

Evaluation of sprinter gestures with RGB videos

Qi Gan^{1,4}, Stéphan Clémonçon^{1,4}, Eric Fenaux^{1,4}, Sao Mai Nguyen^{2,4},
Mounim A. El Yacoubi^{3,4}, Ons Jelassi^{1,4}

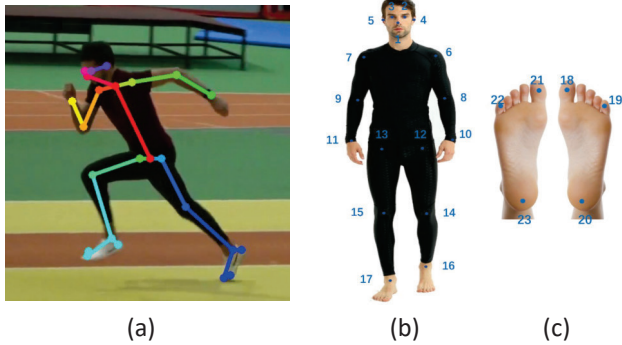
¹Télécom Paris, ²ENSTA Paris, ³Télécom SudParis, ⁴Institut Polytechnique de Paris

Project goals

1. Developing an algorithm to better estimate sprinter's pose during running
2. Extracting parameters of the sprinter in one run based on estimated pose
3. Exploring the relationship between the parameters and the performance of sprinters

Notice: This project started on April 2022, so all the results here are mainly from open-source codes [1-3]

Human skeleton model



Examples of Coco whole body skeleton model. (a) Detection with OpenPose[1] on our athlete's video, (b) & (c) Annotation of the key points [4]

Possible solutions

1. Utilize prior knowledge as constraints [5]
 2. Take temporal consecutive frames as inputs [6]
 3. Utilize visual cues to help infer depth [7]
 4. Train with un-/weakly-supervised learning [8]
- Despite many works have been proposed, more robust and customized algorithms are still necessary

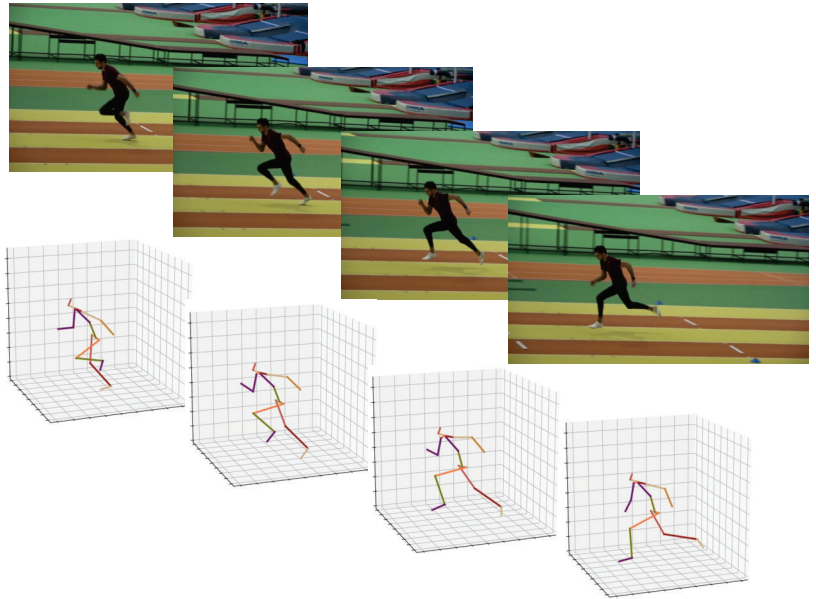
References

- [1] Cao, Zhe, et al. "Realtime multi-person 2d pose estimation using part affinity fields." *Proceedings of the IEEE conference on computer vision and pattern recognition*. 2017.
- [2] Liu, Junfa, et al. "A graph attention spatio-temporal convolutional network for 3D human pose estimation in video." *2021 IEEE International Conference on Robotics and Automation (ICRA)*. IEEE, 2021.
- [3] Li, Wenhao, et al. "Mhformer: Multi-hypothesis transformer for 3d human pose estimation." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2022.
- [4] Jin, Sheng, et al. "Whole-body human pose estimation in the wild." *European Conference on Computer Vision*. Springer, Cham, 2020.
- [5] Sun, Xiao, et al. "Compositional human pose regression." *Proceedings of the IEEE International Conference on Computer Vision*. 2017.
- [6] Pavllo, Dario, et al. "3d human pose estimation in video with temporal convolutions and semi-supervised training." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2019.
- [7] Pavlakos, Georgios, Xiaowei Zhou, and Kostas Daniilidis. "Ordinal depth supervision for 3d human pose estimation." *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. 2018.
- [8] Chen, Ching-Hang, et al. "Unsupervised 3d pose estimation with geometric self-supervision." *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition*. 2019.

Requirements

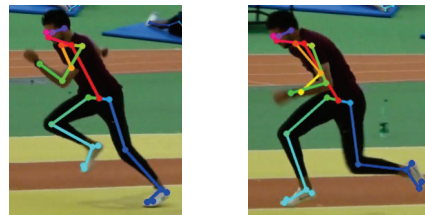
Expected scenario of the projects (Results below based on OpenPose[1] + GastNet[2]):

- Hand-held moving camera;
- Single-camera (monocular) RGB videos;
- To recover 3D human pose.

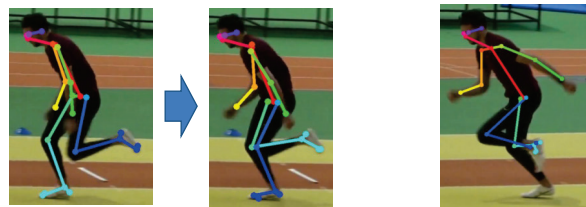


Challenges

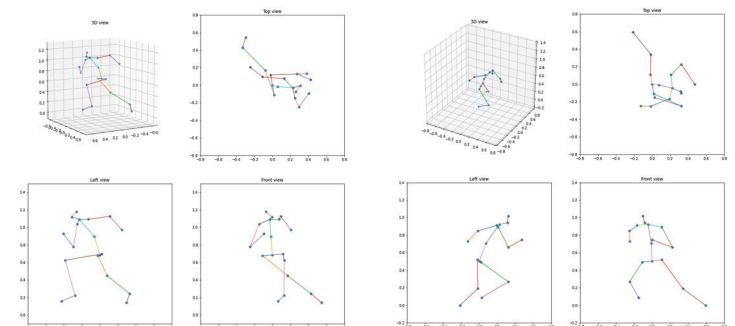
1. Occlusion issue (OpenPose[1])



2. Swaps or detection errors (OpenPose[1])



3. Depth ambiguity (left: OpenPose[1]+GastNet[2], right: MHFormer[3])



4. Gaps between datasets