**Results**

**1.Summer Period**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **All Categories – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 699.14 | 488800.48 | 0.40 | 0.53 | 950.69 |
| XGBoost | 594.42 | 353333.23 | 0.57 | 0.61 | 811.06 |
| **Neural Network** | **452.28** | **204555.26** | **0.75** | **0.79** | **830.28** |

Best Parameters:

* Random Forest:

Criterion: poisson

Max\_depth: 10

Max\_features: sqrt

Min\_samples\_leaf: 1

* XGBoost:

Criterion: friedman\_mse

Loss: squared\_error

Max\_depth: 5

Max\_features: log2

Min\_samples\_leaf: 2

* Neural Network:

Activation: identity

Solver: lbfgs

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| **Dermafiller – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| **Random Forest** | **27.96** | **781.67** | **0.77** | **0.77** | **49.17** |
| XGBoost | 42.16 | 1777.74 | 0.48 | 0.49 | 70.54 |
| Neural Network | 53.79 | 2893.14 | 0.16 | 0.20 | 84.72 |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

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| --- | --- | --- | --- | --- | --- |
| **Mesotherapy – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| **Random Forest** | **1.67** | **2.79** | **-0.28** | **-0.25** | **2.48** |
| XGBoost | 2.21 | 4.88 | -1.23 | -1.20 | 3.17 |
| Neural Network | 3.14 | 9.83 | -3.49 | -1.57 | 6.14 |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'logistic', 'solver': 'lbfgs'}

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| --- | --- | --- | --- | --- | --- |
| **Needles – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 2.00 | 3.99 | 0.72 | 0.86 | 3.41 |
| **XGBoost** | **1.98** | **3.93** | **0.72** | **0.83** | **3.51** |
| Neural Network | 4.80 | 23.05 | -0.62 | 0.66 | 6.71 |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'tanh', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Profilho – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 517.28 | 267576.27 | 0.59 | 0.77 | 741.03 |
| XGBoost | 423.05 | 178973.35 | 0.73 | 0.75 | 565.15 |
| **Neural Network** | **318.10** | **101185.83** | **0.84** | **0.86** | **610.61** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'huber',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skinbooster – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| **Random Forest** | **33.95** | **1152.39** | **0.50** | **0.53** | **44.26** |
| XGBoost | 36.26 | 1315.07 | 0.43 | 0.46 | 51.16 |
| Neural Network | 58.23 | 3391.10 | -0.48 | 0.54 | 82.92 |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Skincare – Summer** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 51.55 | 2657.21 | 0.09 | 0.85 | 73.15 |
| XGBoost | 76.29 | 5819.75 | -1.00 | 0.86 | 99.33 |
| **Neural Network** | **33.99** | **1155.26** | **0.60** | **0.74** | **57.96** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'quantile',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

**2.Winter Period**

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| --- | --- | --- | --- | --- | --- |
| **All Categories – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 1792.80 | 3214142.17 | -11.64 | 0.46 | 2136.78 |
| XGBoost | 1610.31 | 2593089.41 | -9.20 | 0.49 | 1899.85 |
| **Neural Network** | **457.41** | **209220.28** | **0.18** | **0.46** | **711.11** |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'huber',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dermafiller – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 93.22 | 8690.51 | 0.23 | 0.77 | 142.54 |
| **XGBoost** | **24.26** | **588.44** | **0.95** | **0.95** | **34.59** |
| Neural Network | 97.11 | 9430.14 | 0.16 | 0.16 | 135.06 |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mesotherapy – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 5.60 | 31.33 | -0.20 | 0.19 | 9.65 |
| **XGBoost** | **4.58** | **20.93** | **0.19** | **0.47** | **7.91** |
| Neural Network | 5.81 | 33.76 | -0.30 | 0.15 | 9.90 |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'huber',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'logistic', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Needles – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 30.96 | 958.77 | -0.14 | 0.23 | 53.63 |
| XGBoost | 32.36 | 1047.10 | -0.25 | 0.15 | 56.03 |
| **Neural Network** | **17.72** | **314.10** | **0.63** | **0.71** | **30.43** |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Profilho – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 1443.81 | 2084586.86 | -10.25 | 0.76 | 1639.44 |
| **XGBoost** | **1320.98** | **1744994.71** | **-8.42** | **0.57** | **1630.13** |
| Neural Network | 1376.40 | 1894477.23 | -9.23 | -0.28 | 1959.08 |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

