



# No Bells, Just Whistles: Sports Field Registration by Leveraging Geometric Properties

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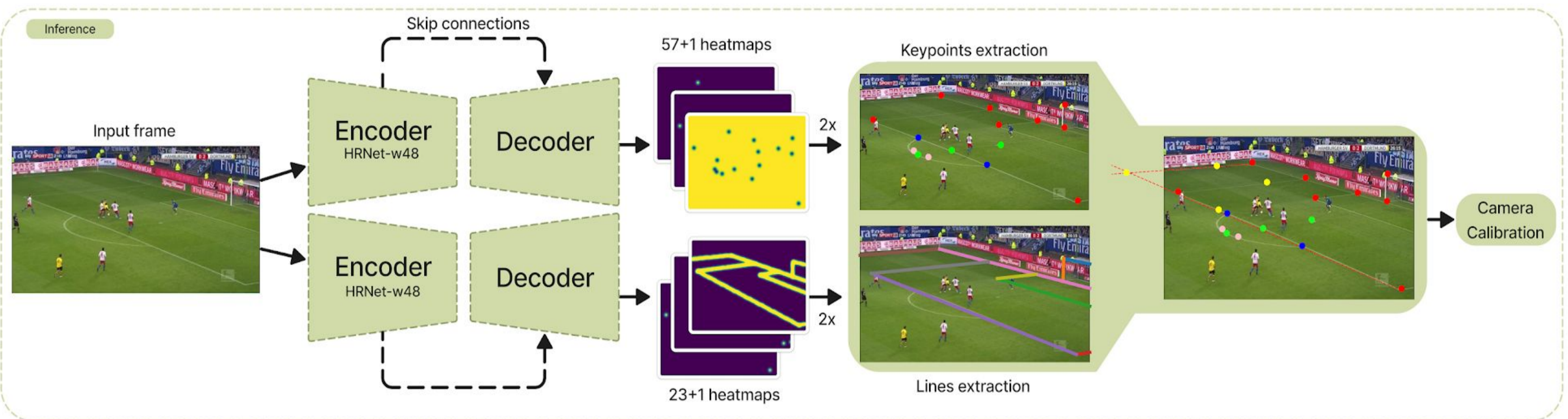
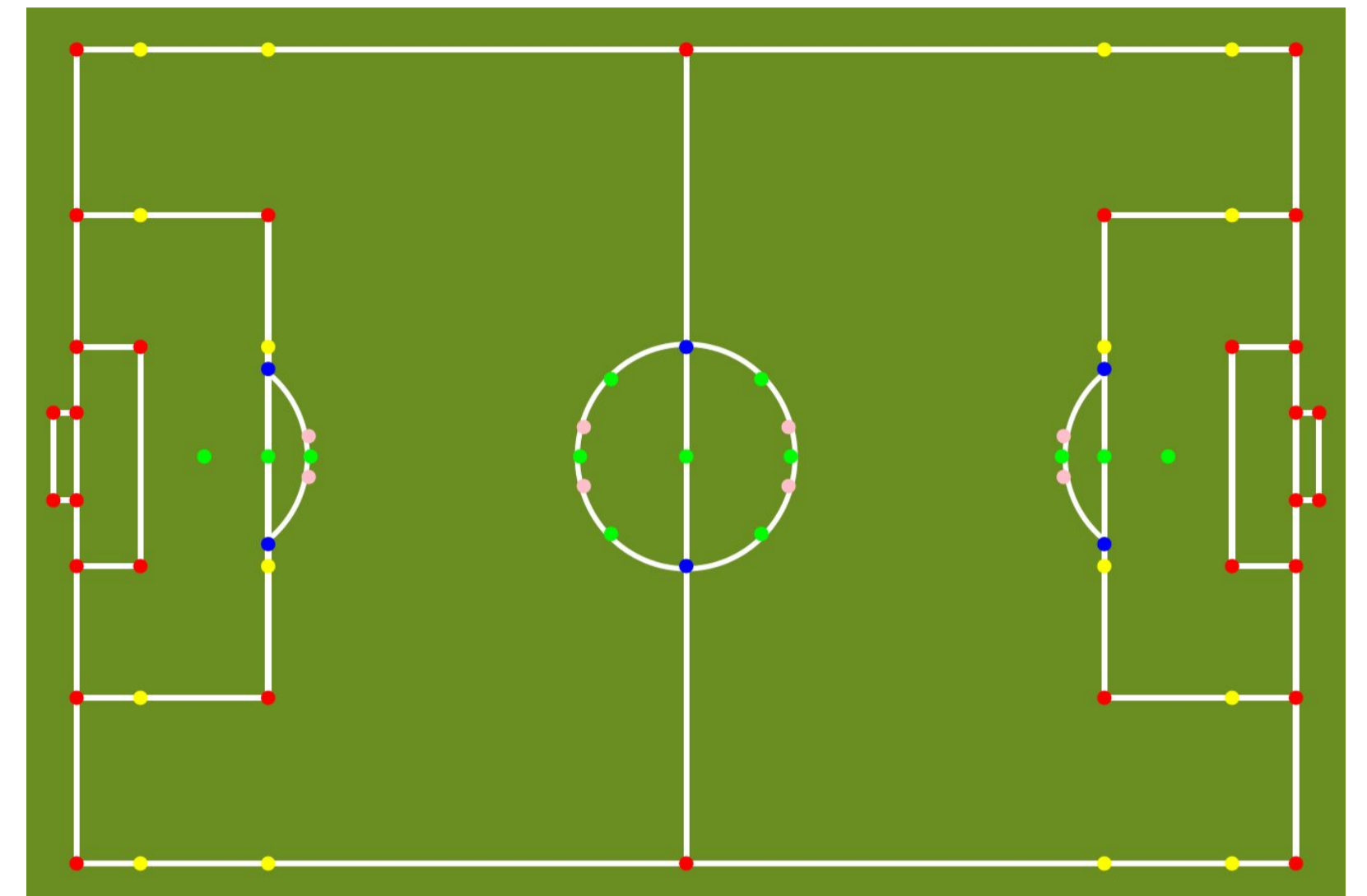
**Goal:** Estimating a projective transformation, which maps a 3D field template to a real-world field image captured from an arbitrary camera viewpoint.

