

# Enhancement of COVID-19 symptom-based screening with quality-based classifier optimisation – supplementary materials

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## Appendix

The parameters of the final classification models generated by means of the XGBoost method are presented in Table A.1. The parameters of the final classification models generated by means of the Logistic Regression method are presented in Tables A.2, A.3 and A.4.

Table A.1: Parameters of the final XGBoost classifiers

| Measure  | $\alpha$ | learn_rate | max_depth | sample_rate | col_sample_rate | ntrees | threshold |
|----------|----------|------------|-----------|-------------|-----------------|--------|-----------|
| $M_{pv}$ | 0.15     | 0.13       | 8         | 0.55        | 0.8             | 50     | 0.81      |
|          | 0.25     | 0.13       | 8         | 0.55        | 0.8             | 50     | 0.81      |
|          | 0.35     | 0.62       | 8         | 0.95        | 0.4             | 40     | 0.86      |
|          | 0.45     | 0.56       | 8         | 0.95        | 1               | 50     | 0.84      |
|          | 0.5      | 0.56       | 8         | 0.95        | 1               | 50     | 0.84      |
|          | 0.55     | 0.56       | 8         | 0.95        | 1               | 50     | 0.84      |
|          | 0.65     | 0.1        | 7         | 0.92        | 0.3             | 40     | 0.49      |
|          | 0.75     | 0.15       | 8         | 1           | 0.2             | 45     | 0.49      |
|          | 0.85     | 0.05       | 5         | 0.7         | 0.65            | 55     | 0.3       |
| $M_{ss}$ | 0.15     | 0.51       | 4         | 1           | 0.1             | 80     | 0.48      |
|          | 0.25     | 0.15       | 3         | 1           | 0.58            | 50     | 0.41      |
|          | 0.35     | 0.11       | 2         | 1           | 0.7             | 50     | 0.31      |
|          | 0.45     | 0.15       | 3         | 0.95        | 0.2             | 90     | 0.3       |
|          | 0.5      | 0.1        | 6         | 0.5         | 0.2             | 80     | 0.3       |
|          | 0.55     | 0.1        | 6         | 0.5         | 0.2             | 80     | 0.3       |
|          | 0.65     | 0.05       | 5         | 0.52        | 0.55            | 50     | 0.29      |
|          | 0.75     | 0.03       | 5         | 0.45        | 0.5             | 45     | 0.3       |
|          | 0.85     | 0.05       | 8         | 1           | 0.18            | 60     | 0.2       |

Table A.2: Logistic regression models summary for maximisation of metrics concerning NPV and PPV

| Feature  | Coefficient  | SE          | z            | p           |
|--|--------------|-------------|--------------|-------------|
| Weight for NPV = 0.15. Threshold = 0.758.                    |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.25. Threshold = 0.758.                    |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.35. Threshold = 0.758.                    |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.45. Threshold = 0.758.                    |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.5. Threshold = 0.758.                     |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.55. Threshold = 0.758.                    |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.65. Threshold = 0.372.                    |              |             |              |             |
| Intercept  | -0.684427926 | 0.131367047 | -5.210042731 | 1.89E-07    |
| Loss of taste/smell (Yes)                                    | 1.43642336   | 0.143183672 | 10.03203323  | 1.10E-23    |
| Number of days of symptoms                                   | -0.114847612 | 0.022167045 | -5.181006949 | 2.21E-07    |
| Contact with infected person (Yes)                           | 0.73243392   | 0.158687959 | 4.615560778  | 3.92E-06    |
| Weight for NPV = 0.75. Threshold = 0.277.                    |              |             |              |             |
| Intercept  | -1.185037093 | 0.173930058 | -6.813296729 | 9.54E-12    |
| Loss of taste/smell (Yes)                                    | 1.765138586  | 0.169591553 | 10.40817515  | 2.28E-25    |
| Number of days of symptoms                                   | -0.20167174  | 0.032512898 | -6.202822715 | 5.55E-10    |
| Contact with infected person (Yes)                           | 1.206253538  | 0.201464262 | 5.987431857  | 2.13E-09    |
| Cough (Yes)  | 0.626345014  | 0.158541082 | 3.95067958   | 7.79E-05    |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1.170163002 | 0.323113945 | -3.6215181   | 0.000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0.111939548  | 0.027563239 | 4.061189973  | 4.88E-05    |
| Weight for NPV = 0.85. Threshold = 0.12.                     |              |             |              |             |
| Intercept  | -1.185037093 | 0.173930058 | -6.813296729 | 9.54E-12    |
| Loss of taste/smell (Yes)                                    | 1.765138586  | 0.169591553 | 10.40817515  | 2.28E-25    |
| Number of days of symptoms                                   | -0.20167174  | 0.032512898 | -6.202822715 | 5.55E-10    |
| Contact with infected person (Yes)                           | 1.206253538  | 0.201464262 | 5.987431857  | 2.13E-09    |
| Cough (Yes)  | 0.626345014  | 0.158541082 | 3.95067958   | 7.79E-05    |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1.170163002 | 0.323113945 | -3.6215181   | 0.000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0.111939548  | 0.027563239 | 4.061189973  | 4.88E-05    |

Table A.3: Logistic regression models summary for maximisation of metrics concerning Sensitivity and Specificity for  $\alpha \leq 0.55$

| Feature  | Coefficient  | SE          | z            | p           |
|--|--------------|-------------|--------------|-------------|
| Weight for Sensitivity = 0.15. Threshold = 0.533.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.25. Threshold = 0.411.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.35. Threshold = 0.338.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.45. Threshold = 0.319.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.5. Threshold = 0.319.             |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.55. Threshold = 0.319.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |

Table A.4: Logistic regression models summary for maximisation of metrics concerning Sensitivity and Specificity for  $\alpha > 0.55$

| Feature  | Coefficient  | SE          | z            | p           |
|--|--------------|-------------|--------------|-------------|
| Weight for Sensitivity = 0.65. Threshold = 0.277.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.75. Threshold = 0.277.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |
| Weight for Sensitivity = 0.85. Threshold = 0.235.            |              |             |              |             |
| Intercept  | -1,185037093 | 0,173930058 | -6,813296729 | 9,53871E-12 |
| Loss of taste/smell (Yes)                                    | 1,765138586  | 0,169591553 | 10,40817515  | 2,27541E-25 |
| Number of days of symptoms                                   | -0,20167174  | 0,032512898 | -6,202822715 | 5,54593E-10 |
| Contact with infected person (Yes)                           | 1,206253538  | 0,201464262 | 5,987431857  | 2,1318E-09  |
| Cough (Yes)  | 0,626345014  | 0,158541082 | 3,95067958   | 7,79296E-05 |
| Loss of taste/smell (Yes):Contact with infected person (Yes) | -1,170163002 | 0,323113945 | -3,6215181   | 0,000292879 |
| Number of days of symptoms:Temperature > 38°C (Yes)          | 0,111939548  | 0,027563239 | 4,061189973  | 4,88232E-05 |