

Project Title : Find The Lag

Team Name : Lag Monster

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Background: The input lag is an important specification for gamers. This determines the millisecond delay between controller user input and screen. The lower the input lag, the faster the response to your actions. A response time greater than 80 ms is unsatisfactory. The targeted value is between 50-75 ms. The response time is crucial, especially in fast-paced video games.

Problem Statement : Design an ML model / any other software model / innovative techniques to measure the latency between pressing the button on the mouse and the computer registering the result in a video.

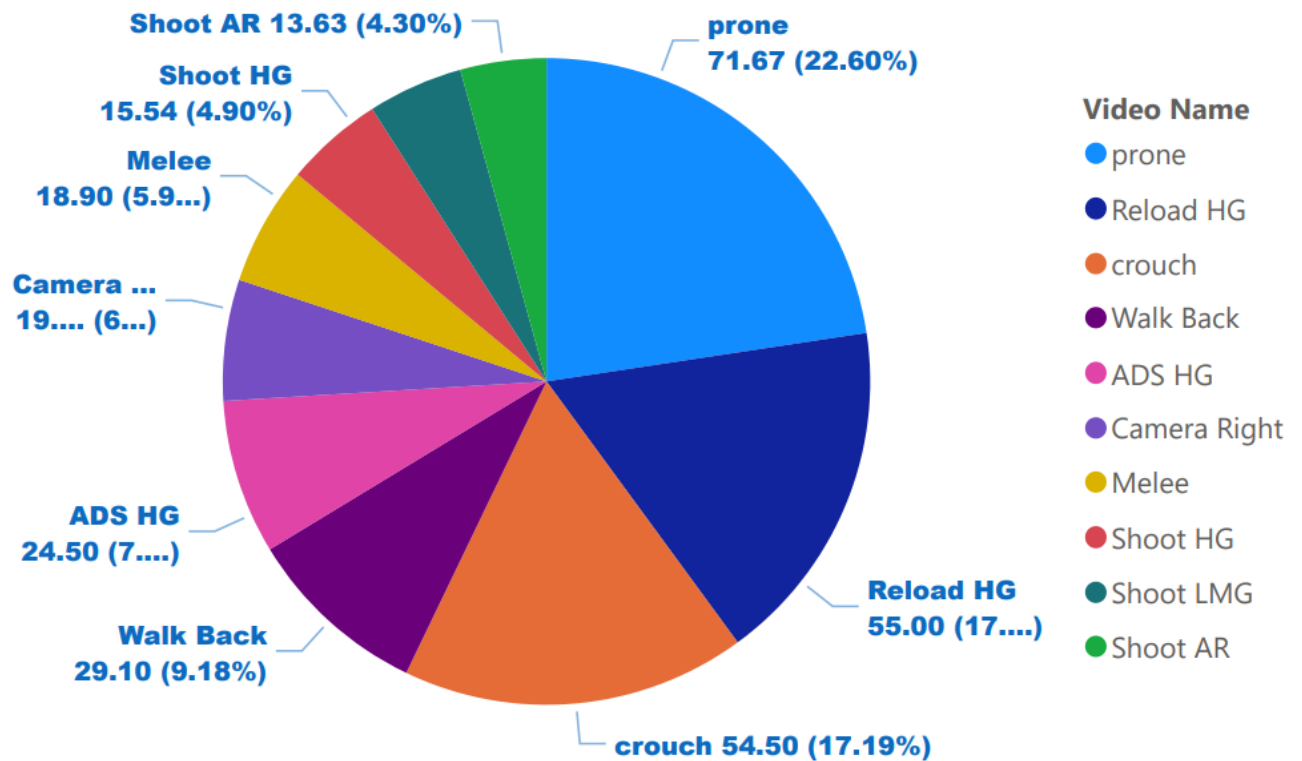
Creating Dataset from Video:

As per the Instruction given in the Apex Legends folder of the dataset, we have used the VirtualDub2 software to create our dataset. There we are facing issues with the Ubisoft option not being available to create a CSV file for model training, so we created our dataset manually by typing every time frame in a spreadsheet where we find motion change in the given videos to create the dataset. It is a bit of a time-consuming process for us but working in a team helps us to divide our work and we easily manage to create our dataset. Moving ahead we find the frame difference along with the video Name is the major contribution to finding the lag. So, to get better accuracy we decided to drop some of our columns that are not contributing a lot to finding the lag.