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| --- | --- | --- | --- | --- | --- |
| **Skinbooster – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 95.15 | 9053.49 | -4.07 | 0.85 | 115.47 |
| XGBoost | 105.61 | 11154.25 | -5.25 | 0.77 | 128.05 |
| **Neural Network** | **51.87** | **2690.48** | **-0.51** | **0.85** | **65.52** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Skincare – Winter** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 146.18 | 21369.34 | -1.31 | 0.08 | 236.12 |
| **XGBoost** | **97.87** | **9578.92** | **-0.03** | **0.16** | **160.44** |
| Neural Network | 249.76 | 62380.59 | -5.73 | -0.05 | 363.33 |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'quantile',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

**3.Whole Year Period**

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| --- | --- | --- | --- | --- | --- |
| **All Categories – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 1876.24 | 3520264.55 | -1.84 | 0.22 | 3170.99 |
| XGBoost | 1458.24 | 2126469.87 | -0.72 | 0.19 | 2799.59 |
| **Neural Network** | **462.02** | **213458.06** | **0.83** | **0.86** | **1101.31** |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dermafiller – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 116.41 | 13552.42 | -0.17 | 0.48 | 224.22 |
| **XGBoost** | **97.84** | **9571.77** | **0.17** | **0.41** | **195.24** |
| Neural Network | 120.33 | 14480.47 | -0.25 | 0.26 | 216.33 |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'huber',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

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| --- | --- | --- | --- | --- | --- |
| **Mesotherapy – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 4.48 | 20.11 | -0.21 | 0.06 | 10.72 |
| **XGBoost** | **3.93** | **15.41** | **0.07** | **0.26** | **9.37** |
| Neural Network | 4.70 | 22.11 | -0.33 | -0.02 | 11.63 |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'huber',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'tanh', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Needles – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 15.71 | 246.86 | 0.20 | 0.28 | 51.33 |
| **XGBoost** | **15.65** | **244.82** | **0.20** | **0.28** | **50.56** |
| Neural Network | 17.50 | 306.10 | 0.00 | 0.12 | 57.16 |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'logistic', 'solver': 'adam'}

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| --- | --- | --- | --- | --- | --- |
| **Profilho – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 1675.11 | 2805995.72 | -2.19 | 0.27 | 3001.09 |
| XGBoost | 1477.46 | 2182875.99 | -1.48 | 0.16 | 2750.87 |
| **Neural Network** | **1103.03** | **1216675.12** | **-0.38** | **0.29** | **2346.13** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skinbooster – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 204.98 | 42015.89 | -8.91 | -0.04 | 277.52 |
| XGBoost | 204.83 | 41955.24 | -8.90 | 0.09 | 278.94 |
| **Neural Network** | **61.91** | **3832.73** | **0.10** | **0.54** | **102.10** |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'huber',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skincare – Whole Year** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| **Random Forest** | **127.95** | **6370.32** | **-0.46** | **0.43** | **295.96** |
| XGBoost | 136.68 | 18682.36 | -0.66 | 0.58 | 276.44 |
| Neural Network | 349.29 | 122000.11 | -9.87 | 0.00 | 581.08 |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'huber',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'tanh', 'solver': 'adam'}

**4.Covid Period**

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| --- | --- | --- | --- | --- | --- |
| **All Categories – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 2291.36 | 5250316.42 | 0.64 | 0.82 | 6300.41 |
| XGBoost | 2112.92 | 4464412.14 | 0.69 | 0.83 | 5953.56 |
| **Neural Network** | **1133.06** | **1283814.63** | **0.91** | **0.94** | **2327.37** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Dermafiller – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 206.86 | 42791.74 | 0.67 | 0.79 | 502.46 |
| **XGBoost** | **183.05** | **33507.03** | **0.74** | **0.80** | **464.39** |
| Neural Network | 188.81 | 35648.21 | 0.73 | 0.82 | 384.63 |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Mesotherapy – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 3.01 | 9.06 | 0.23 | 0.27 | 7.93 |
| XGBoost | 3.28 | 10.76 | 0.08 | 0.10 | 6.70 |
| **Neural Network** | **1.85** | **3.44** | **0.71** | **0.77** | **3.64** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'quantile',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'tanh', 'solver': 'sgd'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Needles – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 22.69 | 514.94 | 0.24 | 0.43 | 71.09 |
| **XGBoost** | **22.03** | **485.42** | **0.29** | **0.42** | **68.86** |
| Neural Network | 30.75 | 945.70 | -0.39 | 0.24 | 86.79 |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'huber',

