Accurate Background Subtraction Using Dynamic Object Presence Probability in Sports Scenes

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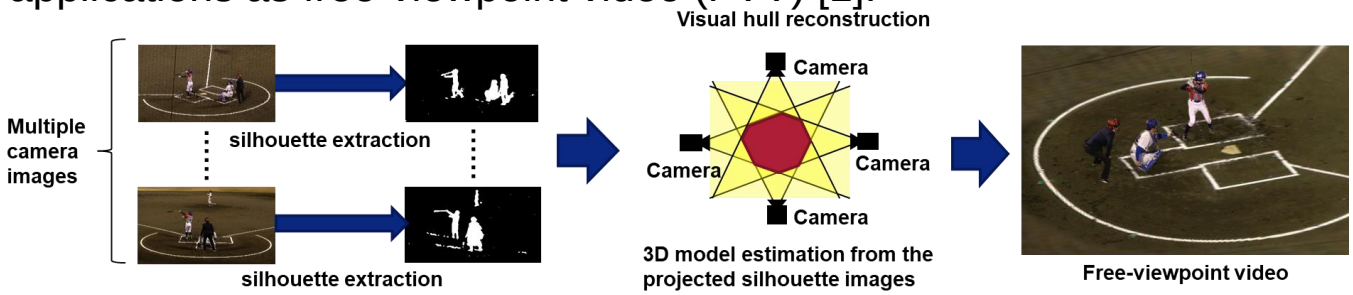
1. Introduction

■ Silhouette extraction technologies play an essential role in such applications as free-viewpoint video (FVV) [1].



■ Issues to be improved in conventional approaches:

1) Background subtraction [2-5]

Difficult to correctly extract under complicated lighting situations

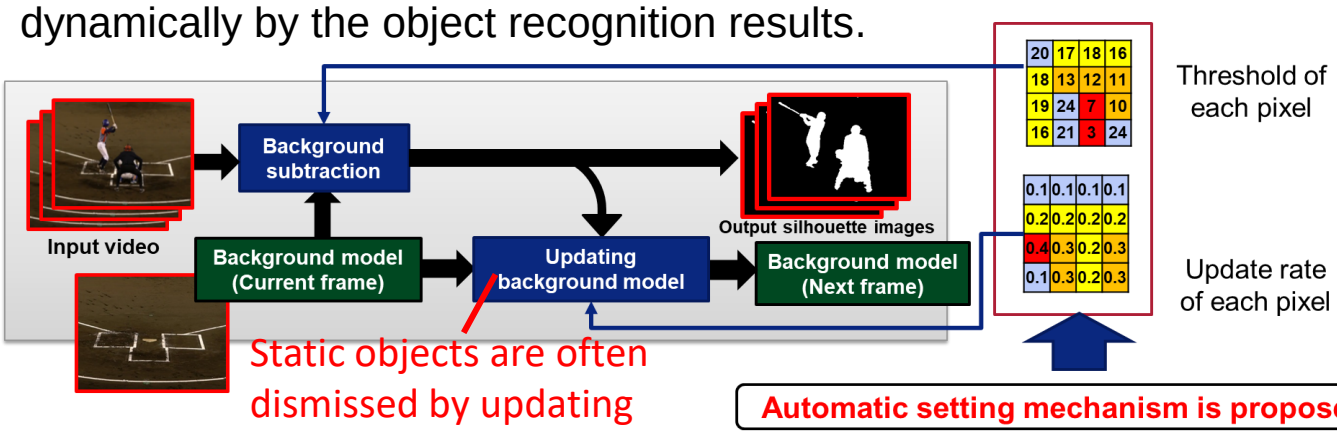
2) Deep-learning based segmentation [6]

Recognition errors and unclear silhouette outlines

We propose an accurate silhouette extraction method called Dynamic Object Presence Probability (DOPP).

2. Proposed Method

■ Threshold and update rate of silhouette extraction are changed dynamically by the object recognition results.

