

# 3D Trajectory Prediction of Basketball Shot Using Filtering Techniques and Computer Vision.

EL2320 - Applied Estimation Project Proposal

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December 2021

## 1 Project Description

The goal of this project would be to track and predict the trajectory of a basketball shot in three dimensional space using video data. Furthermore, we aim to assess multiple filtering techniques and their ability to accurately track and predict the trajectory of the basketball, calculate whether the shot will pass through the net, and the ability to handle unmodelled disturbances such as bouncing off the backboard. An example of two dimensional trajectory tracking with a Kalman filter is shown in Figure 1.

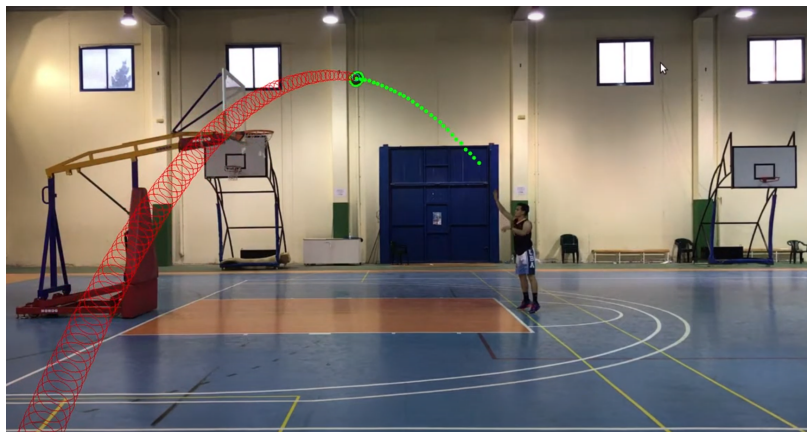


Figure 1: 2D Trajectory Prediction of Basketball Shot with Kalman Filter

## 2 Tracking

Tracking of the ball would be performed by using computer vision pre-processing techniques. Specifically a Hough Transform for circular objects. As the ball needs to be tracked in three dimensional space, the relative position of the ball in one of the dimensions would be related to its size.

Obvious problems with tracking the ball in this manner is the possibility of detecting false positives (other round objects). A potential solution to this is using the color of the ball to positively identify the correct circular object.

## 3 Prediction

The motion of the basketball moving through 3 dimensional space can easily modelled using parabolic motion. Using the position of ball attained through aforementioned methods, the parameters of the motion will be estimated using both Kalman and Particle Filtering techniques. Thus, the path of the ball and whether the ball passes through the net can be predicted. The idea of implementing these two different filtering techniques would be to assess the accuracy of prediction, as well as the ability to recover from unforeseen disturbances such as the ball suddenly changing direction or velocity.