

Development of a mixed reality system to assist pool players using the Microsoft Hololens

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Introduction

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Introduction



Video PoolAid system

Hololens App Development

From Windows Development Center :

- Immersive and holographic apps need tools designed to take advantage of the Windows Mixed Reality APIs. We recommend using Unity to build mixed reality apps. Developers interested in building their own engine can use DirectX and other Windows APIs.

Hololens App Development

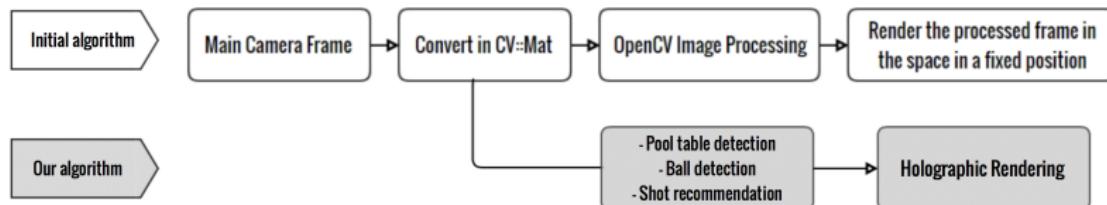
The screenshot shows the Unity Asset Store interface. At the top, there are navigation links for 'All Assets', 'Add-Ons', 'Audio', 'Templates', 'Tools', and 'VFX'. A search bar is present with placeholder text 'Type here to search assets'. On the right, there are links for 'Create a Unity Account', 'Log In', 'Play/Promo', 'August 2018 Free Assets', 'Impressions News Journal', and 'Shop Old Store'. Below the header, a breadcrumb trail shows 'Home > OpenCV for Unity'. The main content area features a large logo for 'OpenCV for Unity' with a stylized 'U' and 'CV' icon. To the left is a sidebar with sections for 'Package contents', 'Releases', and 'Supported Unity versions'. The central part of the page displays the product details: 'FIND SOFTWARE', 'OpenCV for Unity', '5.0', '50 user reviews', 'Popular Tags: Camera, Facetracking, Easy, Multiplatform, Mobile, Tools, Textures, Editor, Premium', 'All Tags', 'Works with Unity Cloud Build', and a list of supported platforms: iOS, Android, Windows, Mac, Linux, and WebGL. A note says 'OpenCV for Unity is an Asset Bundle for using OpenCV 3.4.1 from within Unity.' Below this are sections for 'current ver. 3.3.1' and 'Show More'. At the bottom of the page are buttons for 'Share' and 'Add to List', along with links to 'Support website' and 'Publisher website'. On the far right, there are 'Report this asset' and 'Report this page' buttons.

Hololens App Development

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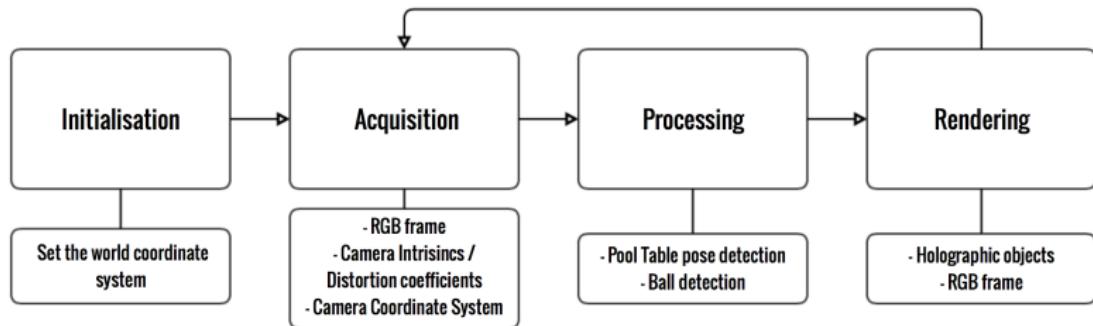
HololensforCV sample open sourced by Microsoft :



