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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/8D77B2E4.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/7B96DC70.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/16692BFE.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/8E6B8BC.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/17ECEA2A.tmp Uganda FCS** | |
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**Figure 2. ROC curves for classifying the** **food secure category VS not**

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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/E8AB7E37.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/C7B37C5D.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/E59FEB73.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/E57128F9.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/77FEEE6F.tmp**  **Uganda FCS** | |

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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/1CB511E3.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/54B7C8E9.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/DB98C3DF.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/C01ED845.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/6C46F79B.tmp**  **Uganda FCS** | |

**Figure 3. ROC curves for classifying the 20 percent food insecure category**

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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/BDDF05F5.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/CF1060CB.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/FE1A4011.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/B92BCD47.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/44516DED.tmp**  **Uganda FCS** | |

**Figure 4. ROC curves with different sampling for the most food insecure category**

**Table 1: ML algorithm V.S. baseline results with most food secure category versus the rest** **categorization**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Food Security Measure | Threshold | Recall  (Base  line) | Recall  (ML) | F-1 score  (Base  line) | F-1 score (ML) | Accuracy  (Baseline) | Accuracy  (ML) |
| Malawi | FCS | 0.50 | 0.38 | 0.55 - 0.89 | 0.47 | 0.66-0.75 | 0.55 | 0.52-0.69 |
| rCSI | 0.40 | 0.60 | 0.76 - 0.96 | 0.71 | 0.83-0.94 | 0.58 | 0.76-0.96 |
| Tanzania | FCS | 0.30 | 0.11 | 0.78 – 1.00 | 0.14 | 0.22-0.50 | 0.84 | 0.12-0.84 |
| rCSI | 0.30 | 0.44 | 0.72-1.00 | 0.46 | 0.56-0.57 | 0.59 | 0.40-0.59 |
| Uganda | FCS | 0.50 | 1.00 | 0.57-1.00 | 0.39 | 0.39-0.48 | 0.25 | 0.24-0.70 |

**\*** ML results shown in range as the performance of the three models vary slightly

**Table 2: ML algorithm V.S. baseline results with most food insecure category versus the rest categorization**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Country | Food Security Measure | Threshold | Recall  (Baseline) | Recall  (ML) | Recall  (ML+  sampling) | F-1 score  (Baseline) | F-1 score (ML) | F-1 score  (ML+  Sampling) |
| Malawi | FCS | 0.01 | 0.36 | 0.73-1.00 | 0.82-0.91 | 0.04 | 0.03-0.06 | 0.03–0.06 |
| rCSI | 0.01 | 0.34 | 0.00-0.85 | 0.15-0.25 | 0.16 | 0.03-0.16 | 0.12-0.17 |
| Tanzania | FCS | 0.01 | 0.00 | 1.00-1.00 | 1.00-1.00 | 0.00 | 0.01-0.04 | 0.01-0.04 |
| rCSI | 0.01 | 0.00 | 0.80-1.00 | 1.00-1.00 | 0.00 | 0.03-0.06 | 0.03-0.03 |
| Uganda | FCS | 0.08 | 0.00 | 0.00-1 | 0.86-0.86 | 0.00 | 0.00-0.30 | 0.19-0.32 |

\* ML results shown in range as the performance of the three models vary slightly

**Table 3: error analysis based on a binary cutoff (most food insecure category versus the rest)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Country | Food Security Measure | Percent of False Negative  (%) | Magnitude of misclassification  (average % off from the cut-off) | Percent of False Positive  (%) | Magnitude of misclassification  (average % off from the cut-off) |
| Malawi | FCS | 0.13 | 6.47 | 54.6 | 42.67 |
| rCSI | 6.91 | 27.13 | 4.73 | 69.72 |
| Tanzania | FCS | 0 | 0 | 21.15 | 86.21 |
| rCSI | 0.32 | 33.04 | 20.51 | 77.41 |
| Uganda | FCS | 0 | 0 | 47.3 | 66.56 |

**Table 1. Results of the percentage of households in the middle and most food insecure category**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Country | Measure | Model | R squared | |
|  |  |  | Percent of most food insecure | Percent of middle and most food insecure |
| Malawi | FCS | Linear Regression | 0 | 0.008 |
| Malawi | rCSI | Linear Regression | 0.001 | 0 |
| Tanzania | FCS | Linear Regression | 0.116 | 0.205 |
| Tanzania | rCSI | Linear Regression | 0.085 | 0.082 |
| Uganda | FCS | Linear Regression | 0.037 | 0.121 |
| Malawi | FCS | LASSO | 0.081 | 0.138 |
| Malawi | rCSI | LASSO | 0.016 | 0.033 |
| Tanzania | FCS | LASSO | 0.117 | 0.237 |
| Tanzania | rCSI | LASSO | 0.031 | 0.094 |
| Uganda | FCS | LASSO | 0.046 | 0.138 |
| Malawi | FCS | ElasticNet | 0.086 | 0.128 |
| Malawi | rCSI | ElasticNet | 0.016 | 0.032 |
| Tanzania | FCS | ElasticNet | 0.113 | 0.25 |
| Tanzania | rCSI | ElasticNet | 0.031 | 0.086 |
| Uganda | FCS | ElasticNet | 0.045 | 0.169 |
| Malawi | FCS | Random Forest | 0.217 | 0.536 |
| Malawi | rCSI | Random Forest | 0.128 | 0.196 |
| Tanzania | FCS | Random Forest | 0.176 | 0.287 |
| Tanzania | rCSI | Random Forest | 0.07 | 0.084 |
| Uganda | FCS | Random Forest | 0.178 | 0.276 |

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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/6486E92.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/7A9934FF.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/7F110665.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/79BAEABB.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/AEC18F81.tmp**  **Uganda FCS** | |

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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/F65CB155.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/609D032B.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/C34BF171.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/2FB865A7.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/2E4854D.tmp**  **Uganda FCS** | |

**Figure A2. Precision-Recall** **of Baseline vs. ML algorithms (most food insecure VS not)**

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| /var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/12D68F61.tmp  **Malawi FCS** | /var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/9F7CE917.tmp  **Malawi rCSI** |
| /var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/3B5B8A3D.tmp  **Tanzania FCS** | /var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/CD8D9453.tmp  **Tanzania rCSI** |
| /var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/7B0624D9.tmp  **Uganda FCS** | |

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| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/42398A1B.tmp**  **Malawi FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/89F45E1.tmp**  **Malawi rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/6E936397.tmp**  **Tanzania FCS** | **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/513868BD.tmp**  **Tanzania rCSI** |
| **/var/folders/8_/hm9hv4nd0snc_rjfnk1n2_0m0000gn/T/com.microsoft.Word/Content.MSO/C85276D3.tmp**  **Uganda FCS** | |

**Figure A2. Precision-Recall curves for classifying the most food insecure category**