

GAIT SILHOUETTE RECONSTRUCTION FOR WALKING ANGLE COMPENSATION

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Abstract

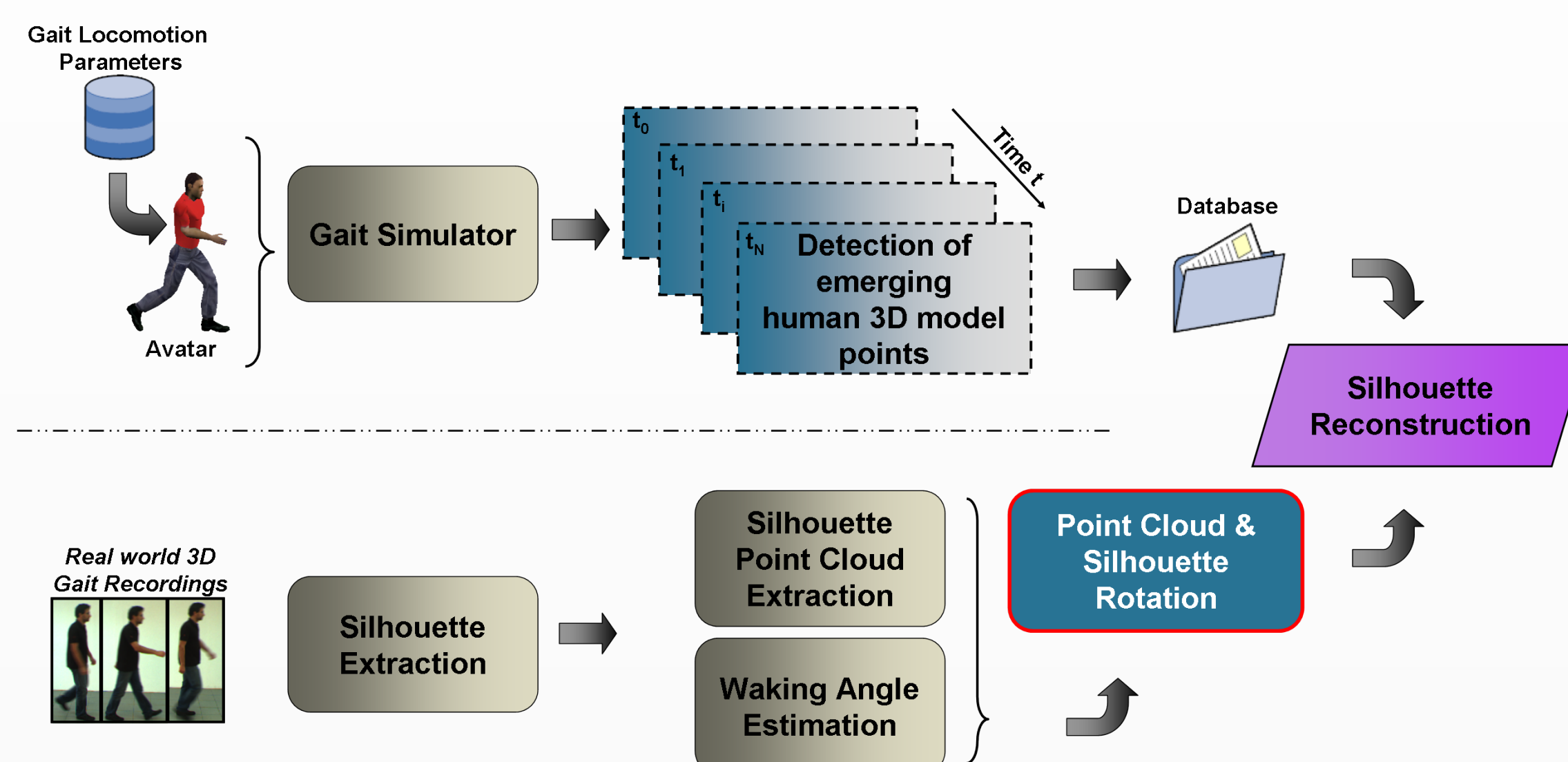
Gait analysis has long been in the focus of the research community, since it forms one of the most characteristic periodic activity patterns of human motion. Moreover, there is a wide spectrum of gait related applications ranging from biometrics for recognition purposes [2] to affective related sciences [1].

Provided that most of the current approaches are tested in controlled lab-environments, the present work aims at addressing realistic assumptions for the acquisition of the input gait sequence, since modern application scenarios and use-cases demand that the applied algorithms are invariant to several specific parameters, like the viewpoint and the special user accessories, e.g. bags. In this concept, the current work presents a novel approach for the synthesis of virtual views of real-world gait sequences, based on a holistic based approach for gait analysis (i.e. human silhouette analysis), by following the general principles of multi-viewpoint video and by using only one depth camera. The preliminary experimental results exhibit a significant improvement in the quality of the reconstructed silhouettes and their resemblance with ground truth data. Future work includes the utilization of the proposed method in a highly efficient single-view (i.e. one camera based-) gait recognition system of increased performance, that can be applied in especially difficult realistic situations.