HoloLens Spacial Perception

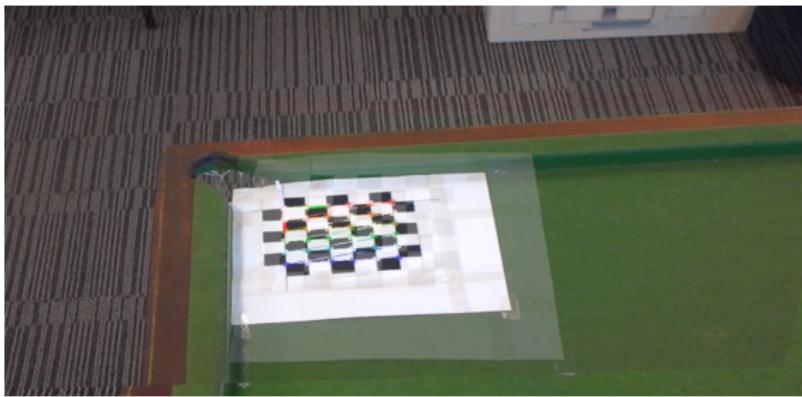


Application Framework

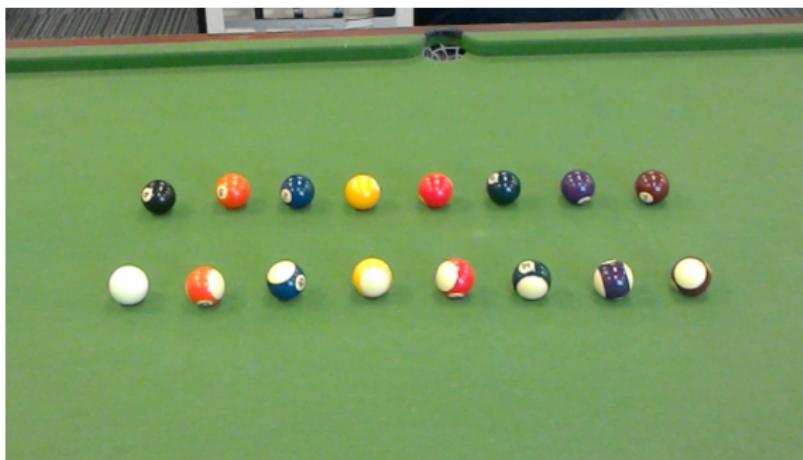


Pool Table Pose Detection

- OpenCV functions *FindChessBoardCorners* / *SolvePnP*.
- Transformation matrix : Pool Table coordinate system to World coordinate system.
- Stored for the whole experience.

