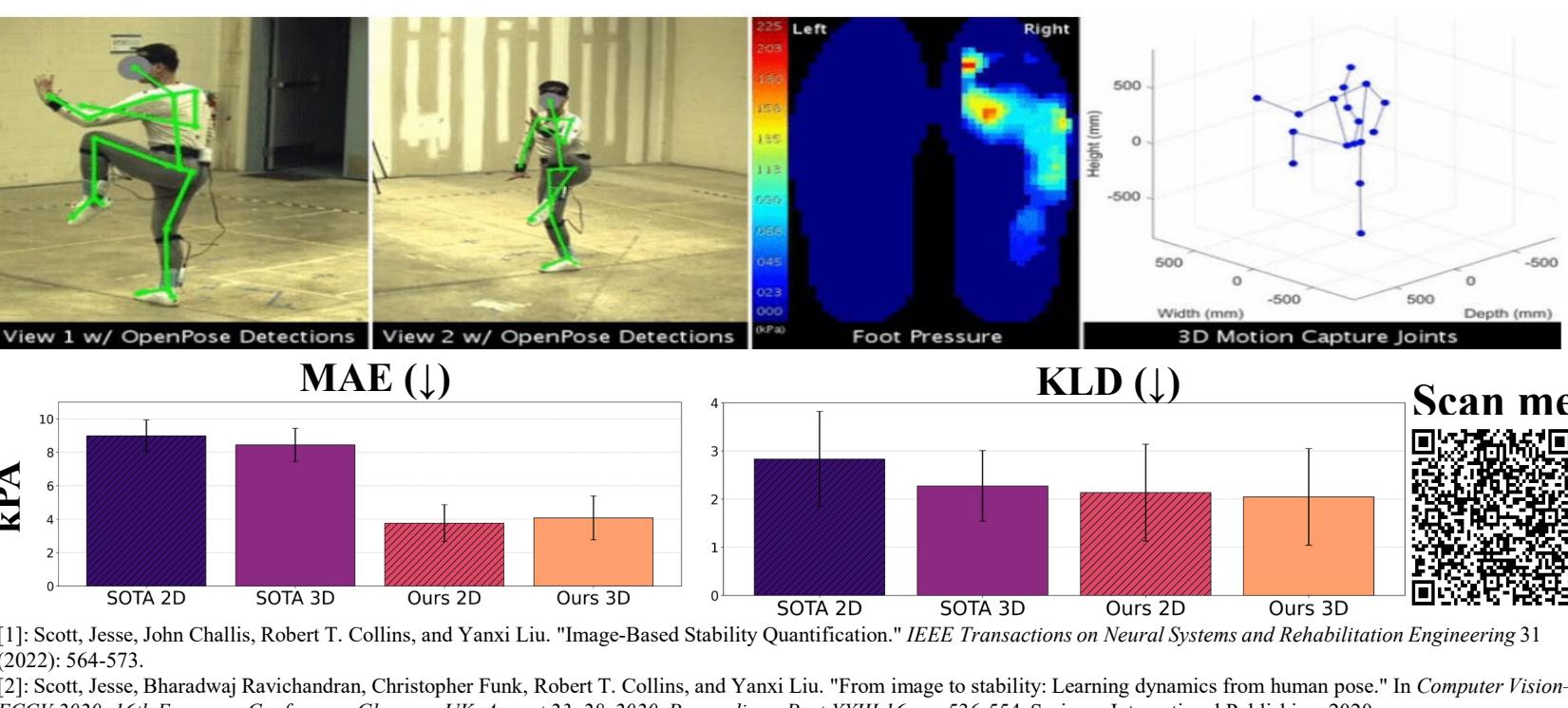


Applications

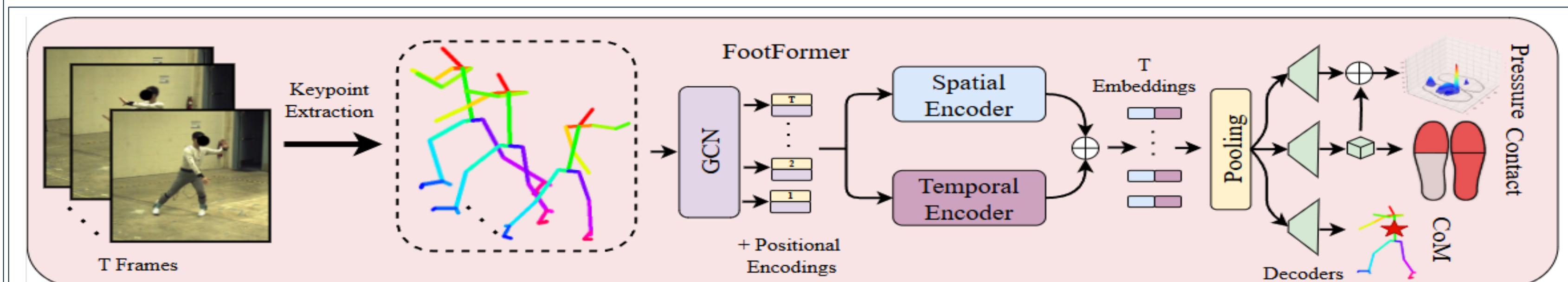
[1] Scott, Jesse, John Challis, Robert T. Collins, and Yanxi Liu. "Image-Based Stability Quantification." *IEEE Transactions on Neural Systems and Rehabilitation Engineering* 31 (2022): 564-573.

[2] Scott, Jesse, Bharadwaj Ravichandran, Christopher Funk, Robert T. Collins, and Yanxi Liu. "From image to stability: Learning dynamics from human pose." In *Computer Vision-ECCV 2020: 16th European Conference, Glasgow, UK, August 23–28, 2020, Proceedings, Part XIII* 16, pp. 536-554. Springer International Publishing, 2020.

