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A multiscale-contour-based interpolation framework for generating a time-varying quasi-dense point cloud sequence

Key words: Multi-view video, Free-viewpoint video, Point-pair, Multiscale-contour-based interpolation, Spatio-temporal-contour, Consistency, Time-varying point cloud sequence

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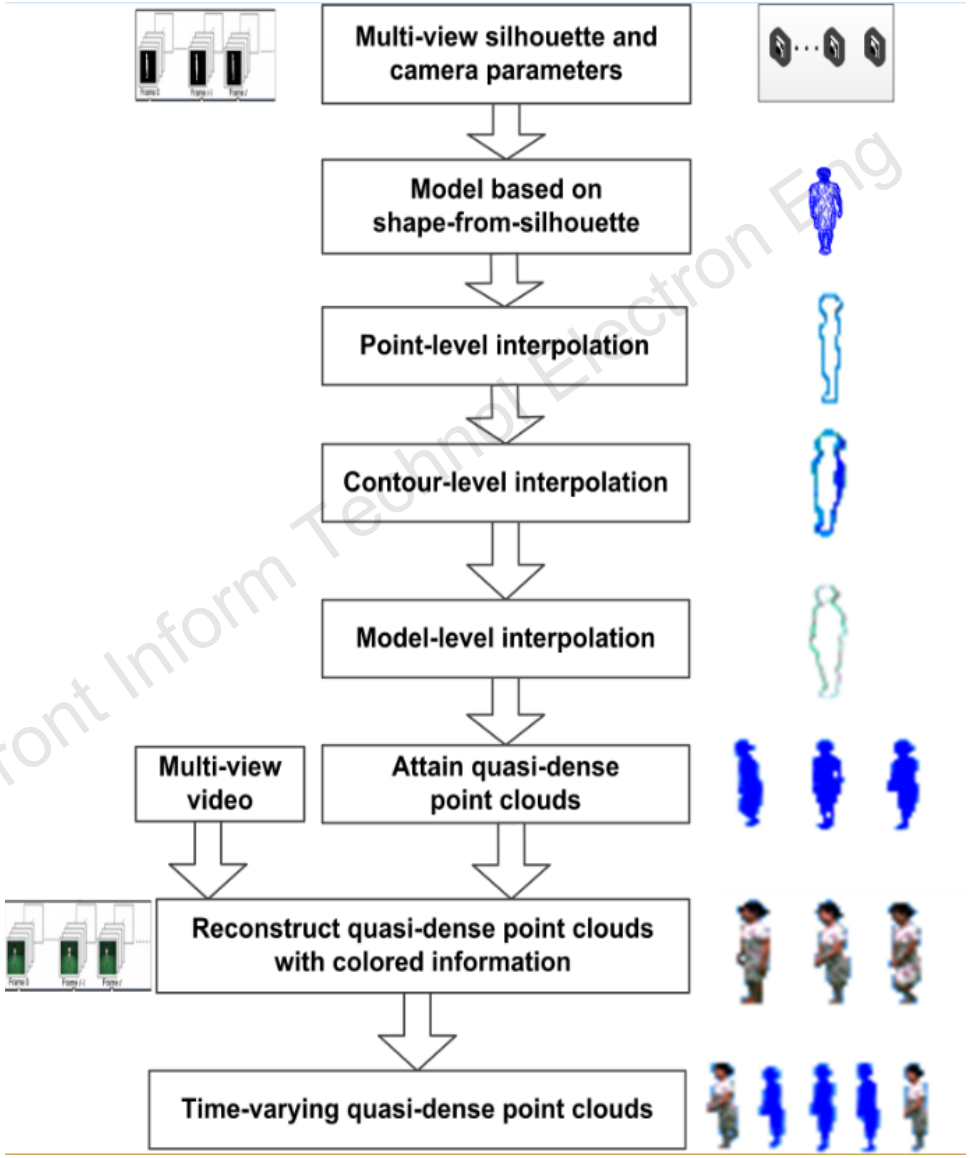
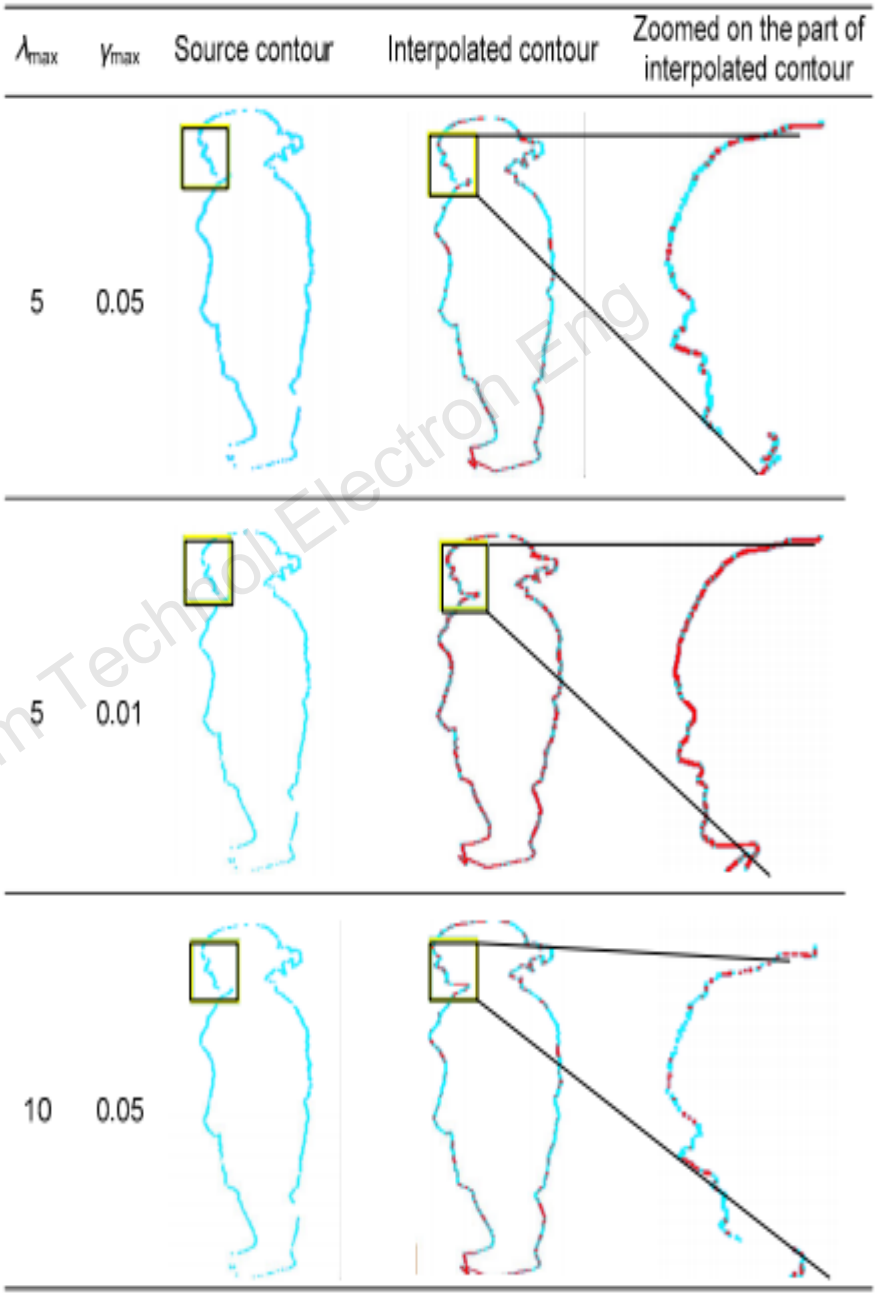
Introduction