## Contributions

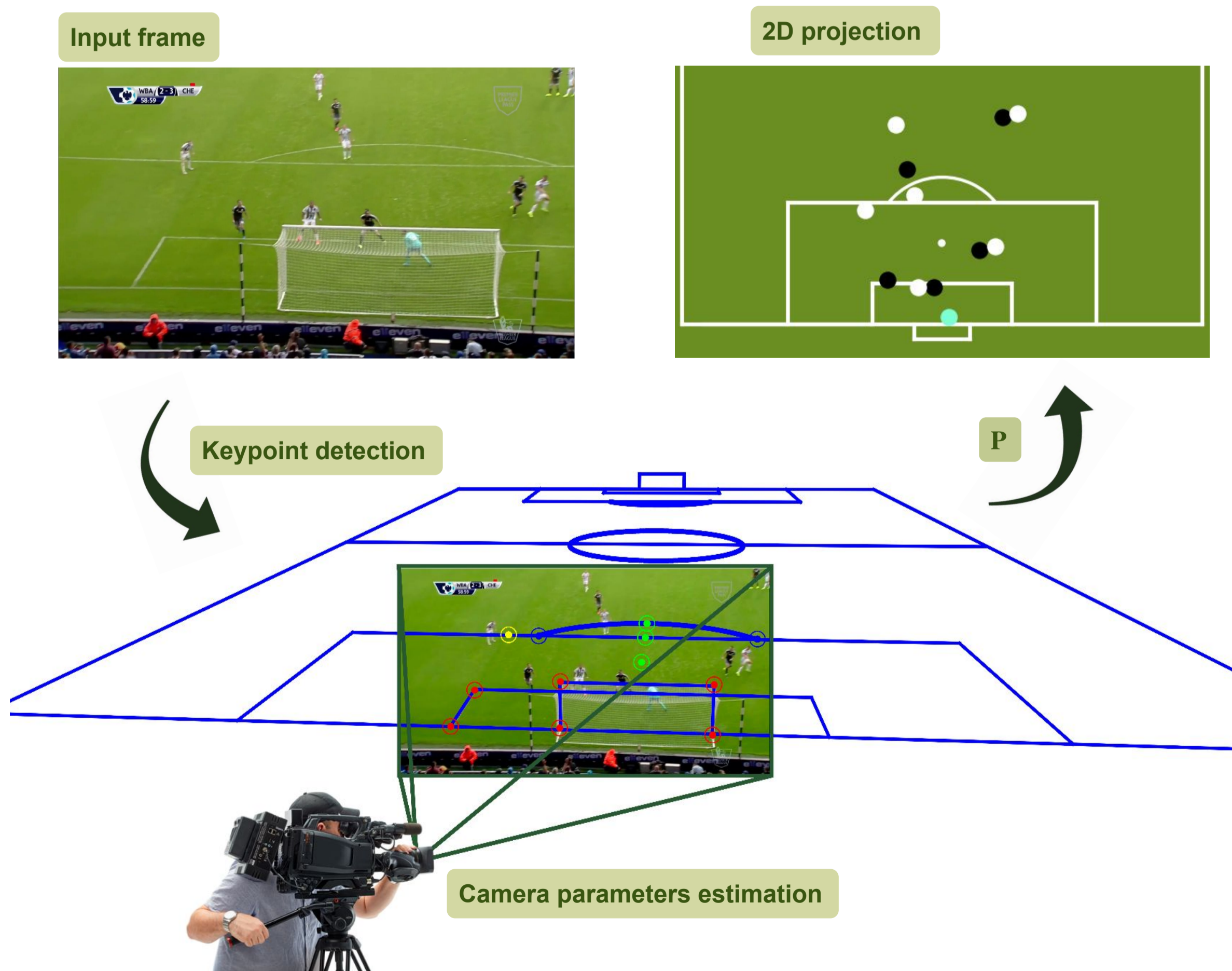
- Geometry-based keypoints grid and retrieval pipeline
- Calibration pipeline for 3D camera calibration extending to multiple views from the TV broadcast
- Pipeline structure focused solely on 2D-3D correspondences