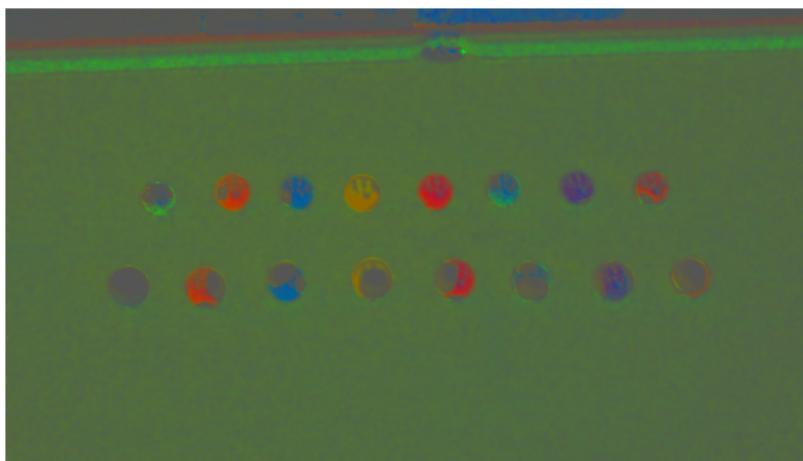


Ball Detection Framework

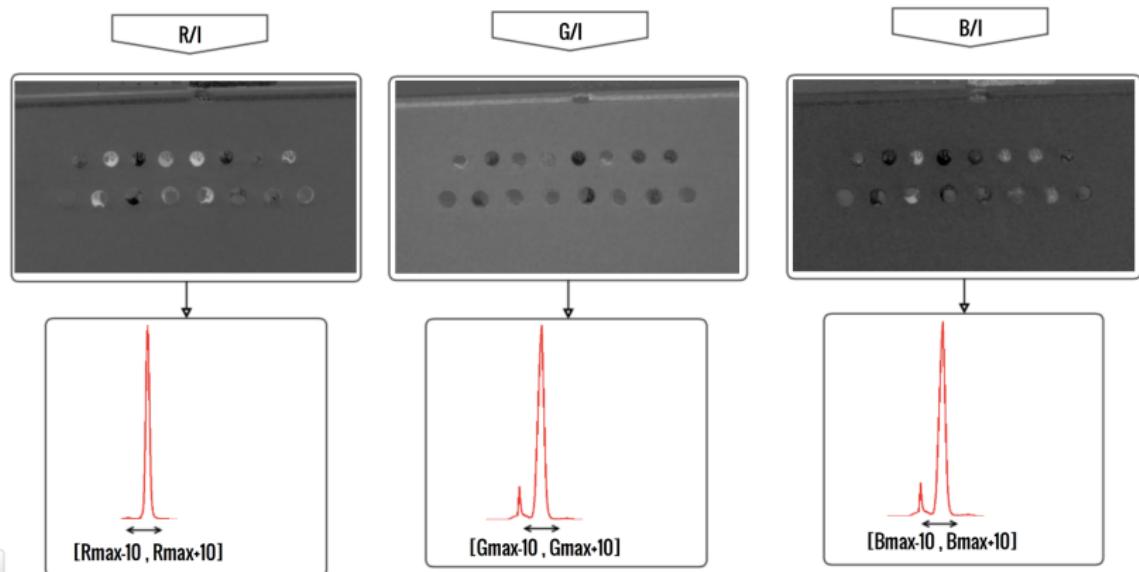


NormalizedRGB Color Segmentation

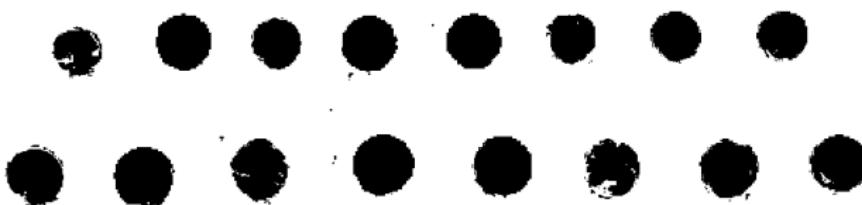
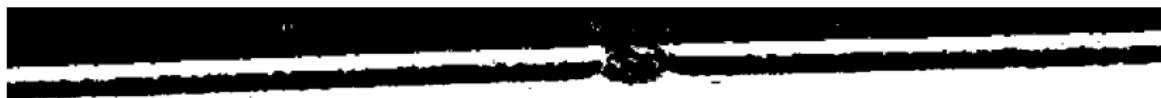
$$\left\{ \begin{array}{l} I = R + B + G \\ R \leftarrow R/I \\ G \leftarrow G/I \\ B \leftarrow B/I \end{array} \right. \quad (1)$$



