**New XAI method**

For each model feature importance was found for 5 random states and were averaged. The average feature importance of each model corresponding to each feature was summed and sorted from highest to lowest.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Regions | RandomForest | CatBoost | XGBoost | SUM |
| rightCheek | 1.029909 | 0.892501 | 0.760791 | 2.683201 |
| leftCheek | 0.787695 | 0.773957 | 0.599525 | 2.161177 |
| lipsUpperOuter | 0.395385 | 0.654809 | 0.418346 | 1.468539 |
| lipsUpperInner | 0.32945 | 0.356087 | 0.227311 | 0.912849 |
| lipsLowerInner | 0.294919 | 0.323933 | 0.176291 | 0.795142 |
| lipsLowerOuter | 0.275048 | 0.257556 | 0.229195 | 0.761799 |
| rightEyebrowUpper | 0.164805 | 0.221544 | 0.164526 | 0.550875 |
| rightEyeLower3 | 0.131113 | 0.100655 | 0.136718 | 0.368486 |
| leftEyeLower0 | 0.094864 | 0.069158 | 0.189709 | 0.353731 |
| leftEyebrowUpper | 0.121507 | 0.103829 | 0.12709 | 0.352426 |
| rightEyeLower1 | 0.104034 | 0.086056 | 0.143715 | 0.333804 |
| rightEyeUpper0 | 0.070306 | 0.076574 | 0.18043 | 0.32731 |
| rightEyeLower0 | 0.100692 | 0.060579 | 0.16055 | 0.321821 |
| leftEyeLower3 | 0.104344 | 0.092446 | 0.122949 | 0.319739 |
| rightEyeLower2 | 0.110078 | 0.064719 | 0.140853 | 0.31565 |
| rightEyeUpper2 | 0.103445 | 0.06803 | 0.128841 | 0.300317 |
| leftEyeUpper1 | 0.077822 | 0.035525 | 0.185374 | 0.298722 |
| leftEyeLower2 | 0.094555 | 0.059997 | 0.139283 | 0.293835 |
| leftEyeLower1 | 0.090249 | 0.093595 | 0.108907 | 0.292751 |
| leftEyeUpper2 | 0.090189 | 0.057062 | 0.13077 | 0.278021 |
| rightEyebrowLower | 0.081828 | 0.07084 | 0.11586 | 0.268528 |
| leftEyebrowLower | 0.079328 | 0.090016 | 0.079579 | 0.248923 |
| rightEyeUpper1 | 0.083078 | 0.049846 | 0.115162 | 0.248086 |
| leftEyeUpper0 | 0.065802 | 0.049928 | 0.130766 | 0.246496 |
| noseBottom | 0.034437 | 0.105552 | 0.021638 | 0.161627 |
| midwayBetweenEyes | 0.028327 | 0.101508 | 0.018577 | 0.148413 |
| noseRightCorner | 0.030914 | 0.052914 | 0.028081 | 0.111909 |
| noseLeftCorner | 0.025877 | 0.030783 | 0.019161 | 0.075821 |

Each model with tuned hyperparameters were trained on top 1 to top 28 models and the following results were obtained:  
XGBoost model has the highest accuracy score of 0.9375 with 11 regions.

Random Forest model has the highest accuracy score of 0.93 with 3 regions.

CatBoost model has the highest accuracy score of 0.945 with 10 regions.

Voting model has the highest accuracy score of 0.94 with 10 regions.

As the top 2 accuracies were obtained using the top 10 regions. XGB and RF was tuned again on the top 10 regions. Which resulted in the following:

CB: 94.5

RF: 93.75

XGB: 93.25

Voting: 94.75