Automatic Score Keeper for Cornhole

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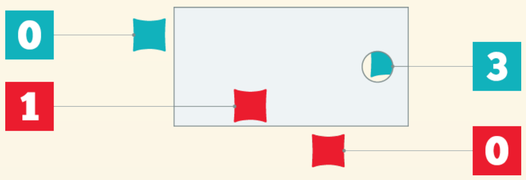
Introduction

- Cornhole is a game with teams, bean bags, and platforms that have a hole in the far end
- Each player throws bean bags onto a platform

Cornhole game in action

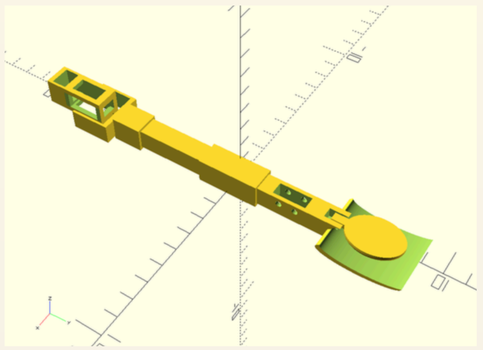
Rules

- A bag on the platform yields one point
- A bag within the hole earns three points
- A bag outside of the platform receives zero points
- Game ends when either team reaches a score of 21



Cornhole Robot

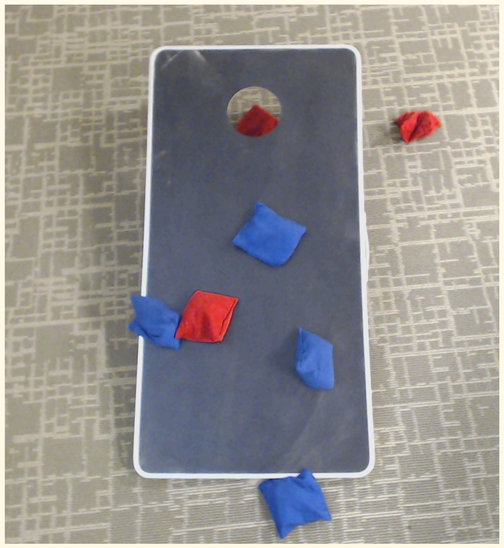
- Research project to develop a cornhole-playing robot
- Robot is an underhand-tossing solution for pitching



Problem

- Cornhole robot must evaluate a game state
- Robot needs to find each bag, its location and color
- Such combination provides estimated scores

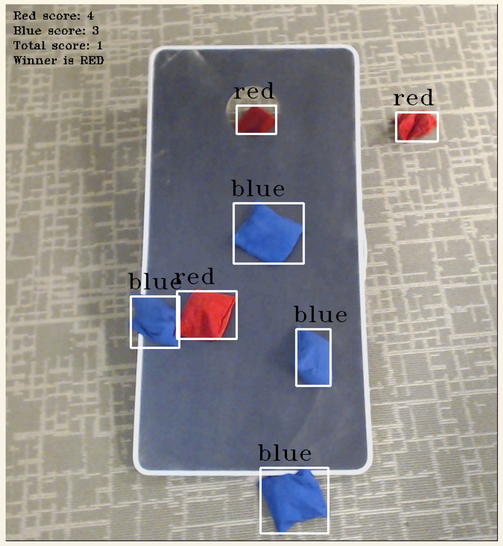
Input image



Approach

- Our approach is state estimation using computer vision on a single image via commodity webcam
- Implementation of the approach is Automatic Score Keeper (ASK)

Output result



System Pipeline

System uses OpenCV (open source computer vision library):

1. Apply a Gaussian blur to reduce noise
2. Perform largest contour detection to find platform
3. Use a Hough transform to recognize platform's hole
4. Search (heuristically) for bags via HSV color model

Gaussian blur

Hough transform

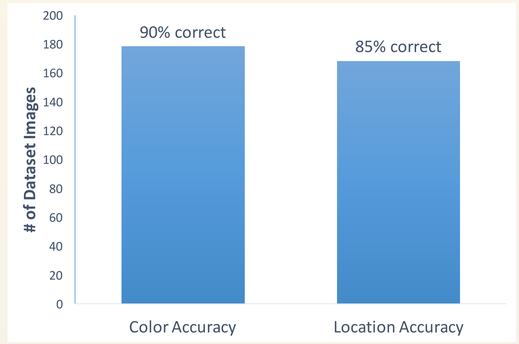
Contour detection

Input image | Desired output

Results

- Given dataset (of **198** images) from cornhole robot research, metrics measure accuracy of Automatic Score Keeper (ASK)
- The score keeper achieved ~**90%** color accuracy
- The score keeper produced ~**85%** location accuracy

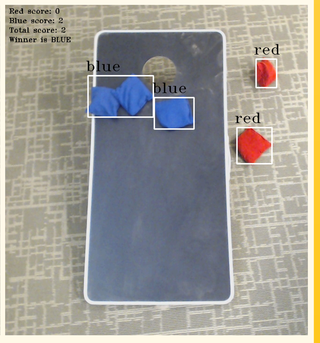
Automatic Score Keeper Accuracy



Future Work

Occlusion and lighting

Same color proximity



Conclusions

- Obtained level of accuracy as a starting point for game
- Lighting plays an important role in overall detection
- Additional approaches can be assessed in the future

References

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