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| AutoML Modeling Report |  |

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Binary Classifier with Clean/Balanced Data

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| **Train/Test Split**  How much data was used for training? How much data was used for testing? | 200 images (100 normal, 100 pneumonia) have been used for training and 20 images (10 normal, 10 pneumonia) for testing. |
| **Confusion Matrix**  What do each of the cells in the confusion matrix describe? What values did you observe (include a screenshot)? What is the true positive rate for the “pneumonia” class? What is the false positive rate for the “normal” class? | The first cell describes the true positive rate for pneumonia the second cell describe the false positive rate for pneumonia, the third cell describe the false positive rate for normal the fourth cell describe the true positive rate for normal.  Where I observed 100% true positive rate for pneumonia  And 100% true positive rate for normal.  The true positive rate for pneumonia is 100%.  The false positive rate for normal is 0%. |
| **Precision and Recall**  What does precision measure? What does recall measure? What precision and recall did the model achieve (report the values for a score threshold of 0.5)? | Precision is the ratio of true positives to predicted positives.  Recall is the ratio of true positives to actual positives.  The model reported 100% precision and 100% recall. |
| **Score Threshold**  When you increase the threshold what happens to precision? What happens to recall? Why? | The precision increases, but the recall decrease.  When we increase the classification threshold the number of false positives decreases, but false negatives increase.  because the model calculates the Possibility of each image being in the same class. |

Binary Classifier with Clean/Unbalanced Data

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| **Train/Test Split**  How much data was used for training? How much data was used for testing? | 400 images (100 normal, 300 pneumonia) have been used for training and 40 images for testing. |
| **Confusion Matrix**  How has the confusion matrix been affected by the unbalanced data? Include a screenshot of the new confusion matrix. | the true positive rate decreased, and the false positive rate increased in the normal prediction in result of the lack in normal data compared to pneumonia. |
| **Precision and Recall**  How have the model’s precision and recall been affected by the unbalanced data (report the values for a score threshold of 0.5)? | The unbalanced data affected precision and recall by decreasing the true positive rate and increasing false positive rate in the normal prediction that result in lower precision and recall.  Where the precision is 95%.  And the recall is 95%. |
| **Unbalanced Classes**  From what you have observed, how do unbalanced classed affect a machine learning model? | The model got affected from the lack in normal data compared to pneumonia in the unbalanced data thus classifying some of the pneumonia data as normal resulting in lower true positive rate and higher false positive rate in the normal prediction and lowering the precision and recall. |

Binary Classifier with Dirty/Balanced Data

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| **Confusion Matrix**  How has the confusion matrix been affected by the dirty data? Include a screenshot of the new confusion matrix. | The matrix got affected by the dirty data been classified wrong where 40% true positive and 60% false positive in pneumonia and 20 % false positive and 80 % true positive in normal this happened because of a portion of normal data been places inside the pneumonia file and a portion of pneumonia placed in normal file causing misclassifying. |
| **Precision and Recall**  How have the model’s precision and recall been affected by the dirty data (report the values for a score threshold of 0.5)? Of the binary classifiers, which has the highest precision? Which has the highest recall? | The Precision and recall got affected when the dirty data corrupt the true positive and false positive thus resulting in inaccurate Precision and recall.  The highest Precision and recall is the Binary Classifier with Clean/Balanced Data. |
| **Dirty Data**  From what you have observed, how does dirty data affect a machine learning model? | This dirty data affected the model by making it misclassify data in training by adding a portion of normal data inside the pneumonia file and a portion of pneumonia in normal file causing in a bad Precision and recall and resulting in inaccurate model. |

3-Class Model

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| **Confusion Matrix**  Summarize the 3-class confusion matrix. Which classes is the model most likely to confuse? Which class(es) is the model most likely to get right? Why might you do to try to remedy the model’s “confusion”? Include a screenshot of the new confusion matrix. | In this Confusion Matrix we can see 3 classes normal, bacterial pneumonia, and viral pneumonia, the normal class have 100% true positive and the viral pneumonia have 73% true positive and 27% false positive, the bacterial pneumonia have 60% true positive and 40% false positive.  Which make the bacterial pneumonia the most confusing class and the normal class is the most to get right.  I might remedy the model’s confusion by adding more balanced data to the model so it can distinguish between the viral and the bacterial and train it more. |
| **Precision and Recall**  What are the model’s precision and recall? How are these values calculated (report the values for a score threshold of 0.5)? | The Precision is 82.14%  The recall is 74.19%  Precision= = 0.81  Recall = = 0.73 |
| **F1 Score**  What is this model’s F1 score? | F1= = |