ACCURATE AND ROBUST MEASURING OF BALL SPIN

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Registration and Video Analysis

Abstract

We present a novel ball spin measurement method which can be applied for reasoning on racket sports equipment properties. Based on high-speed video we require high accuracy and robustness which influences our ball and feature tracking approach. Our measurement setting cannot simulate sufficiently realistic ball rebound, though we can prove the correctness and applicability of our method.

Motivation
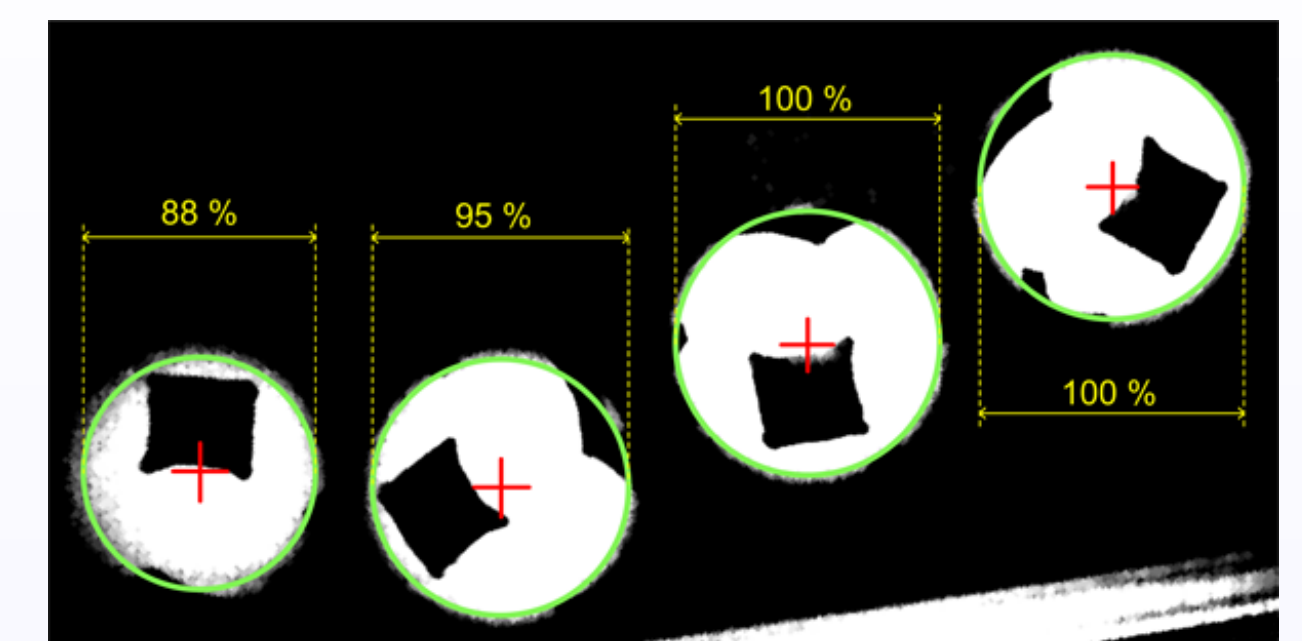
Rubber Classification

Visualisation of Ball Spin for Sport Broadcasts
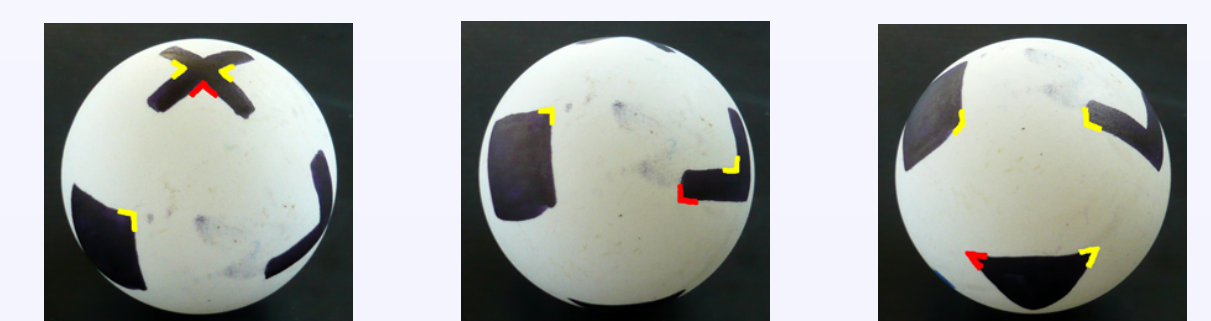
Challenges

