**Literature review**

**Key Concepts, Theories, and Studies**

Our project will implement study upon three main areas, image recognition, machine learning, and kinematics, or physics study of motion. One area of study for detecting a circle in an image is using circle Hough transform (CHT) and the HSV color method [1]. As was noted by Faris both methods implemented together were the most accurate fashion to detect a circle. Another project focused on using a genetic algorithm to plan a path of a soccer robot because of the algorithm's ability to consider internal and external information [2]. We however will not have external cameras monitoring the position of the opposite team, ball, goal, and the robot itself as we are just training a robot to shoot at a goal. Wang and his team used a color segmentation method to detect the position of the ball and used a masked image to reduce the compute cost of the image identification. They also used a lookup table to determine the real position of the robot, this was possible as the four corners of the field were marked with cylinders [5]. Setyawan and his team used the HSV color space and a neural network together with an adaptive particle swarm optimization to detect objects and distances [6].

**Key Debates and Controversies**

We aim to see whether a Machine learning or a kinematic approach will be more effective in controlling a robot to locate and hit a tennis ball towards a goal. There is debate whether localized vision (camera on the robot) is more effective than external vision (camera over the entire field). In the latter scenario, the robots must deal with the issue of locating themselves more so than with cameras mounted to the robots themselves [4]. However, Hong and his team were able to do this and predict the locations of opponents and the ball using a recursive current position and velocity algorithm [3]. Although, having a picture of the entire field and all objects allows for more strategy and planning. Though few models have used an omnidirectional camera on the robot, Wang and his team were able to quickly and efficiently analyse 360-degree photos in their image recognition model [5]. This argues that this form could be superior to the traditional static mounted cameras that have a lower range of view.

**Gaps in Existing Knowledge**

We aim to see whether a Machine learning or a kinematic approach will be best suitable to help the robot reposition itself such that the ball is found in the center of the image. This will allow for the robot to drive straight forward to hit the ball. Otherwise, the robot could miss the ball entirely.

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