Introduction

Autism Spectrum Disorder (ASD) is characterized by various traits and behaviors, including notable differences in eye contact and gaze patterns. Individuals on the autism spectrum tend to avoid direct eye contact and exhibit a greater focus on details compared to their neurotypical peers. For that reason, I chose the research question about whether autistic people's gaze would be significantly different when looking at images or videos. My hypothesis was that we would see the gaze of autistic people "jumping" around more.

I worked with a large eyetracking dataset (approximately 150 MB in size when fully downloaded) containing data from both autistic and non-autistic participants. Each participant took part in multiple experiments and viewed a range of different stimuli, providing a robust dataset.

Methods

Because the dataset is so large, I split each calculation into smaller steps and stored intermediate results in files to ensure everything could run on a regular laptop. I chose three main metrics to describe gaze behavior: the frequency of saccades, their total duration, and how far each participant's gaze deviated from the average path.

The original dataset labeled each gaze point as either a fixation, saccade, or blink, which made calculating saccade frequency straightforward—just dividing the number of saccade points by the total of saccade and fixation points. To measure the length of each saccade, I first computed the duration of every datapoint, then added up the durations of those labeled as saccades.

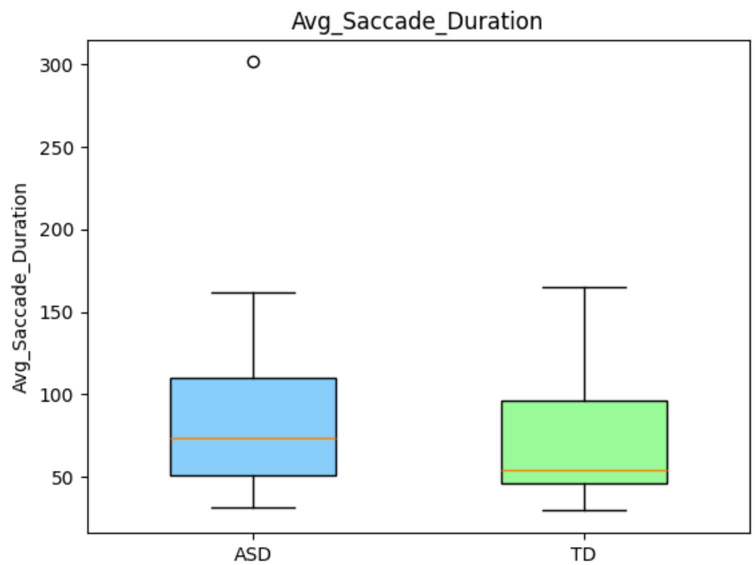
Measuring gaze deviation from the average path was the most involved. The dataset included X and Y coordinates for each eye plus a recording time in milliseconds, but this time covered entire experiments where different participants saw multiple stimuli. To fix that, I normalized the time so each participant's experiment started at zero. I then introduced another column where the clock reset whenever a new stimulus was presented, making it possible to compare how participants viewed the same stimulus at matching time frames.

Still, individual datapoints didn't align perfectly because sampling intervals varied. To tackle that, I "snapped" each recording time (per stimulus) to the closest 20 ms increment while skipping any duplicates, so we could link up gaze coordinates at roughly the same moment. Using this approach, I created a file for each stimulus containing the average coordinates at each snapped time. I then compared every participant's own coordinates to this average, calculating how far they deviated.

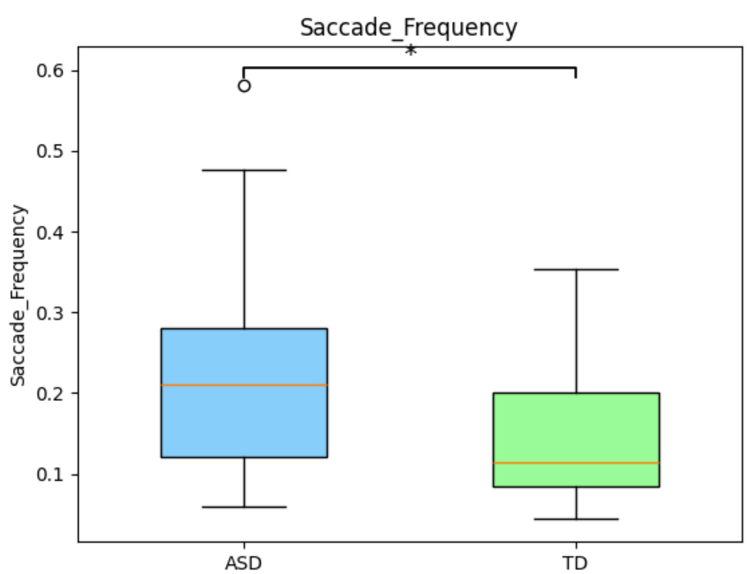
After that, I averaged these metrics in two stages. First, I found an average value per experiment per stimulus for each participant. Then, I combined those to get a single score for each participant in each category. Finally, I used t-tests to compare the ASD group's overall results with those of the neurotypical group.