System Architecture

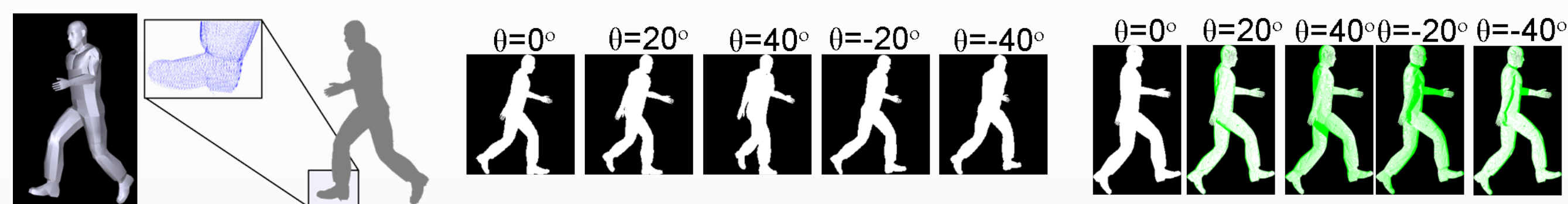
The proposed system consists of 2 parts:

- Pre-Processing, where a gait simulator is used to generate rotation data (top part)
- Run-time, where a captured gait sequence is rotated and reconstructed to canonical (side) view using the pre-processed data (bottom part)



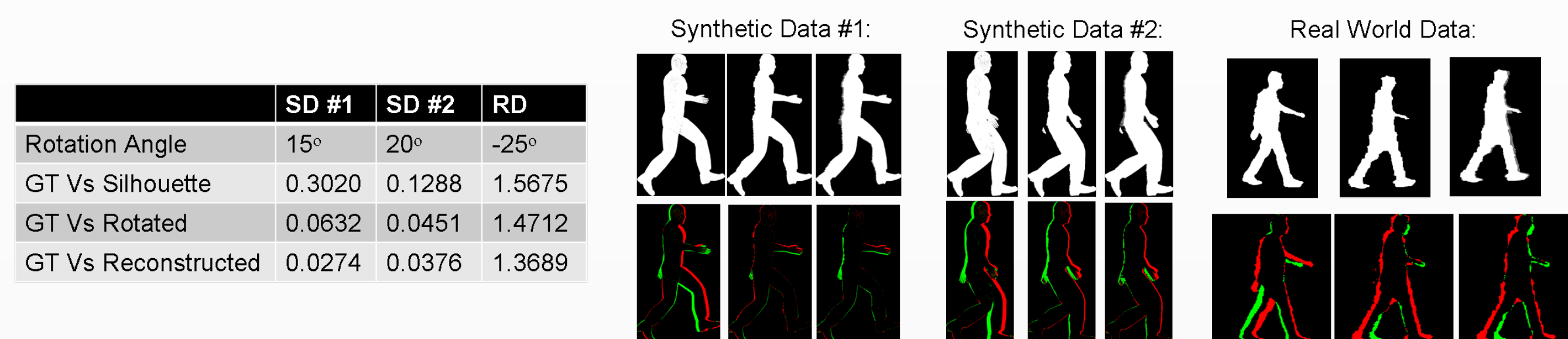
Pre-Processing

- 3D Model extraction from gait simulator and voxelization (left)
- Silhouette extraction for angles $\theta \in [0^\circ, 360^\circ)$ with 5° step (middle)
- Mapping of the points the emerge when the silhouette is rotated so that $\theta_{new} = 0$ (right)



Run-Time Preliminary Evaluation

- Preliminary results are presented for 2 synthetic silhouettes as well as 1 from real world data.
- Comparison of silhouettes using Radon Transform and image comparison
- Ground truth (GT) for the synthetic data is a silhouette extracted with $\theta = 0^\circ$
- For the Real World data, ground truth (GT) is considered the gait period with the minimum θ



References

- [1] D.Janssen, W.I.Schoellhorn, K.M.Newell, J.M.Jaeger, F.Rost, K.Vehof, "Diagnosing fatigue in gait patterns by support vector machines and self-organizing maps", in *Human Movement Science*, vol. 30, pp. 966–975, 2011.
- [2] J.Lu, G.Wang, P.Moulin, "Human Identity and Gender Recognition From Gait Sequences With Arbitrary Walking Directions", in *textit IEEE Trans.Inf. Forensics Security*, vol. 9, no. 1, pp. 51–61, 2014

Acknowledge

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