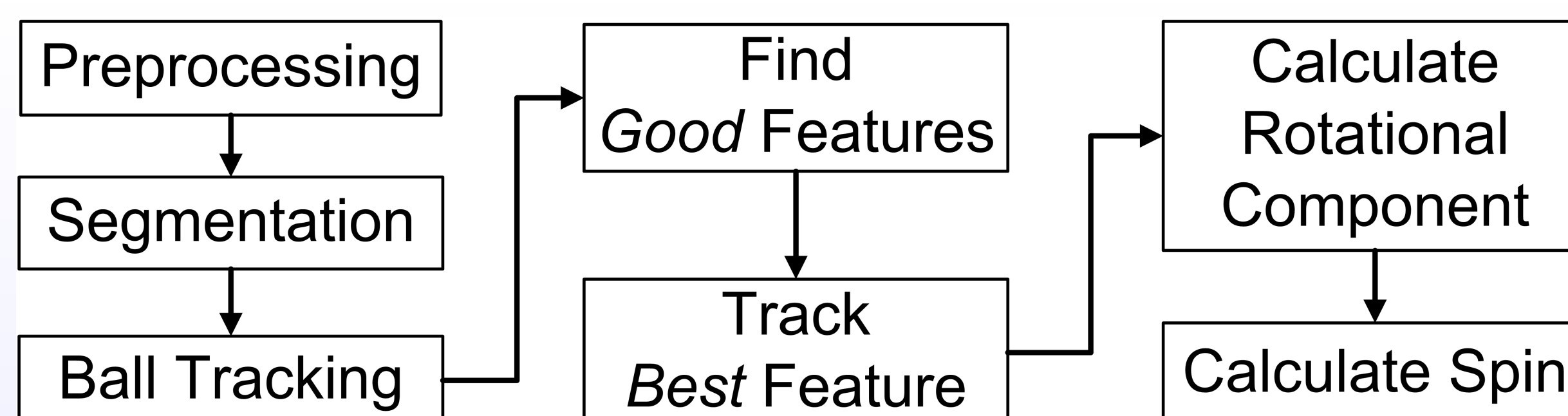- Accurate Ball Silhouette Tracking for Center Finding

- Seamless Feature Tracking and Simultaneous Tracking of Several Features

- Geometric Distortion of Sphere

- Changing View Angle and Lighting Direction

Method

Preprocessing → Segmentation → Ball Tracking → Find *Good* Features → Track *Best* Feature → Calculate Rotational Component → Calculate Spin

Setting

- Total Resolution: $1280 \times 512\ pixels$
- Frame Rate: $1000\ per\ second$
- Shutter Speed: $\frac{1}{7000}\ s$
- Floodlight: $3000\ W$
- Table Tennis Balls Painted with different Features
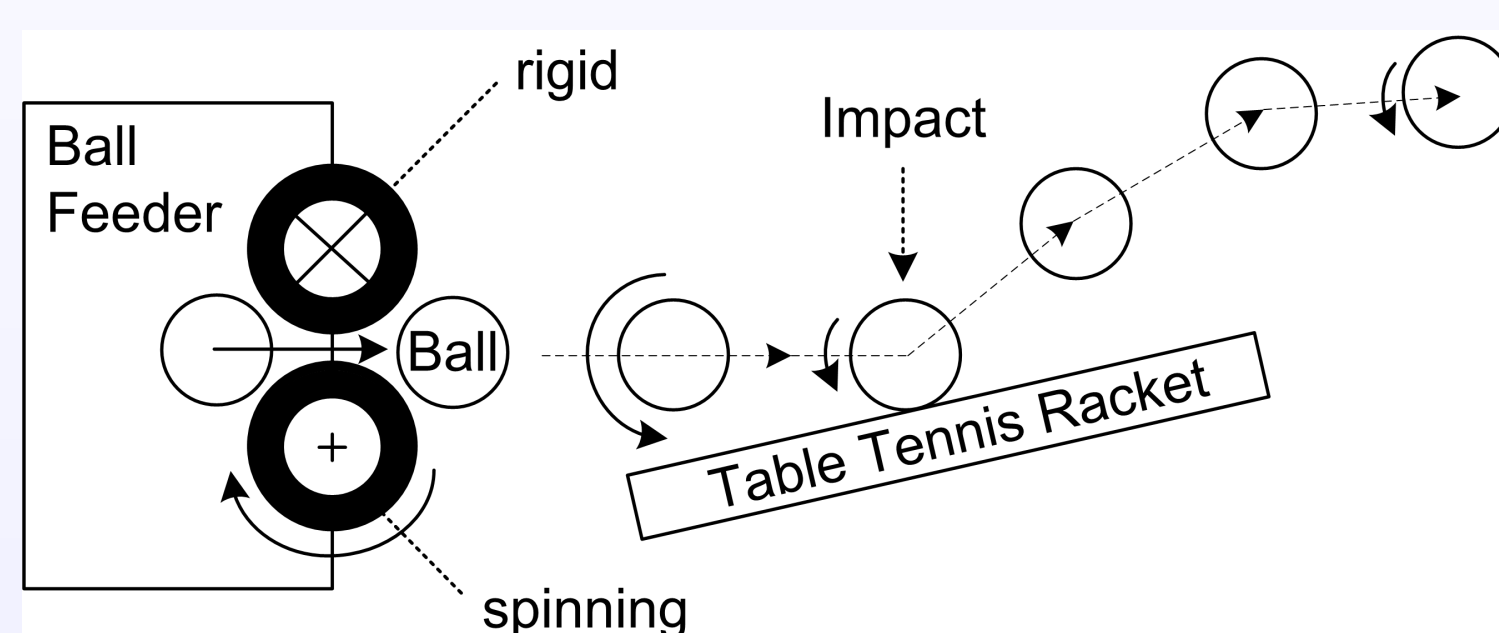
Outlook

