Augmented Reality:
Putting the X on the Spot

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Outline

- Overview
- Algorithm
- Performance
- Demo
- Improvements
Overview

- Augmented Reality (AR) is the augmentation of elements in a live view of a physical world.

- AR for TIC TAC TOE
  - The Goal: Provide an interactive interface for AR for both 2D and 3D TIC TAC TOE.
Assumptions

- Only Two Things Present
  - Live Camera Feed
  - TICTACTOE Board
    - Empty
    - Four Intersecting Lines
    - Orientation Marker

- Algorithm accounts for
  - Lighting changes
  - Board translation/rotation
Algorithm

- Image Collection
  - Calibrated Camera (live)
- Threshold to binary
- Edge Detection
  - Canny
- Finding Lines
  - Hough Transform: Both board and orientation marker
Algorithm (cont.)

- Find Line Intersection Points
- Calculate Camera Pose
- Project TIC TAC TOE Game on Board
Key Features

- Hough Transform
  - Quick for Live Video
  - Used for both board and marker
- Line Intersections
  - Simple Cross-Products
- Initial Point Correspondence
  - Closest to origin, rotate around clock-wise
  - Marker forces actual order
- Initial Camera Pose
  - Initial angle between points 1 and 2 provide a ‘z’ angle guess
Performance

- MATLAB
  - Computer Generated
    - Actual Corners found
    - Camera Pose found (usually 5 or less iterations)
  - Digitally Drawn
    - Actual Corners found
    - Camera Pose found (usually 7 or less iterations)
  - Digital Picture
    - Corners not found
Performance (cont.)

Computer Generated

Digitally Drawn

Digital Picture
Digital Picture

- Poor Line Finding
  - Due to uneven surface
Demo

- OpenCV (not currently working)
- MATLAB
Improvements

• Marker Finder (not currently working)
  • Hough Transform in selected regions

• TIC TAC TOE Marker Generator
  • Not yet coded

• Digital Camera Line Capture Improvement
  • NEW ASSUMPTION: Flat surface
    • Make Better, Straighter lines
Questions?