

Investigating Detection Techniques For Real Time Tracking Of Billiard Balls

Overview

- Real time object tracking has become a core an integral part of many systems within sports.
- This research focused on the object detection aspects within billiard sports (specifically Snooker).
- A number of detection techniques were developed and tested within a real environment.
- The accuracy and performance results were analysed to identify the most suited techniques.

Setup Diagrams

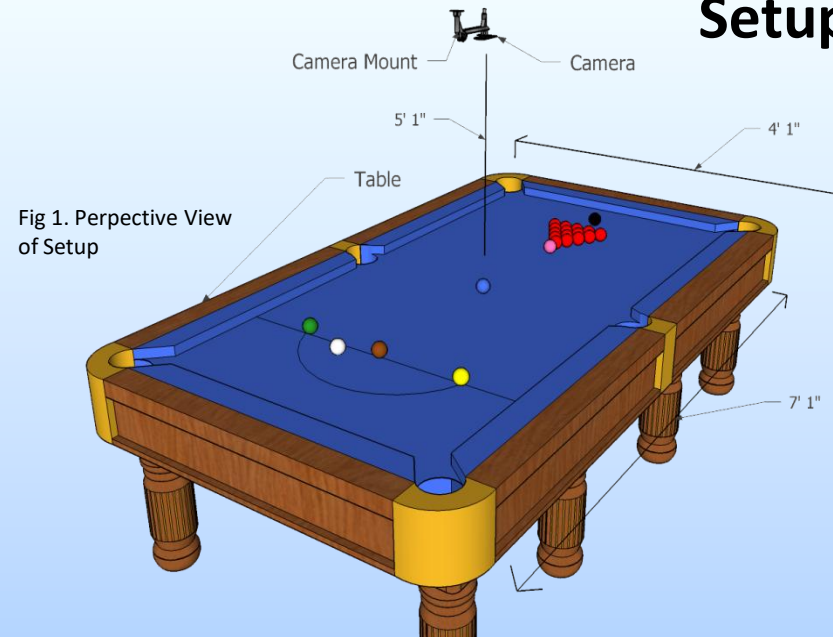
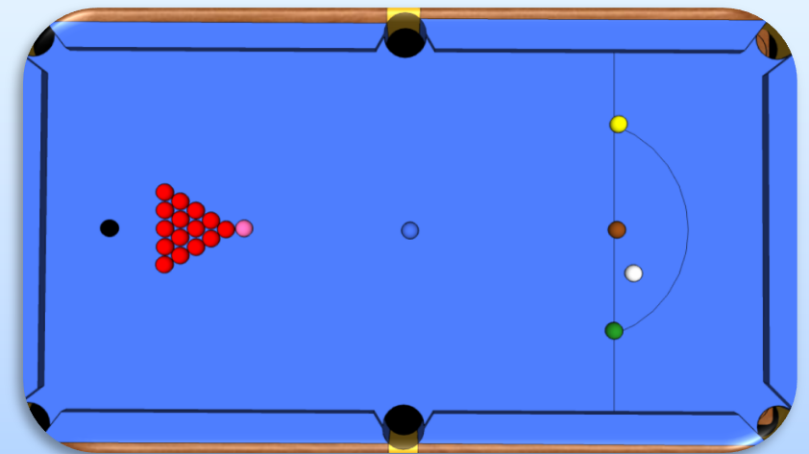


Fig 1. Perspective View of Setup

Fig 2. Initial Camera View



Test Environment

- Snooker/pool table with a single fixed camera mounted directly above it.
- A mobile phone (Android) was used as the camera and processing unit.
- Red, yellow and white ball were tested.

Proposed Techniques

There are a substantial amount of techniques and approaches that can be utilised for this specific problem. These can range from the relatively simple, to more complex and computationally expensive algorithms. Within these initial tests, a range of lower level functions were used to try and achieve some working solutions. Commonly used detection and performance enhancing techniques included :

- Colour Based Thresholding
- Morphological operations (Erosion & Dilation)
- Linear Filtering (Blurring/Smoothing)
- Contour Matching (Hough Transform)

Implementation

To implement and test potential techniques, a benchmarking application was created for the Android phone. The strategy design pattern was used to encapsulate and interchange detection techniques at run time. The application also gathered the necessary data samples.

Data Analysis

- Over 7000 individual frames were analysed for accuracy and performance.
- ANOVA tests were used to prove any significant variation between techniques.
- Of the techniques tested, a mixture of both colour based thresholding and contour estimation (Hough transform) seem to perform best overall.