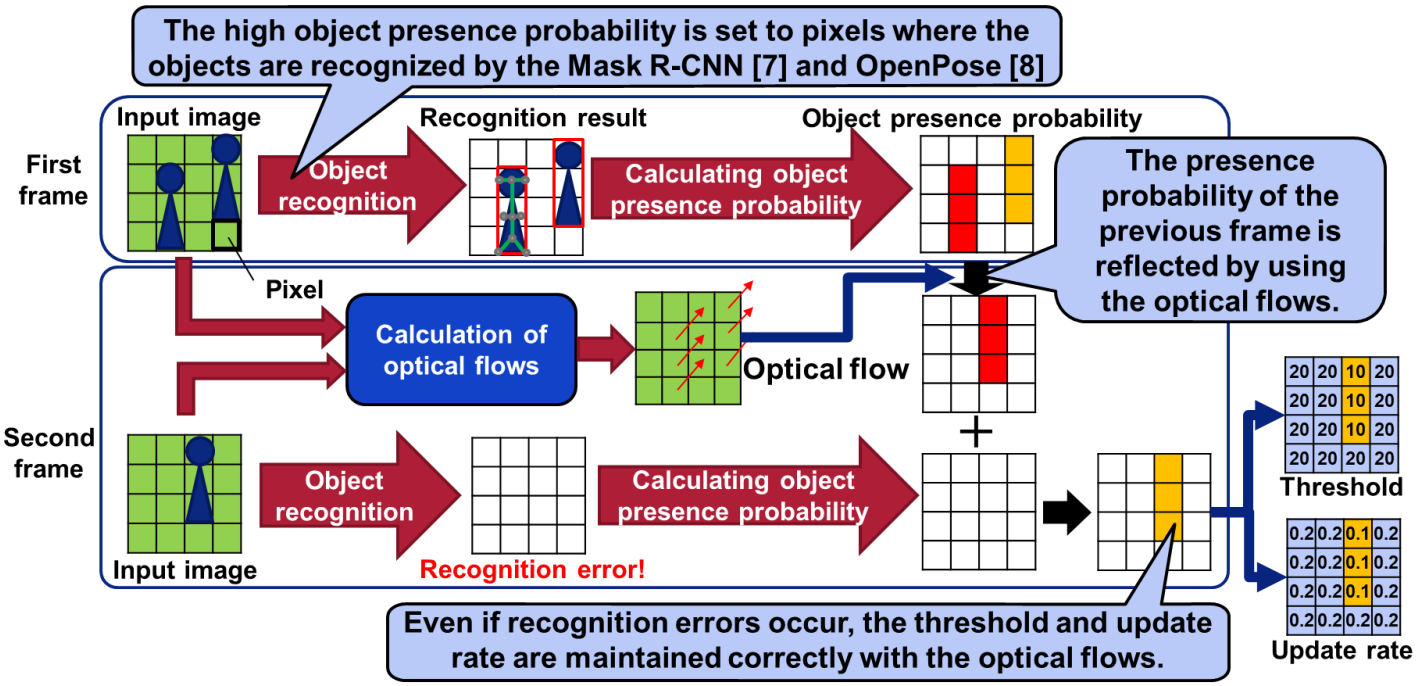


Automatic setting mechanism is proposed.

When objects are recognized…

Setting low threshold	→	The pixels are easily determined as a foreground.
Setting low update rate	→	Silhouettes of static objects are maintained.

■ Calculation process of the proposed method

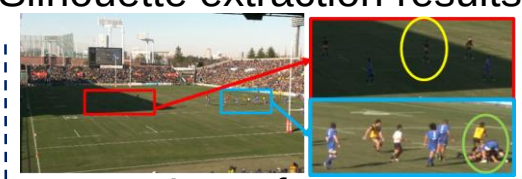


3. Experimental results

■ Conditions

- We evaluated three sports sequences (Baseball, Rugby and Badminton).

【Silhouette extraction results】



Input frame

DOPP (Proposed)

KNN

Mask R-CNN

■ Results

【Quantitative results using F-Measure】

Method	Baseball	Rugby	Badminton
DOPP (Proposed)	**0.957**	**0.887**	**0.943**
GMM[2]	0.539	0.513	0.601
KNN[3]	0.770	0.785	0.666
PBAS[4]	0.874	0.664	0.703
SubSENSE [5]	0.917	0.681	0.887
Mask R-CNN[6]	0.889	0.780	0.846

Proposed method achieved the best quality!

References

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