# Gate placement

For gate placement, we wanted to investigate the results for adding gates near the project start, middle, and end. We also implemented functionality for drawing these diagrams, with the help of functionality implemented in Assignment 2 – Chess Games. Gates are represented as orange diamonds. These images are saved in the images folder if they are too blurry in the report.

## Villa PERT-Diagrams with gate placements

|  |  |  |
| --- | --- | --- |
| Gate after C | Gate after H | Gate after P |
|  |  |  |

# **Machine Learning Results**

# Classification

## Accuracy for different classification methods

|  |  |  |  |
| --- | --- | --- | --- |
|  | Gate after C | Gate after H | Gate after P |
| Logistic Regression | 73% | 79% | 96.5% |
| Random Forest | 73.5% | 77.5% | 98% |
| Decision Trees | 53% | 67.5% | 98% |

## **Confusion matrixes for different classification methods**

For confusion matrixes, a good prediction means that most of the values are on the diagonal.

### Gate after C

|  |  |  |
| --- | --- | --- |
| Logistic Regression | Random Forest | Decision Trees |
|  |  |  |

## Gate after H

|  |  |  |
| --- | --- | --- |
| Logistic Regression | Random Forest | Decision Trees |
|  |  |  |

## Gate after P

|  |  |  |
| --- | --- | --- |
| Logistic Regression | Random Forest | Decision Trees |
|  |  |  |

## Regression

### Accuracy tables for different regression methods

Gate after C

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R^2 | MAE | MSE | Accuracy |
| Logistic Regression | 0.63 | 16.79 | 446.48 | 63% |
| Random Forest | 0.55 | 17.97 | 536.16 | 55% |
| Decision Trees | 0.09 | 25.68 | 1076.07 | 9.9% |

Gate after H

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R^2 | MAE | MSE | Accuracy |
| Logistic Regression | 0.79 | 11.16 | 186.26 | 79% |
| Random Forest | 0.77 | 11.55 | 203.86 | 77% |
| Decision Trees | 0.54 | 16.18 | 399.04 | 54% |

Gate after P

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | R^2 | MAE | MSE | Accuracy |
| Logistic Regression | 0.99 | 1.06 | 1.71 | 99% |
| Random Forest | 0.99 | 1.24 | 2.31 | 99% |
| Decision Trees | 0.99 | 1.73 | 4.60 | 99% |

## Comment on the result

The findings indicate that setting the gate later in the project timeline leads to increased prediction accuracy. This observation aligns with expectations. However, it is essential to consider that setting the gate too late may diminish the ability to mitigate project delays effectively. Consequently, the most critical aspect of the results pertains to the accuracy of predictions when the gate is set earlier in the project. The primary objective is to achieve a high level of prediction accuracy at these earlier stages to enable timely intervention and project management.

Upon examining the classifier models, it becomes evident that logistic regression and random forest classification surpass decision tree classification in performance. A similar trend is observed in regression models, where linear regression and random forest regression demonstrate superior performance compared to decision tree regression.

One reason why decision trees may underperform is their susceptibility to overfitting. Decision trees, especially deep ones, can create very complex structures by making multiple splits on the input features, which leads to capturing intricate patterns in the training data. While this might result in high accuracy on the training data, the model may fail to perform well on the test data, as it has essentially memorized the training data instead of learning the underlying patterns that would allow it to generalize to new data.

# Statistics from 1000 samples of each risk factor

Deciles = 10

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Risk factor | Min duration | Max duration | Mean duration | Std deviation | Deciles (comma-separated) | Successes | Acceptables | Failures |
| 0.8 | 299.258 | 393.880 | 352.750 | 15.344 | 333.471, 339.671, 344.784, 348.669, 352.504, 356.175, 360.623, 366.045, 373.165 | 990 | 10 | 0 |
| 1.0 | 330.969 | 426.948 | 376.608 | 15.520 | 356.393, 363.446, 368.728, 372.157, 375.987, 379.873, 384.583, 390.212, 397.736 | 790 | 209 | 1 |
| 1.2 | 354.308 | 460.359 | 401.636 | 14.943 | 382.309, 388.955, 393.647, 398.295, 401.685, 405.277, 409.724, 414.269, 420.406 | 209 | 749 | 42 |
| 1.4 | 380.945 | 472.191 | 426.541 | 15.605 | 407.266, 414.076, 418.431, 422.463, 426.298, 430.354, 434.453, 439.738, 447.173 | 10 | 495 | 495 |