

3D physics simulators can measure physical plausibility of 3D human poses.

Measuring Physical Plausibility of 3D Human Poses Using Physics Simulation

Introduction

- Human 3D poses can be used to understand actions, movements, and how humans interact with their environment.
- Kinematics-based metrics that evaluate absolute positions do not capture realism or plausibility of outputs
- Existing physics-based metrics do not measure stability during motion or over time

Objective

- Model the progression and temporal impact of physical implausibility
- Show agreement with previously proposed metrics
- Examine the quality of produced external contact forces

Proposal

- Measuring physical plausibility of 3D poses can be performed within physics simulators
- Physics simulators inherently supports friction, gravity, collisions

Proposed Metrics

- Center-of-mass Distance

$$CD = \frac{1}{T} \sum_t \|c_t^k - c_t\|_2$$

- Pose Stability Duration

$$PSD_T = \min(T - N, t_F)$$

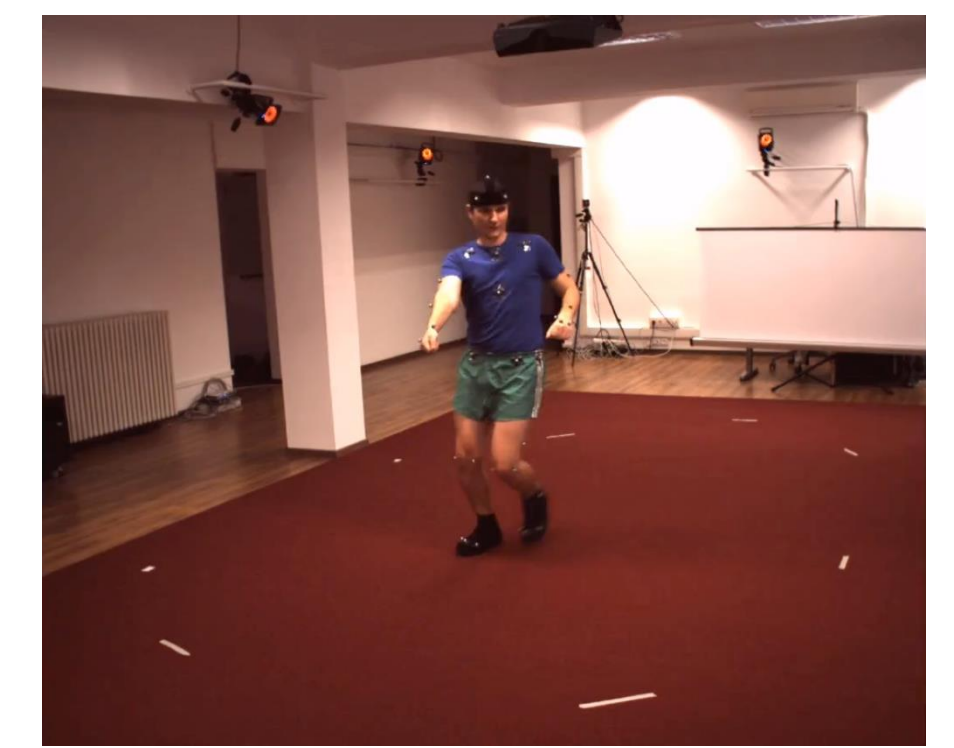
Conclusion

- Simulation based measures show consistency with other kinematics and physics-based metrics when determining physically plausible outputs
- Limitations:
 - Optimization falls into local minimums
 - Computationally expensive
 - Simulated bodies should reflect size and shape of detected humans