Results and Discussion

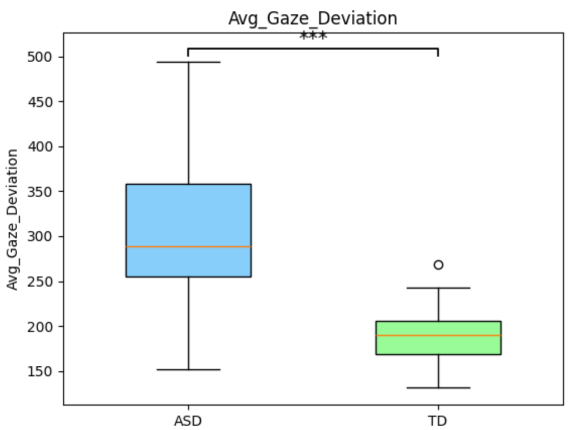
There was no significant difference in the duration of the saccades.

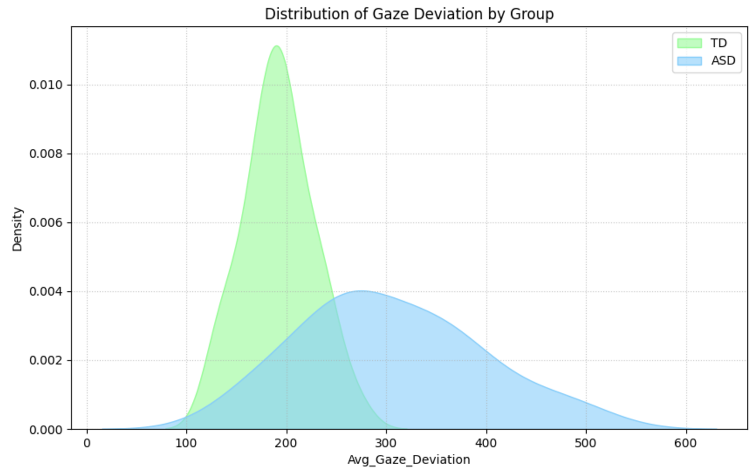


However, there was a significant difference (p<0.05) in saccade frequency, with autistic participants showing a higher average frequency of saccades.

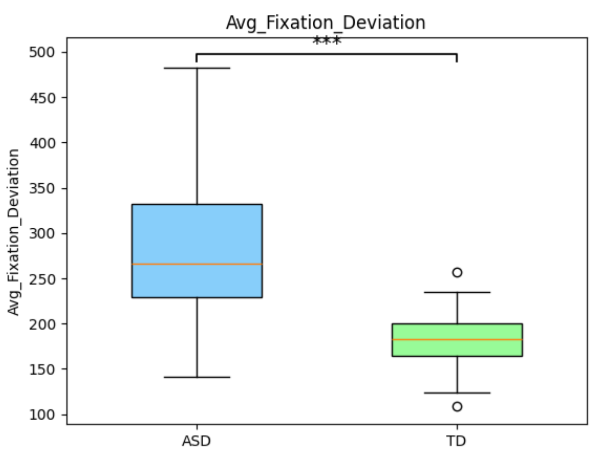


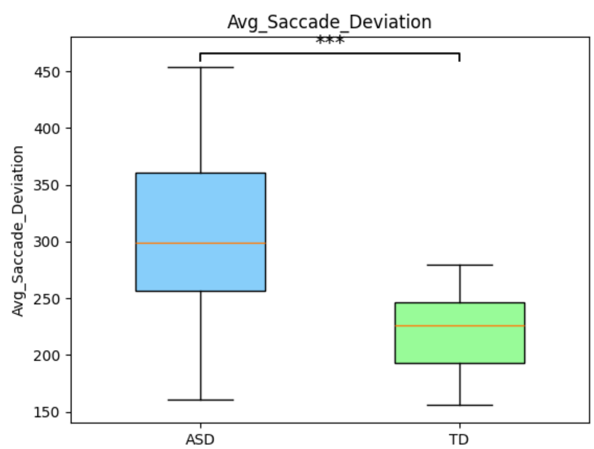
In addition, a highly significant difference ($p<0.001$) emerged in how far the gaze deviated from the average path between the two groups. The autistic group tended to stray farther on average and also had greater variance. This distinction is especially noticeable in the density plot.





It also appears that this greater deviation remains consistent whether we focus on gaze during fixation or during saccades.





Overall, these findings indicate that eye-tracking might hold diagnostic potential—particularly when examining saccade frequency or the degree to which someone's gaze shifts away from a central path. This is consistent with research from Bar Ilan University, which found that autistic children make more saccades and view scenes more randomly, especially as ASD symptoms become more severe.