- The reconstruction of 3D dynamic scenes is a key technology to obtain FVV. we propose an efficient framework to reconstruct 3D dynamic objects using a multiscale-contour-based interpolation from MVVs.
- The framework focuses on obtaining a higher frame rate point cloud sequence to generate FVV.
- Improving efficiency by using a multiscale-contour-based framework: We have integrated multiscale spatio-temporal-contour consistency into a framework in three stages: interpolating single contours, interpolating two spatial contours which belong to the same model, and interpolating two spatial contours which belong to different neighboring models.

Block diagram of the proposed shape tracking system



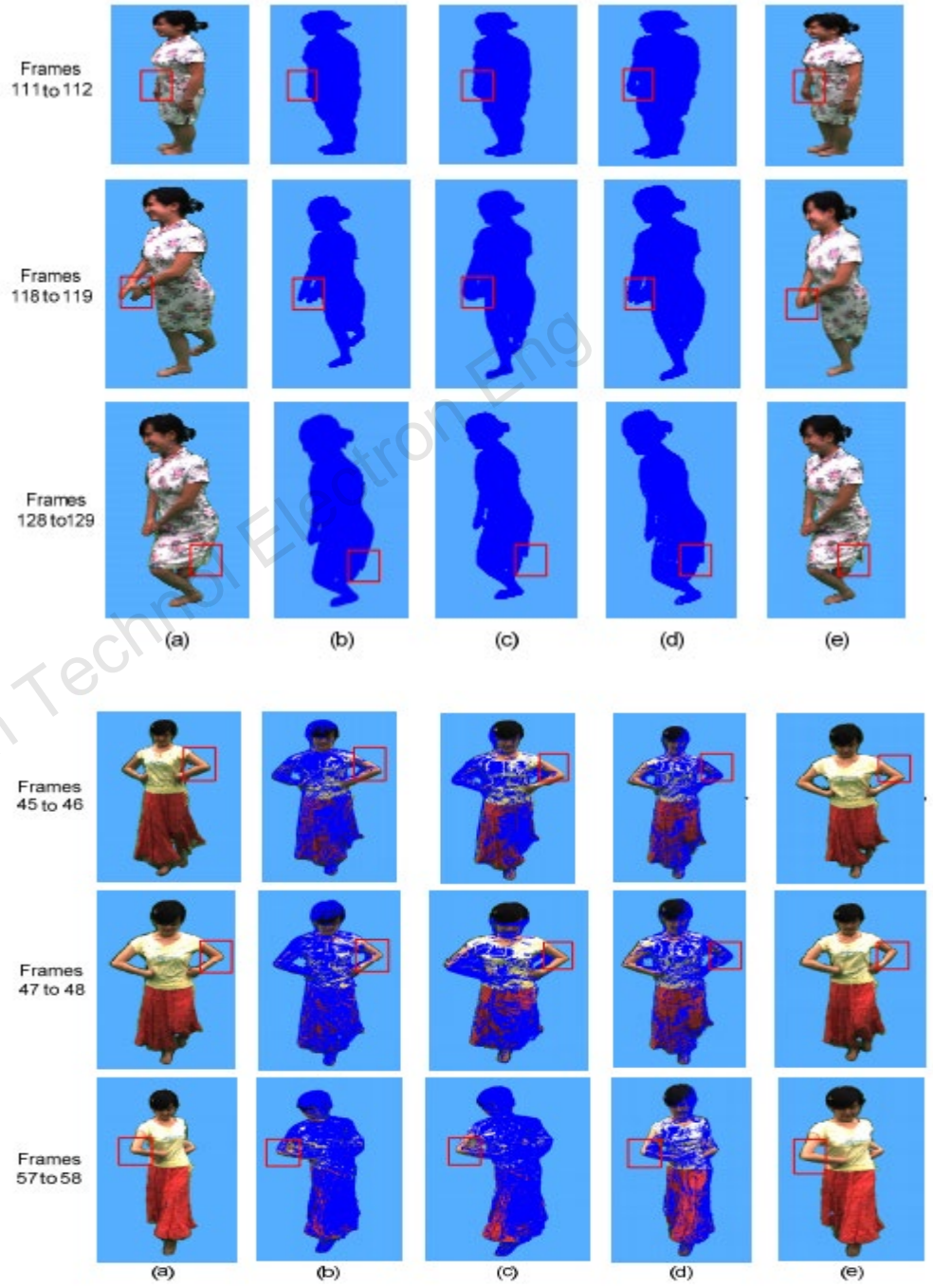
Point-level interpolation



Contour-level interpolation

Dataset	λ_{max}	γ_{max}	Sparse point cloud	Quasi-dense point cloud	Color quasi-dense point cloud
Lady Dance	5	0.05			
	5	0.01			
	10	0.05			
Redshirt	5	0.05			
	5	0.01			
	10	0.05			
Cheongsam	5	0.05			
	5	0.01			
	10	0.05			

Model-level interpolation



Performance comparison

Table 3 Average reconstruction time per frame between neighboring frames using different methods

Method	Reconstruction time (s)		
	Frames 111 to 112	Frames 118 to 119	Frames 128 to 129
Liu *et al.* (2010)	140.32	138.61	141.94
Bilir and Yemez (2012)	67.45	66.43	71.45
Allain *et al.* (2015)	80.73	78.72	82.75
Our method	59.26	47.69	49.19

Table 4 Average reconstruction time per frame through the sequence

Dataset	Method	Time (s)
Cheongsam	Liu *et al.* (2010)	142.68
	Bilir and Yemez (2012)	67.45
	Allain *et al.* (2015)	80.85
	Our method	52.59
Redskirt	Liu *et al.* (2010)	145.45
	Bilir and Yemez (2012)	68.45
	Allain *et al.* (2015)	80.78
	Our method	56.54

Conclusions

- We have proposed an interpolation framework to construct the shape of an object. The interpolation is performed within a frame, between neighboring frames temporally, and between neighboring frames.
- We have obtained a higher frame rate, spatio-temporal-coherence, and quasi-dense point cloud sequence with color information.
- Speeding up reconstruction by using the multiscale-contour-based framework. According to the different levels of the contour consistency, we integrated the multiscale spatio-temporal-contour consistency into a framework and made good use of these consistencies to reduce the reconstruction time.