RESULTS

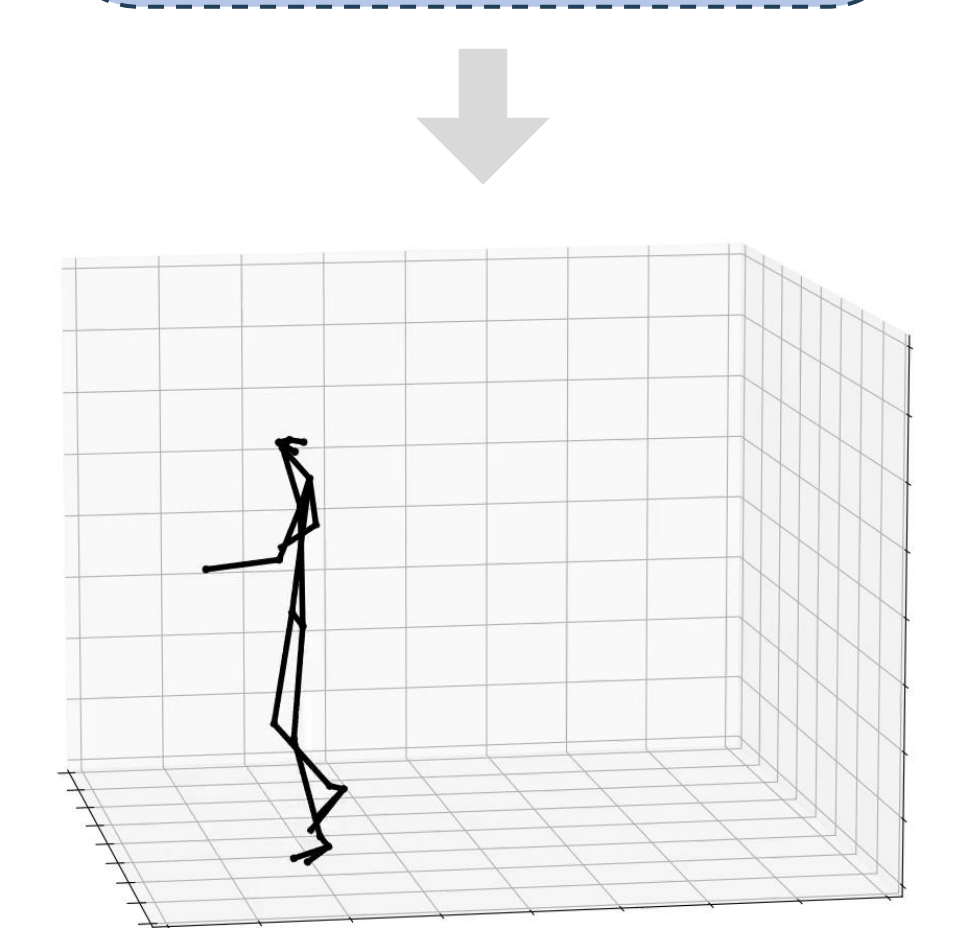
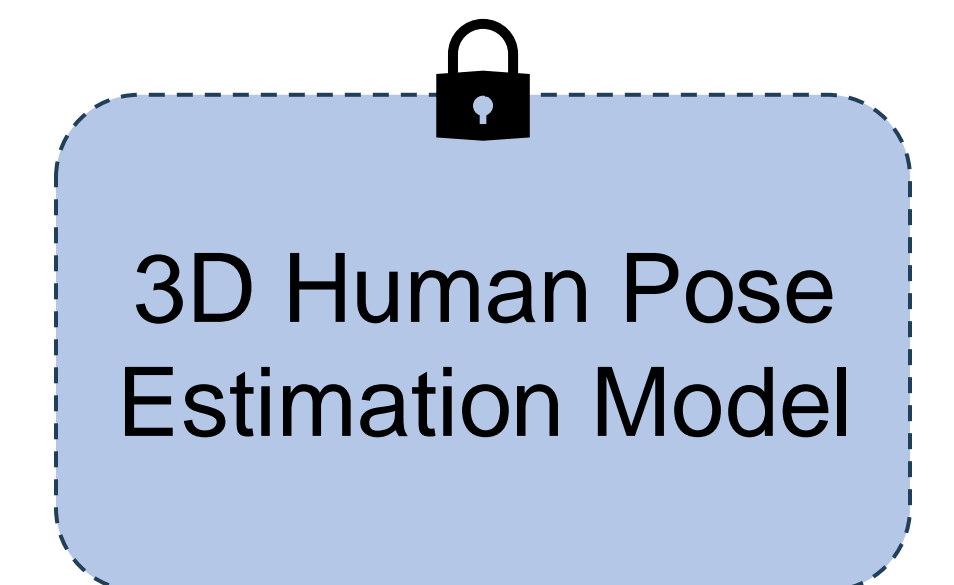
Method	FS (%) ↓	GP ↓	CD (Ours) ↓	PSD ₁₀₀ (Ours) ↑
NeuralPhysCap (Shimada <i>et al.</i>)	29.7	2.62	29.6	62.3
PoseFormer (Zheng <i>et al.</i>)	4.4	0.30	36.2	64.8
Triangulated 3D	2.6	0.26	27.3	70.6