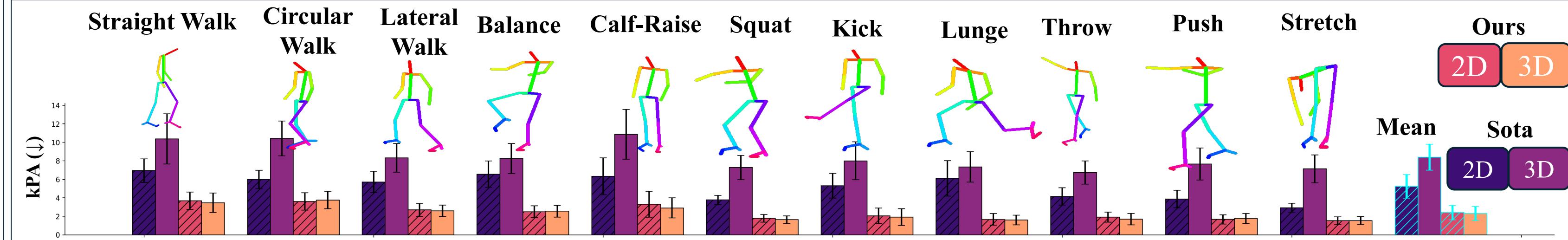
PSUTMM-100



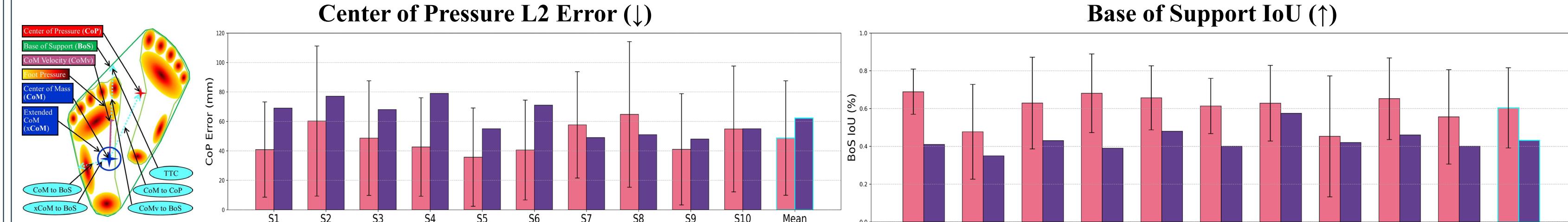
Network



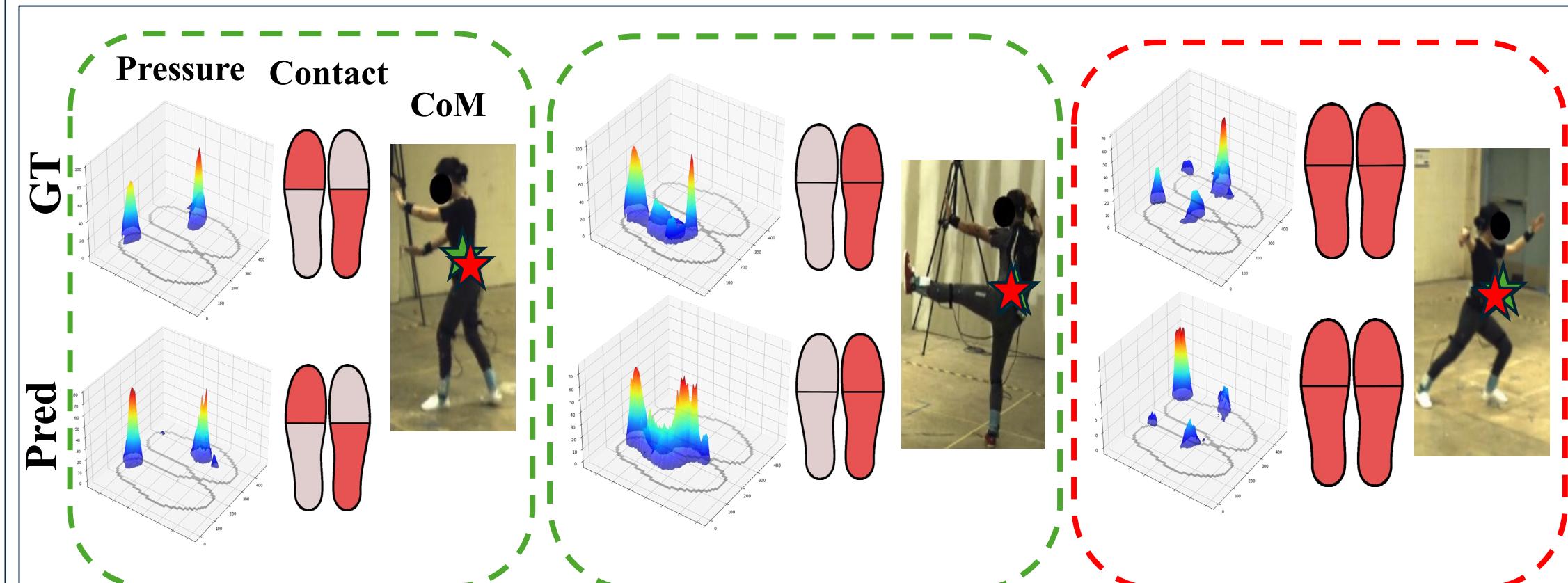
Generalizing on Unseen Ordinary Movements



Vision to Stability



Qualitative Examples



Conclusion

- This work pushes the current SOTA on estimating human dynamics from vision
- Given 2D estimated pose, we regress foot pressure distribution, foot contact labels, and center of mass
- Given model predictions we estimate center of pressure and base of support
- We intend to further this direction by directly estimating stability from visual input in future work.

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Conclusion

We have proposed an alternative unsupervised vanishing point detection algorithm, R-VPD, that uses feature correspondences in recurring patterns (RP) to form implicit lines for VPD. We contribute two RP-based vanishing point datasets: RPVP-Synthetic has 3200 synthetic images with VPs and camera parameters, and RPVP-Real has 1400 real-world images with vanishing point annotations.

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