Results:

Analysis :

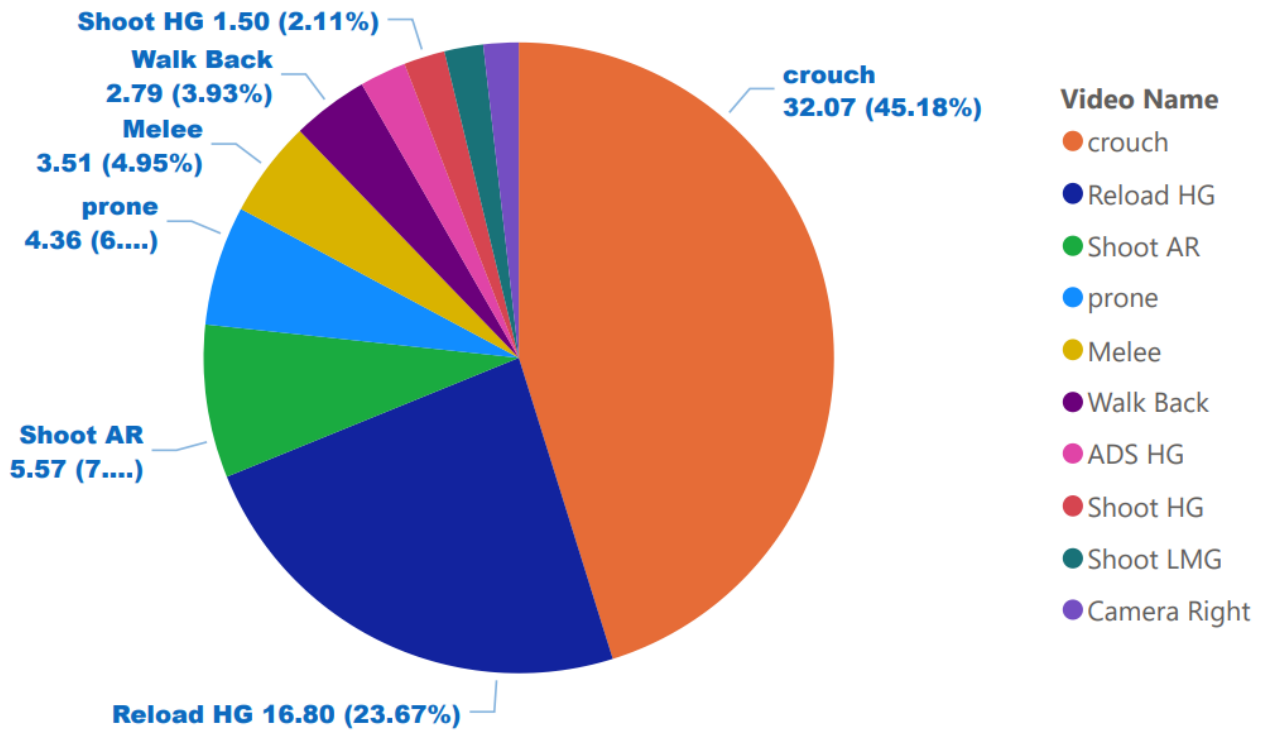
Average of Frame Difference by Video Name



Key Analytical points from above graph

- Pressing the key to Prone takes the maximum frame difference, averaging 71.67 frames lag.
- Pressing the key to Shoot AR takes the minimum frame difference with an average value of 13.63 frames lag.
- Prone, Reload HG, and Crouch comprise a frame lag of more than 15% each. Contributing a total frame lag of about 57%

Variance of Frame Difference by Video Name

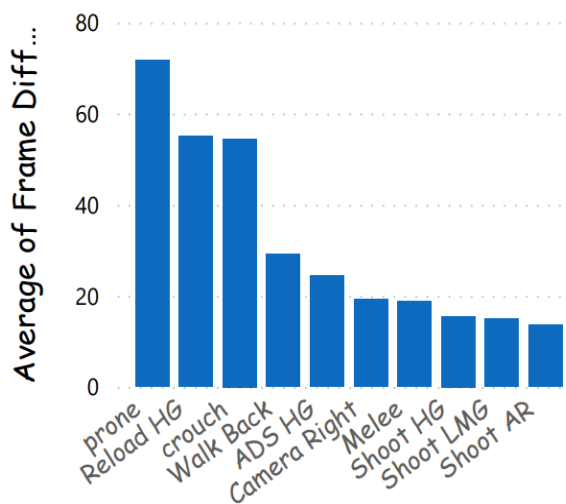


Key Analysis from above graph

- Key for Crouch showing the maximum variation in the number of frames lag
- Removing Outliers from a crouch, Reload HG, and Shoot AR might give better results while training the model to find the lag.