Method	Dir.	Disc.	Greet	Photo	Pose	Purch.	Wait	WalkD.	WalkT.	Walk	Avg.
NeuralPhysCap (Shimada <i>et al.</i>)	86.5	82.3	73.1	89.6	62.7	35.8	70.4	52.1	26.2	44.3	62.3
PoseFormer (Zheng <i>et al.</i>)	69.8	77.8	81.0	82.8	80.5	13.3	42.2	55.8	66.1	78.3	64.8
Triangulated 3D	88.2	82.4	66.0	87.6	72.9	72.4	53.5	27.7	77.8	77.2	70.6

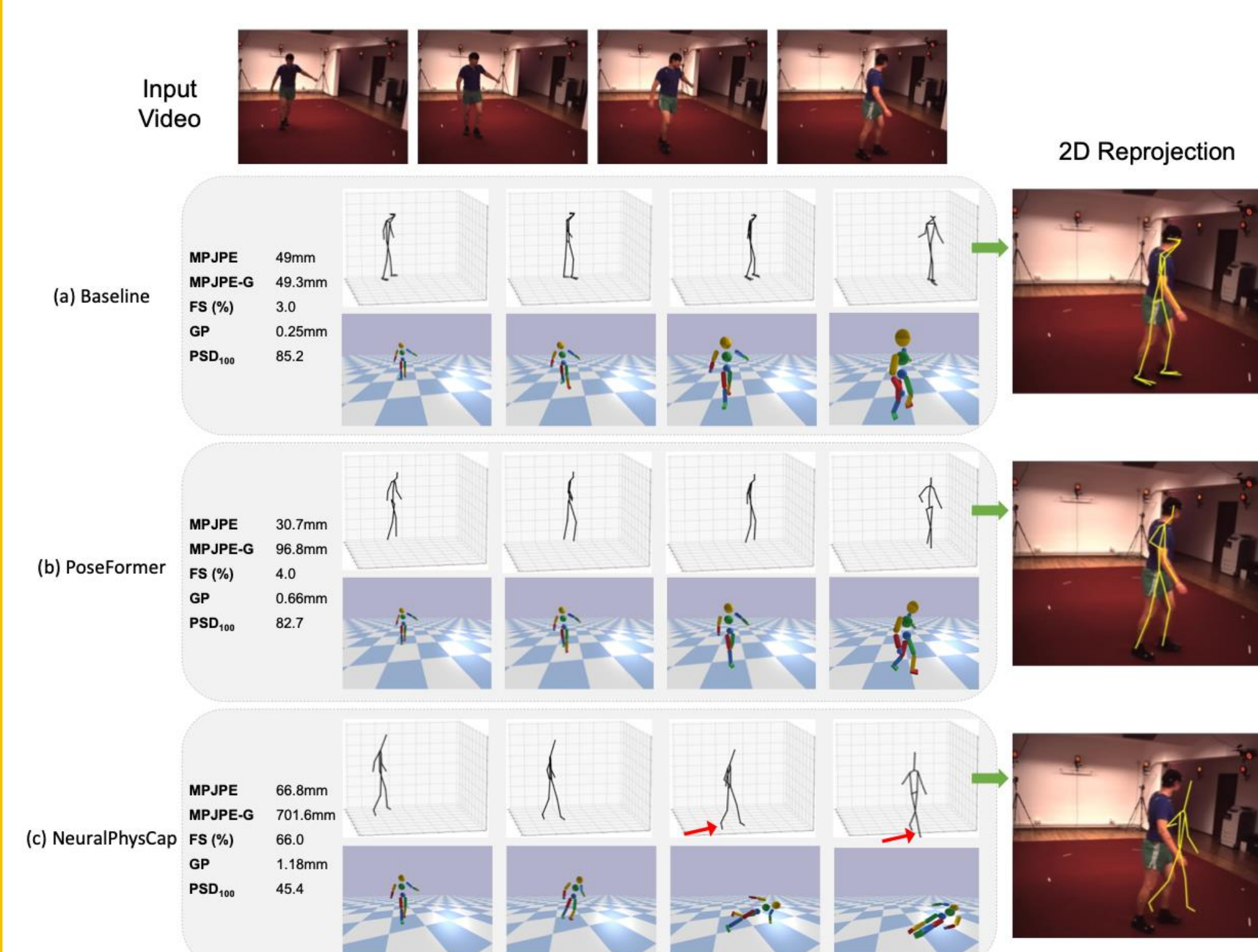
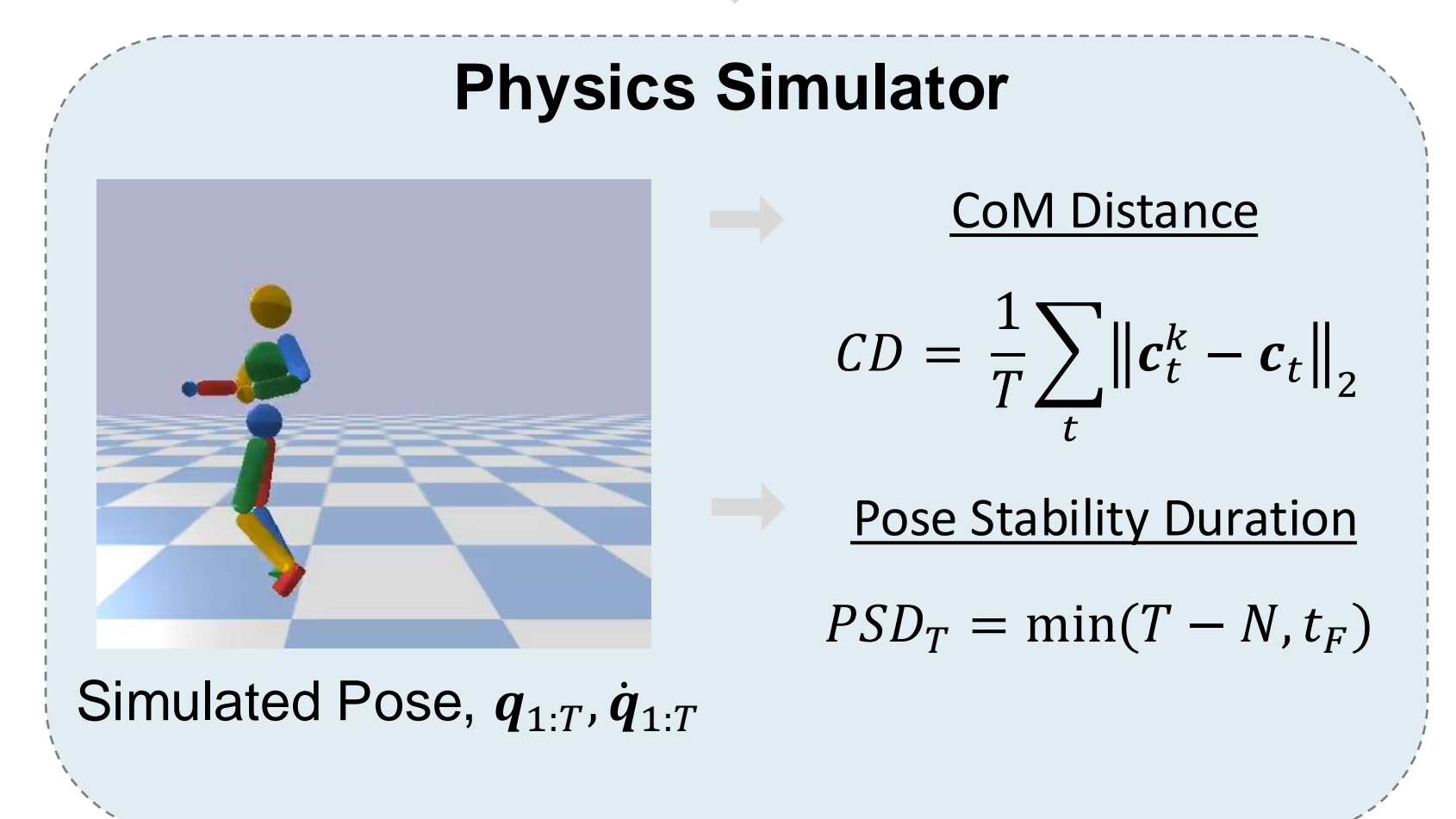