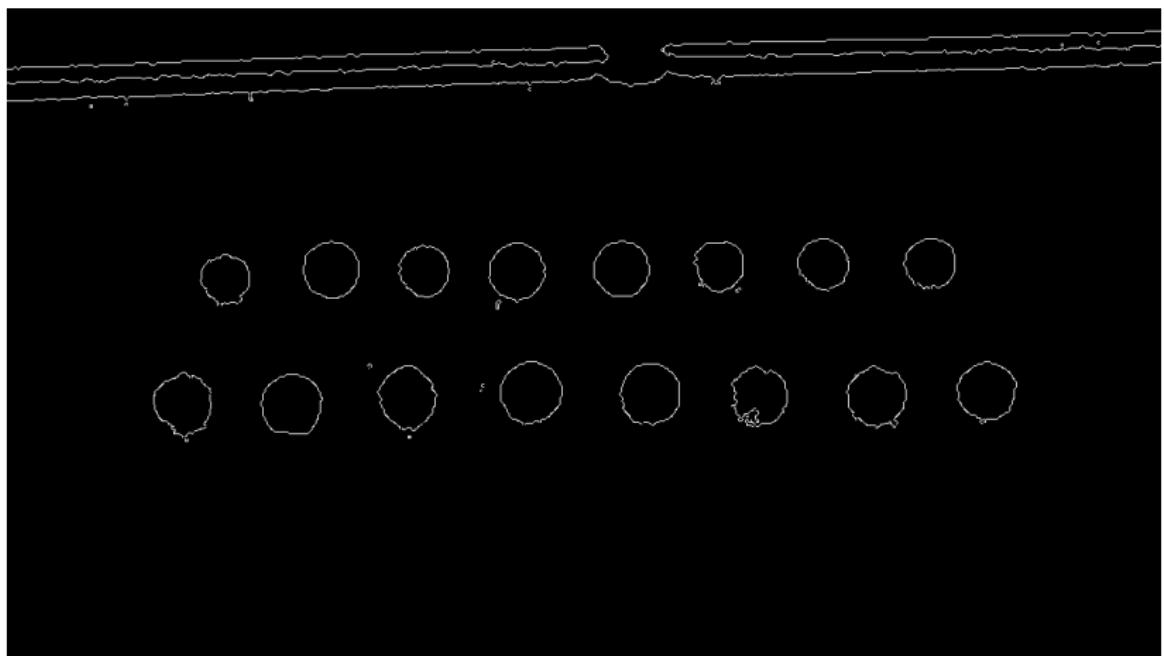
NormalizedRGB Color Segmentation



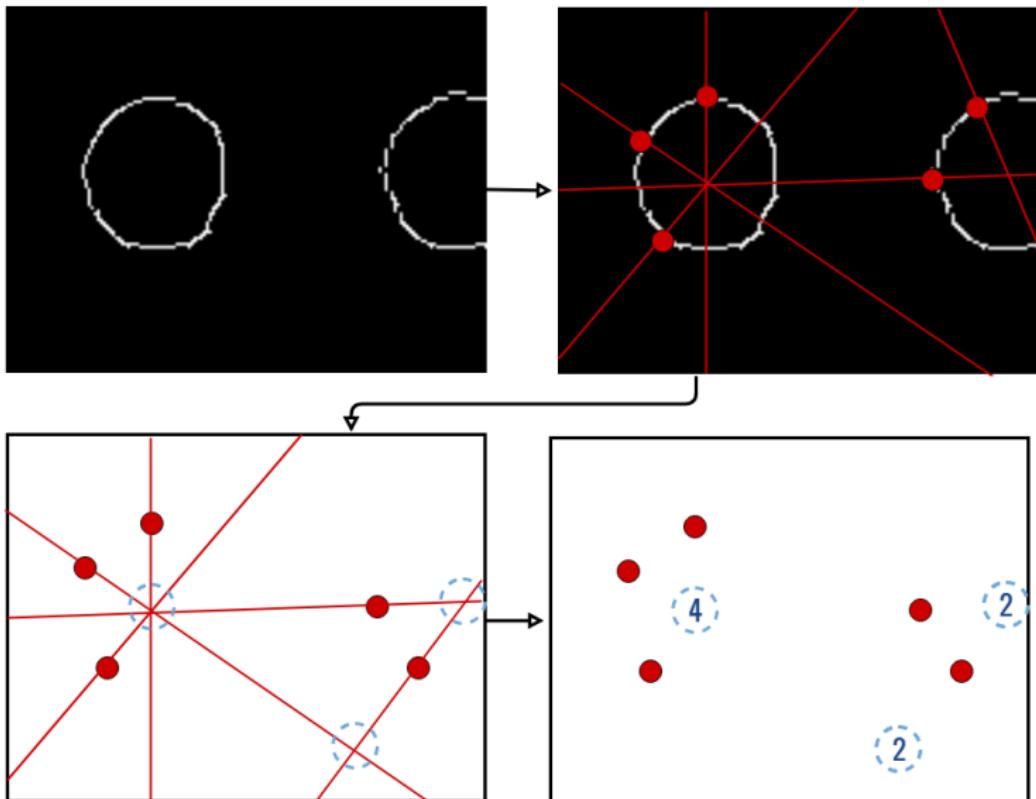
NormalizedRGB Color Segmentation



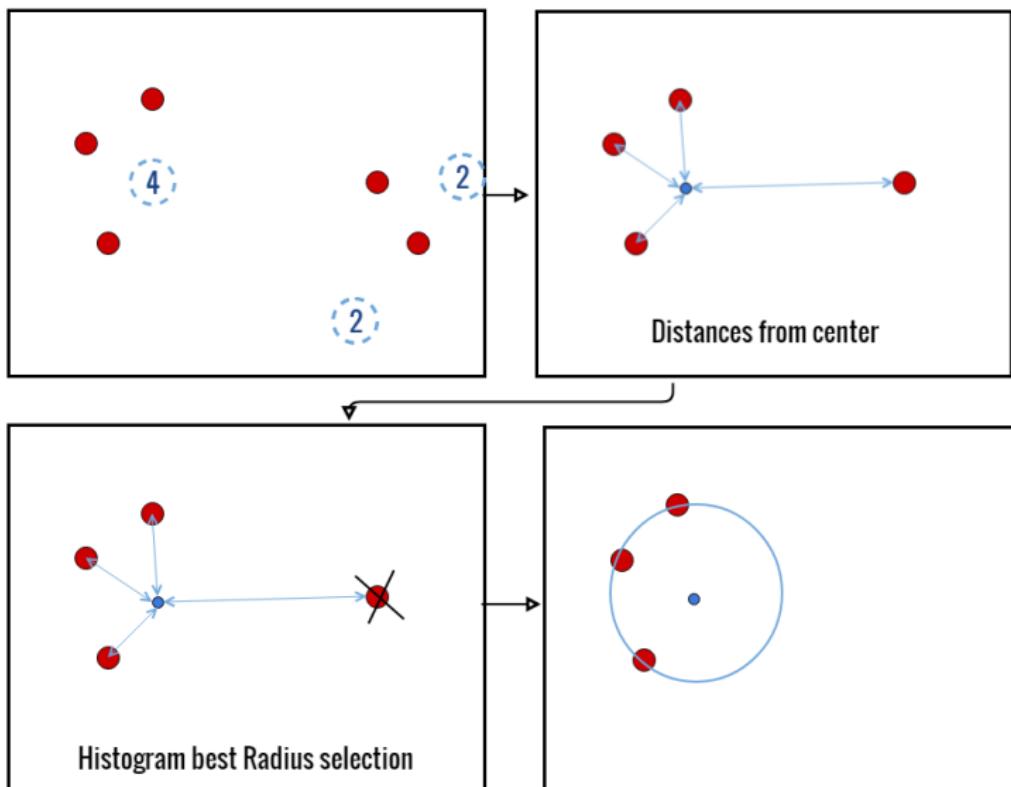