'max\_depth': 5,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'tanh', 'solver': 'adam'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Profilho – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 2501.59 | 6257969.26 | 0.39 | 0.72 | 6616.18 |
| XGBoost | 2228.09 | 4964391.25 | 0.51 | 0.75 | 5937.97 |
| **Neural Network** | **818.93** | **670646.48** | **0.93** | **0.94** | **1498.09** |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

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| --- | --- | --- | --- | --- | --- |
| **Skinbooster – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| **Random Forest** | **21.42** | **458.81** | **0.96** | **0.96** | **45.95** |
| XGBoost | 27.98 | 783.14 | 0.93 | 0.96 | 50.11 |
| Neural Network | 110.95 | 12309.57 | -0.10 | 0.50 | 194.54 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | J | F | M | A |  |  |  |  |  |  |  |  |
| Actual |  |  |  |  |  |  |  |  |  |  |  |  |
| Predicted |  |  |  |  |  |  |  |  |  |  |  |  |
| Difference |  |  |  |  |  |  |  |  |  |  |  |  |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'friedman\_mse',

'loss': 'quantile',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'relu', 'solver': 'lbfgs'}

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| --- | --- | --- | --- | --- | --- |
| **Skincare – Covid** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 95.19 | 9061.22 | 0.72 | 0.79 | 193.77 |
| XGBoost | 67.16 | 4509.87 | 0.86 | 0.88 | 137.10 |
| **Neural Network** | **65.80** | **4330.27** | **0.86** | **0.91** | **177.75** |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

**5. Last 3 Months**

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| --- | --- | --- | --- | --- | --- |
| **Dermafiller – Last 3 Months** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 130.93 | 17142.74 | -0.47 | 0.27 | 218.95 |
| XGBoost | 126.66 | 16042.45 | -0.38 | 0.52 | 207.96 |
| **Neural Network** | **67.94** | **4616.01** | **0.60** | **0.75** | **117.54** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dec | Feb | Mar |
| Actual | 623 | 711 | 883 |
| Predicted | 617.29 | 711.06 | 765.46 |
| Difference |  |  |  |

Best Parameters:

* Random Forest:

Criterion: friedman\_mse

Max\_depth: 5

Max\_features: sqrt

Min\_samples\_leaf: 1

* XGBoost:

Criterion: squared\_error

Loss: squared\_error

Max\_depth: 5

Max\_features: log2

Min\_samples\_leaf: 2

* Neural Network:

Activation: identity

Solver: lbfgs

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| **Mesotherapy – Last 3 Months** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 0.99 | 0.98 | -0.46 | -0.43 | 1.50 |
| XGBoost | 1.74 | 3.02 | -3.53 | -3.33 | 2.30 |
| **Neural Network** | **0.98** | **0.96** | **-0.44** | **0.41** | **1.48** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dec | Feb | Mar |
| Actual | 8 | 7 | 9 |
| Predicted | 6.52 | 7.25 | 9.80 |
| Difference |  |  |  |

Best Parameters:

* Random Forest:

Criterion: friedman\_mse

Max\_depth: 5

Max\_features: sqrt

Min\_samples\_leaf: 1

* XGBoost:

Criterion: friedman\_mse

Loss: squared\_error

Max\_depth: 5

Max\_features: sqrt

Min\_samples\_leaf: 2

* Neural Network:

Activation: tanh

Solver: adam

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| --- | --- | --- | --- | --- | --- |
| **Needles – Last 3 Months** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 3.17 | 10.05 | 0.38 | 0.82 | 4.52 |
| XGBoost | 5.35 | 28.65 | -0.77 | 0.72 | 6.78 |
| **Neural Network** | **1.90** | **3.62** | **0.78** | **0.99** | **2.34** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dec | Feb | Mar |
| Actual | 8 | 9 | 17 |
| Predicted | 6.18 | 6.66 | 15.56 |
| Difference |  |  |  |