Input Video, v

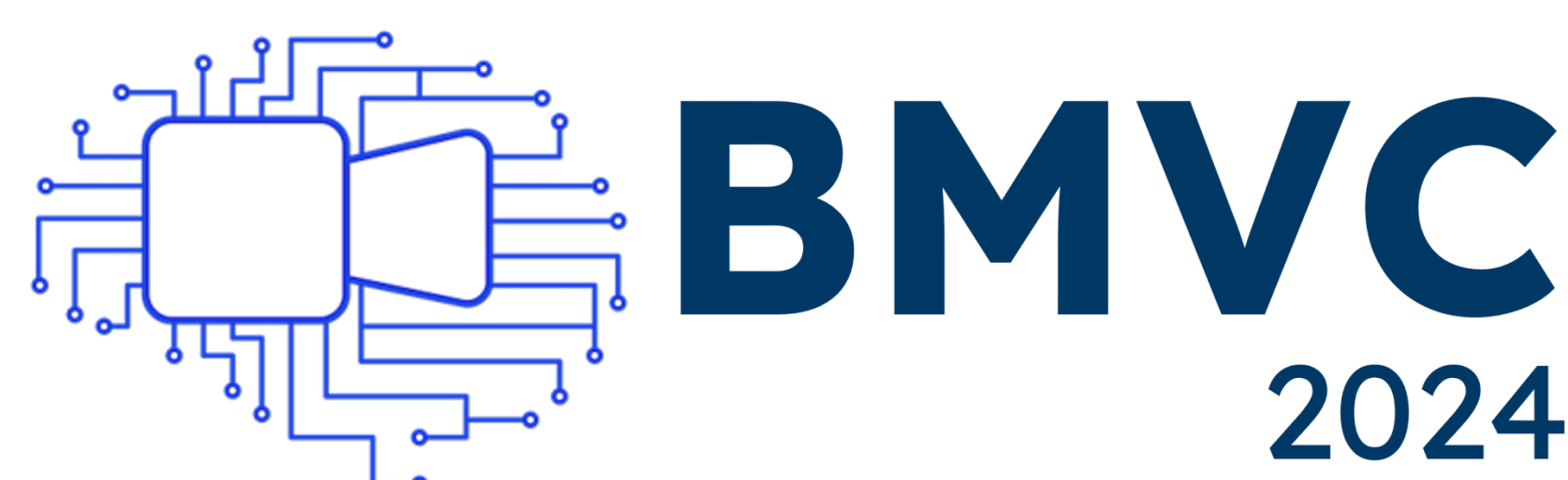
(frozen weights)



Predicted 3D Pose, X



• Nathan Louis, Mahzad Khoshlessan, Jason J. Corso



Take a picture to access our code

