Mobile Pool Table Analysis

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Motivation

Novices have difficulty with shot selection in billiards

Players have no practical way of analyzing their performance

Mobile devices are ubiquitous and turn-based play makes recording possible
Goals

Capture table state from a single photo

Populate a virtual game table with the state

Shot selection and guidance with rendered graphics
Methods & Approach

Apply strong constraints on the problem

- Table and ball size is standardized
- Planar scene
- A single dominant hue near the center of the photo

OpenCV and OpenGL ES 2.0
Challenges

- View from any angle
- Ball occlusion
- Table occlusion due to FOV or objects
Pipeline

Table Detection
Pipeline

Table Detection

- Hue based seg./cropping
- Phase-unwrapping and equalization
**Pipeline**

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- Phase-unwrapping and equalization
**Pipeline**

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- **Edges**
  - Hough transform
  - Rejection using surface-based metric
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- **Orientation**
  - Homography
  - Hypothesis testing
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Ball Segmentation

- High-resolution processing
- Connected component labeling

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Positioning

- Circular Hough transform
- Radius range from homography
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- Rejection
  - Collision physics
  - Pixel radius constraints
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Discussion

Pipeline is heavily dependent on surface segmentation

- Plays a critical role in the edge rejection metric
- Also it is itself a major edge for finding lines

Balls localization

- Rejection needs work
- Occlusion is difficult

Video tracking