Canny Edge Detection



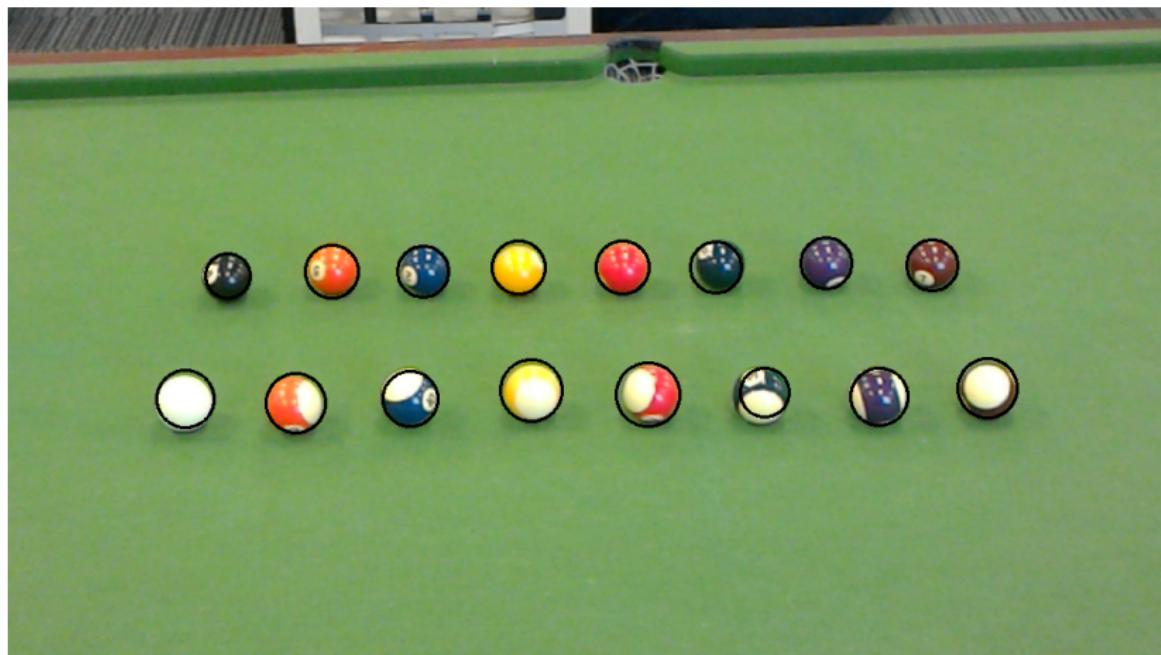
Hough Circle Transform Theory



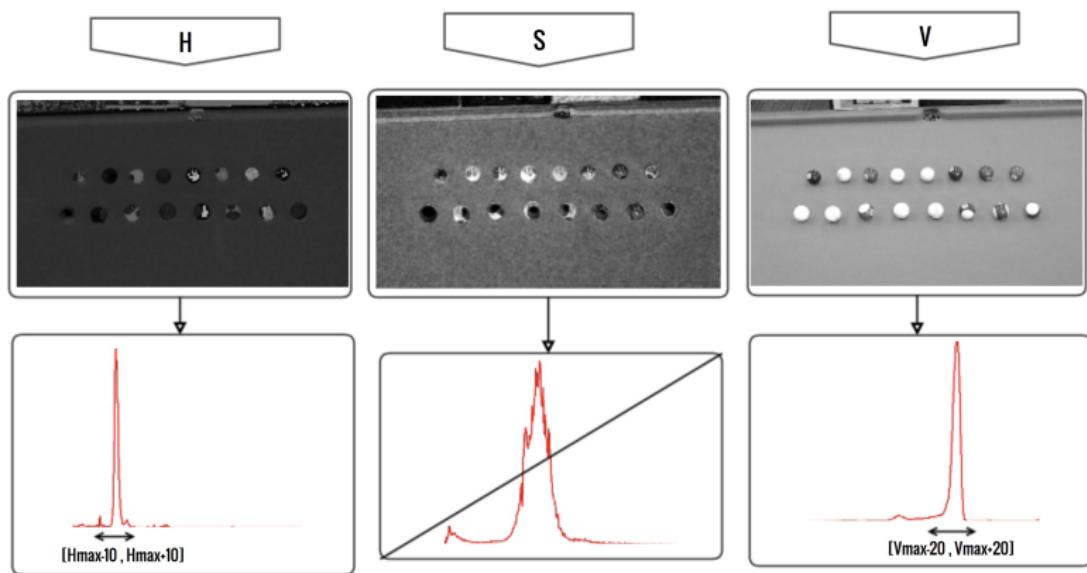
Hough Circle Transform Theory