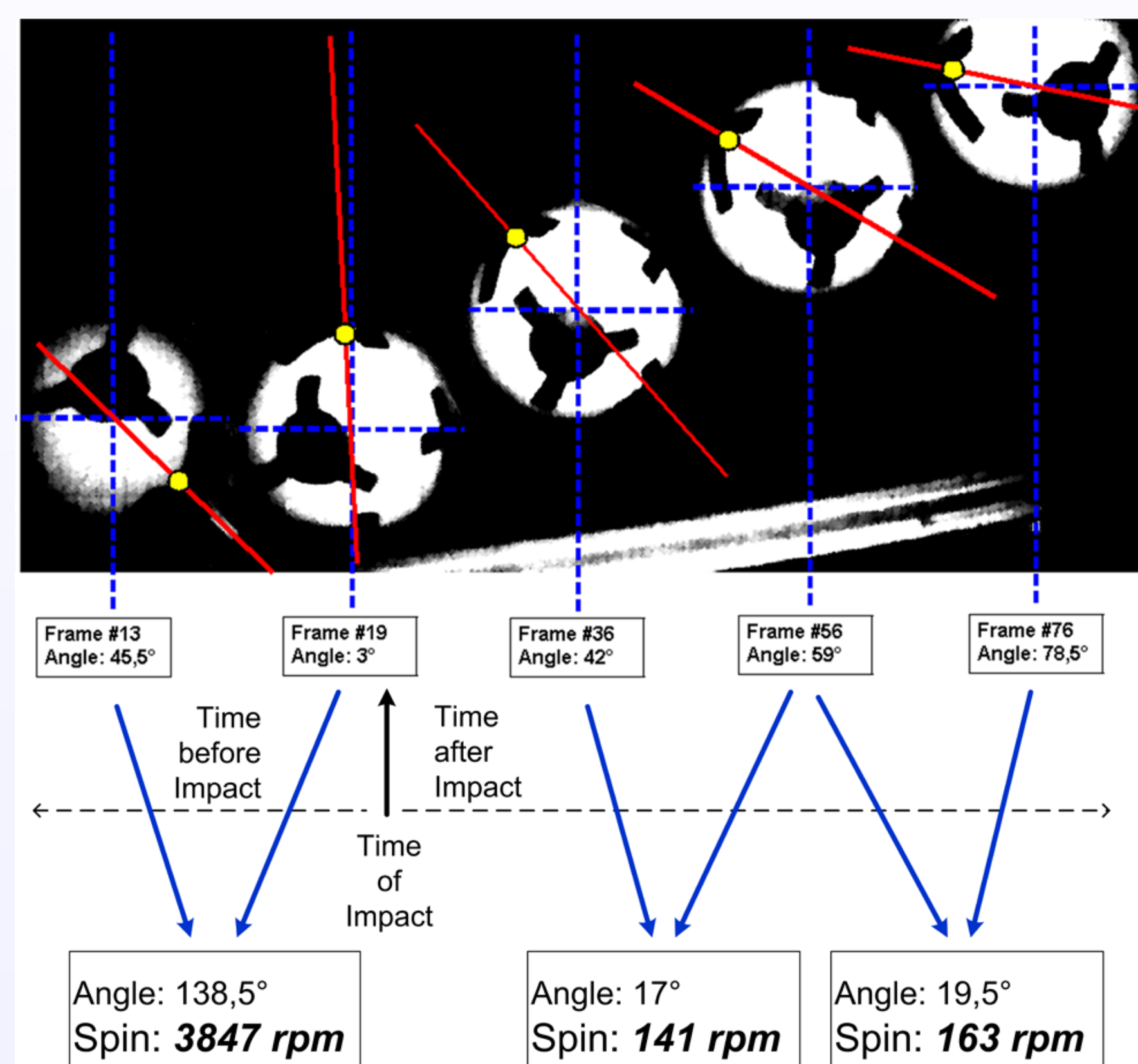Measuring spin without additional artificial features.
Challenge: Occlusion of feature.

Acknowledgements

Results

Five superimposed frames of same sequence. Tracked feature is marked with yellow dot. Angle is measured between red line and vertical ball axis. Problem: First frame has low contrast because of less lighting.

Calculation of rotational component by subtraction of translational component:
Top: Frame 11,
Upper Middle: Frame 12,
Lower Middle: Superimposed,
Bottom: Subtraction (enlarged)

Frame #13 Angle: 45,5°
Frame #19 Angle: 3°
Frame #36 Angle: 42°
Frame #56 Angle: 59°
Frame #76 Angle: 78,5°

Time before Impact
Time after Impact
Time of Impact

Angle: 138,5° Spin: **3847 rpm**
Angle: 17° Spin: **141 rpm**
Angle: 19,5° Spin: **163 rpm**

Translation of Center
Pure Rotation
Motion of Feature