Best Parameters:

* Random Forest:

Criterion: squared\_error

Max\_depth: 10

Max\_features: log2

Min\_samples\_leaf: 1

* XGBoost:

Criterion: squared\_error

Loss: squared\_error

Max\_depth: 10

Max\_features: sqrt

Min\_samples\_leaf: 1

* Neural Network:

Activation: identity

Solver: adam

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| --- | --- | --- | --- | --- | --- |
| **Profilho – Last 3 Months** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 1751.73 | 3068542.82 | 0.61 | 0.62 | 2444.21 |
| XGBoost | 1990.93 | 3963801.21 | 0.49 | 0.70 | 2644.16 |
| **Neural Network** | **814.83** | **663947.75** | **0.92** | **1.00** | **963.92** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dec | Feb | Mar |
| Actual | 10237 | 13809 | 17092 |
| Predicted | 10893.38 | 14603.91 | 18055.92 |
| Difference |  |  |  |

Best Parameters:

* Random Forest:

{'criterion': 'poisson',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 10,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'lbfgs'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skinbooster – Last 3 Months** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 41.11 | 1690.34 | 0.60 | 0.68 | 55.77 |
| **XGBoost** | **23.83** | **568.03** | **0.86** | **0.91** | **40.42** |
| Neural Network | 50.13 | 2513.23 | 0.40 | 0.54 | 77.29 |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dec | Feb | Mar |
| Actual | 205 | 327 | 354 |
| Predicted | 209.49 | 286.58 | 346.94 |
| Difference |  |  |  |

Best Parameters:

* Random Forest:

{'criterion': 'friedman\_mse',

'max\_depth': 10,

'max\_features': 'log2',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Skincare – Last 3 Months** | | | | | |
| **Algorithm** | **RMSE** | **MSE** | **R^2** | **Explained Variance** | **Max Error** |
| Random Forest | 26.52 | 703.51 | 0.29 | 0.29 | 34.86 |
| XGBoost | 43.01 | 1849.59 | -0.86 | 0.53 | 61.08 |
| **Neural Network** | **19.83** | **393.31** | **0.60** | **0.61** | **25.42** |

|  |  |  |  |
| --- | --- | --- | --- |
|  | Dec | Feb | Mar |
| Actual | 638 | 582 | 564 |
| Predicted | 639.85 | 607.42 | 540.97 |
| Difference |  |  |  |

Best Parameters:

* Random Forest:

{'criterion': 'squared\_error',

'max\_depth': 5,

'max\_features': 'sqrt',

'min\_samples\_leaf': 1}

* XGBoost:

{'criterion': 'squared\_error',

'loss': 'squared\_error',

'max\_depth': 5,

'max\_features': 'log2',

'min\_samples\_leaf': 2}

* Neural Network:

{'activation': 'identity', 'solver': 'adam'}

126 Experiments

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Summer** | **Winter** | **Whole Year** | **Covid** | **Last 3 Months** |
| **Dermafiller** | 27.96  Random Forest | 24.26  XGBoost | 97.84  XGBoost | 183.05  XGBoost | 67.94  Neural Network |
| **Mesotherapy** | 1.67  Random Forest | 4.58  XGBoost | 3.93  XGBoost | 1.85  Neural Network | 0.98  Neural Network |
| **Needles** | 1.98  XGBoost | 17.72  Neural Network | 15.65  XGBoost | 22.03  XGBoost | 1.90  Neural Network |
| **Profilho** | 318.10  Neural Network | 1320.98  XGBoost | 1103.03  Neural Network | 818.93  Neural Network | 814.83  Neural Network |
| **Skinbooster** | 33.95  Random Forest | 51.87  Neural Network | 61.91  Neural Network | 21.42  Random Forest | 23.83  XGBoost |
| **Skincare** | 33.99  Neural Network | 97.87  XGBoost | 127.95  Random Forest | 65.80  Neural  Network | 19.83  Neural Network |