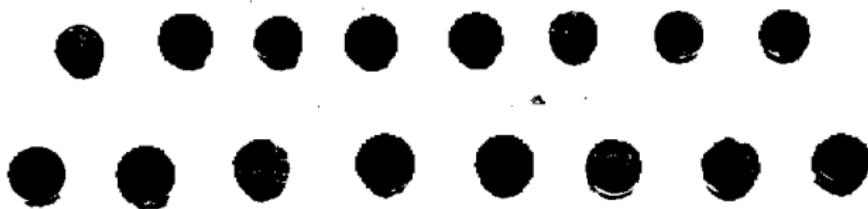


Circle Detection Result

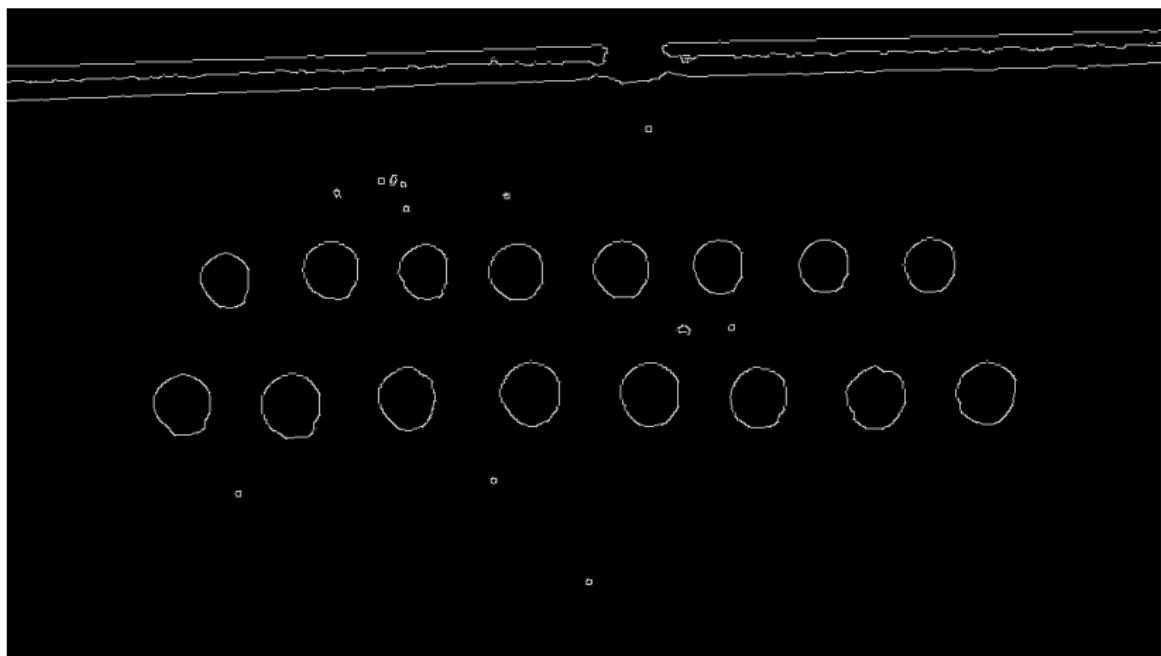


HSV Color Segmentation

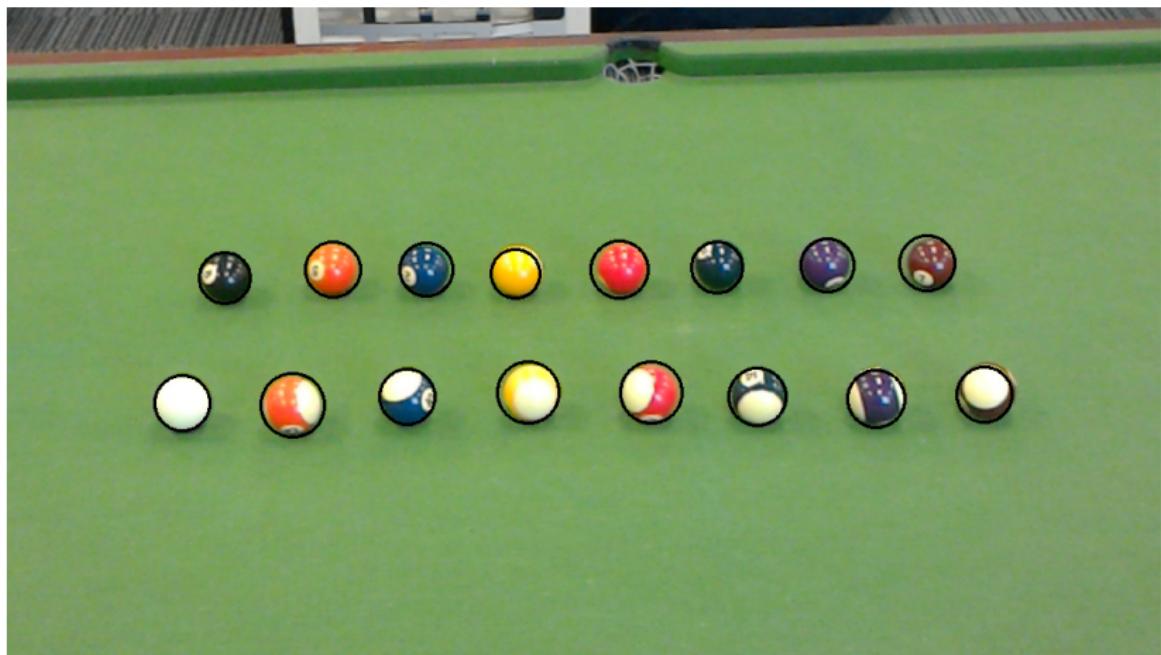




Canny Edge Detection



Circle Detection Result



Conclusion

Demonstration

Future improvement :

- Ball detection precision, color segmentation method.
- Holograms stability.
- Use depth sensors.
- Shot recommendation.