Average Of Frame Difference

Average of Frame Difference by Video Name

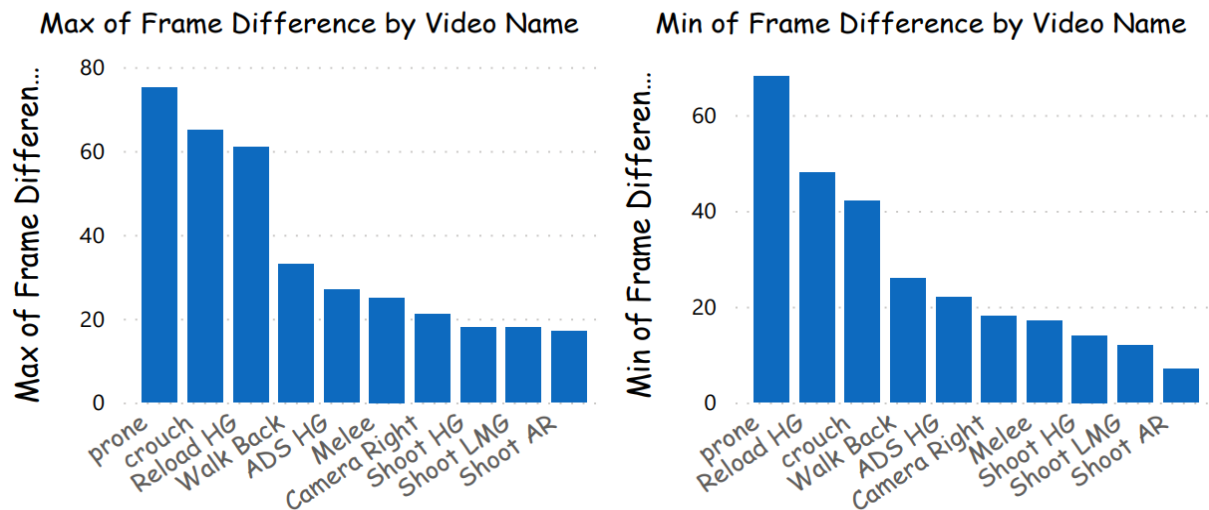


Video Name Average of Frame Difference

| | |
|--------------|--------------|
| ADS HG | 24.50 |
| Camera Right | 19.20 |
| crouch | 54.50 |
| Melee | 18.90 |
| prone | 71.67 |
| Reload HG | 55.00 |
| Shoot AR | 13.63 |
| Shoot HG | 15.54 |
| Shoot LMG | 15.06 |
| Walk Back | 29.10 |
| Total | 32.62 |

- 32.62 can be observed as an overall frame lag.
- All shooting activities such as Shoot HG, Shoot LMG & Shoot AR consist of the lowest frame lag.
- While activities that lead to changes in the Game map area such as Camera Right, Melee, and ADS HG take slightly more frame lag.
- An activity that consists of the motion of an in-game player from a certain position to another such as Prone, Crouch & Walks Back takes the most frame lag.
- Reloading the gun (Reload HG) also takes a considerably high frame lag

Max & Min Frame Difference



Video Name Max of Frame Difference

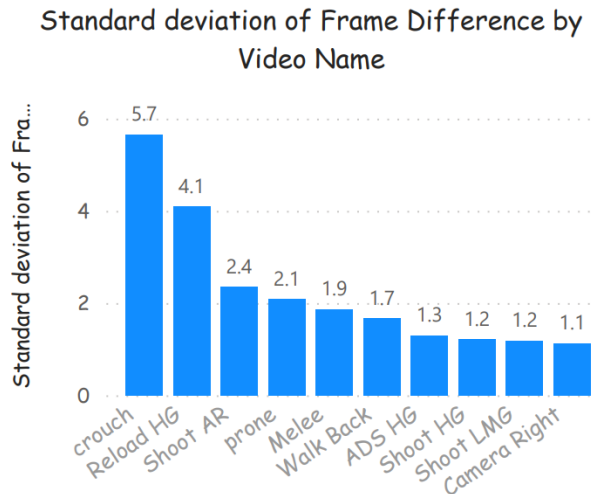
| | |
|--------------|-----------|
| ADS HG | 27 |
| Camera Right | 21 |
| crouch | 65 |
| Melee | 25 |
| prone | 75 |
| Reload HG | 61 |
| Shoot AR | 17 |
| Shoot HG | 18 |
| Shoot LMG | 18 |
| Walk Back | 33 |
| Total | 75 |

Video Name Min of Frame Difference

| | |
|--------------|----------|
| ADS HG | 22 |
| Camera Right | 18 |
| crouch | 42 |
| Melee | 17 |
| prone | 68 |
| Reload HG | 48 |
| Shoot AR | 7 |
| Shoot HG | 14 |
| Shoot LMG | 12 |
| Walk Back | 26 |
| Total | 7 |

- Prone has a Max frame difference of 75, but We can also see that the minimum frame difference in prone is 68 making a very less frame difference. Hence 75 is the maximum frame difference in prone is not impacting as an outlier.
- Similarly in Crouch we can observe a Max difference of 65 and a Min difference of 42, the difference here is 65-42 gives out 23, which points out that a Max Difference of 65 or Min difference of 42 one may be an outlier.