## Proposed grid

- Line-Line intersections ( $K_p$ )
- Extended Line-Line intersections ( $K_{pe}$ )
- Line-Ellipse intersection ( $K_{p1}$ )
- Ellipse tangent points ( $K_{p2}$ )
- Additional points ( $K_{p3}$ )



## Qualitative Results



## 3D Calibration

Dataset	Approach	Acc@t [%]				
		5	10	20	CR	FS
SN23-test	Ours <sub>MV</sub>	73.7	86.7	90.4	77.5	57.1
SN22-test -center	[6] + HDecomp	34.4	64.6	81.3	66.6	22.9
	TVCalib ( $\tau$ ) [31]	57.6	81.7	93.2	93.7	53.9
	TVCalib [31]	54.8	78.5	90.4	100.0	54.8
	Ours <sub>SV</sub>	75.3	89.4	91.1	97.8	73.7

## Ablation Study

$K_{pe}$	$K_{p1}$	$K_{p2}$	$K_{p3}$	Acc@t [%]				
				5	10	20	CR	FS
X	X	X	X	66.8	73.9	91.9	85.9	57.4
✓	X	X	X	66.9	86.0	91.9	85.9	57.5
✓	✓	X	X	74.6	89.1	92.1	91.8	68.6
✓	✓	✓	X	73.8	87.8	91.1	96.5	71.3
✓	✓	✓	✓	75.3	89.4	91.1	97.8	73.7

## 2D Calibration

Dataset	Approach	IoU <sub>part</sub> ↑ (%)		IoU <sub>whole</sub> ↑ (%)		Proj. ↓ (m)		Reproj. ↓	
		Mean	Median	Mean	Median	Mean	Median	Mean	Median
WC14-test	Shi <i>et al.</i> [29]	96.6	97.8	93.1	94.8	-	-	-	-
	Maglo <i>et al.</i> [23]	96.3	97.4	92.0	94.1	0.74	0.55	0.018	0.014
	Oo <i>et al.</i> [26]	96.9	97.9	92.9	94.6	0.65	0.46	0.016	0.012
	Ours <sub>SV</sub>	96.2	97.8	92.2	94.3	0.68	0.46	0.016	0.011
TSWC-test	Chu <i>et al.</i> [7] <sup>‡</sup>	98.1	98.2	94.8	95.4	0.36	0.33	0.009	0.008
	Maglo <i>et al.</i> [23] <sup>‡</sup>	98.3	98.5	95.7	96.2	0.26	0.23	0.008	0.006
	Oo <i>et al.</i> [26] <sup>‡</sup>	98.5	98.7	95.8	96.7	0.26	0.21	0.007	0.006
	Ours <sub>SV</sub> <sup>‡</sup>	98.6	98.8	96.3	96.8	0.23	0.20	0.005	0.005



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**Research Plan defense:** September 2023



## Funding

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## Publications

[1] M Gutiérrez-Pérez and A Agudo (2024). **No Bells, Just Whistles: Sports Field Registration by Leveraging Geometric Properties**. In: Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops (CVPRW), 10th International Workshop on Computer Vision in Sports (CVsports) at CVPR 2024.