Using Machine Learning to Track Motion of Table Tennis Ball and Predict its Spin

Owen Huang, Princeton University
Richie Zachariah, Adlai E. Stevenson High School
Summer 2021 Mechanistic Data Science - Northwestern University
July 10, 2021

Objective

In the sport of table tennis, players use a variety of serves and returns to score their points. These hits often involve applying strong spin on the ball by hitting it at a specific angle with the paddle. Our initial goal in this project will be to allow the computer to recognize a table tennis ball frame by frame using footage on a game table. Our next goal will be to allow the computer to make predictions about how the ball was initially hit by using the path the ball takes in the footage. For example, if the ball changes its direction to the right after bouncing, the computer would be able to predict that the ball was spun to the right.

Approach

System and Design:
The ability to predict how the ball was hit is especially beneficial for the use of gathering information and statistics on the sport of table tennis with respect to the frequency of certain serves and returns compared to others. This could also improve the quality of replays in official table tennis matches. The same concept could be applied to other sports too such as soccer, baseball, or pool, where applying spin to the ball can really give players a strong advantage. Overall, there is great potential for spin prediction in other sports to add to sports analysis.

Multimodal Data Generation and Collection:
We plan to record footage of different hits on the ball on an actual game table at Northwestern. We will also manually place bounding boxes around the ball to train the computer to do so itself.

Regression and Classification:
We will use a convolutional neural network to build a model that can recognize a ping pong ball in images. This will allow the computer to track the ball frame by frame. After this, footage of different ball paths will be used for training so that the computer can predict how the ball was hit.

Summary

We plan to complete a working algorithm that can track and predict how the ping pong ball was hit within the five weeks we will have. We could possibly extend this project to have an application with more features and greater ease of use. This is a little more difficult for a user to use since the camera angle at which the ball is recorded should be somewhat consistent.