Standard Deviation of Frame Difference

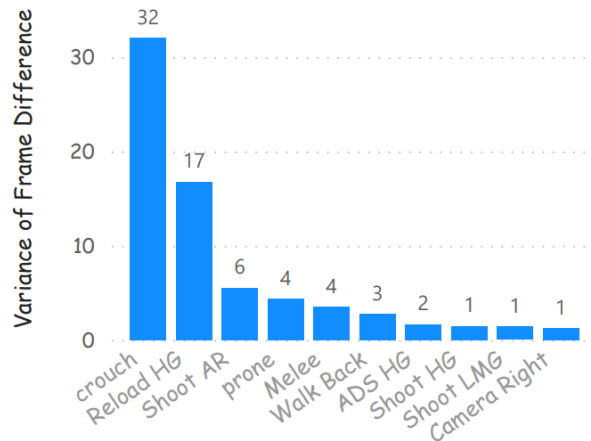


| Video Name | Standard deviation of Frame Difference |
|--------------|--|
| ADS HG | 1.30 |
| Camera Right | 1.13 |
| crouch | 5.66 |
| Melee | 1.87 |
| prone | 2.09 |
| Reload HG | 4.10 |
| Shoot AR | 2.36 |
| Shoot HG | 1.22 |
| Shoot LMG | 1.19 |
| Walk Back | 1.67 |

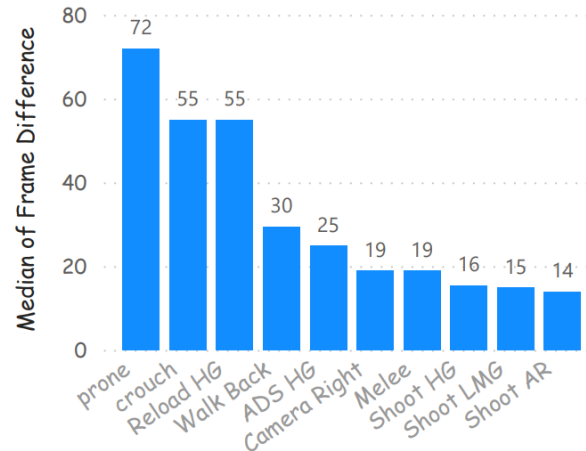
- High Amount of Deviation in data is easily observed while crouching and reloading the gun, other features are not contributing that significantly to deviation.
- This Measure of Standard Deviation is helpful further to normalize the dataset to some extent.

Variance & Median of Frame Difference

Variance of Frame Difference by Video Name



Median of Frame Difference by Video Name



| Video Name | Variance of Frame Difference |
|--------------|------------------------------|
| ADS HG | 1.69 |
| Camera Right | 1.28 |
| crouch | 32.07 |
| Melee | 3.51 |
| prone | 4.36 |
| Reload HG | 16.80 |
| Shoot AR | 5.57 |
| Shoot HG | 1.50 |
| Shoot LMG | 1.42 |
| Walk Back | 2.79 |

| Video Name | Median of Frame Difference |
|--------------|----------------------------|
| ADS HG | 25 |
| Camera Right | 19 |
| crouch | 55 |
| Melee | 19 |
| prone | 72 |
| Reload HG | 55 |
| Shoot AR | 14 |
| Shoot HG | 15.5 |
| Shoot LMG | 15 |
| Walk Back | 29.5 |

- Such data help us in data Cleaning and hyperparameter tuning of our model.
- That helps us to increase the accuracy of our model by a significant amount.

Model Training :

The code of the training can be found on the [GitHub repository](#). Alternatively, the notebook can be accessed directly on [Google Colab](#). The following results were concluded after training the model:

Linear Regression

MSE = 1.4035352641174722e-24
Accuracy of the model is 100.0 %

Random Forest Regression

MSE = 0.06069333333333378
Accuracy of the model is 99.99918735832328 %

SVR

MSE = 0.06069333333333378
Accuracy of the model is -242.03747890782208 %

Logistic Regression

MSE = 12081.28
Accuracy of the model is 12.0 %

KNN

MSE = 13337.6
Accuracy of the model is 8.0 %

Naive Bayes

MSE = 1.92
Accuracy of the model is 88.0 %

Random Forest Classification

MSE = 58.88
Accuracy of the model is 56.00000000000001 %