

New Release

# Device Control Desktop App

Minor version - V3.0.12

2024/08/16

File Name  
VN\_ROB\_G1S16\_TTDSUPERCLFile Location  
D:\Projects\csmart-digit-validation\ROB filesLast Analysis Model  
224\_MCL\_RNXT\_CAN\_VNM\_NATV00\_D86Francisco Massucci Silveira  
Open Web Server

## Quality Control

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- Artificial Intelligence
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- Image Mosaic
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## Cloud Services

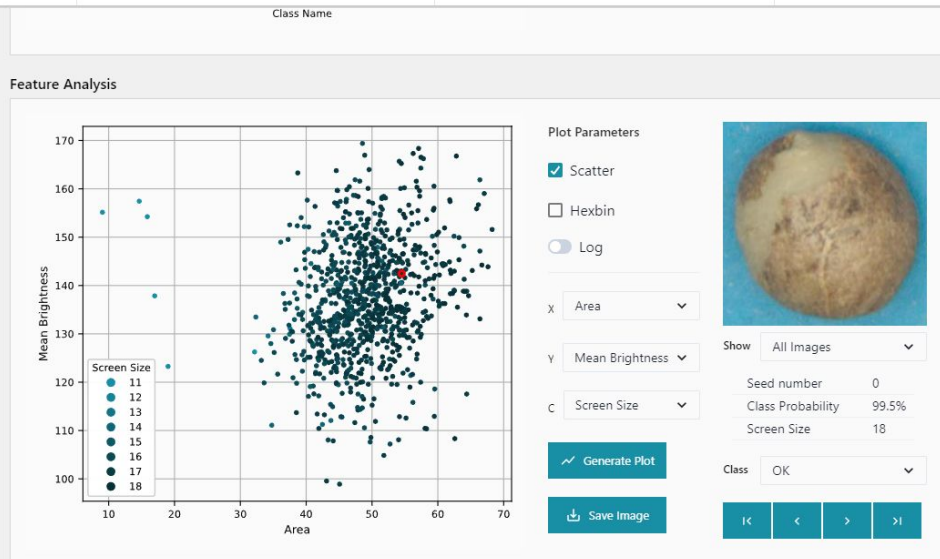
- Upload Analysis

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## AI Model Parameters

Average Entropy 7.32%

Inference Confidence **High Confidence**

Cohen's Kappa 87.3%

Binary Accuracy  
**894**  
Ratio: 97.17%

Binary Error  
**26**  
Ratio: 2.83%

Multiclass Accuracy  
**892**  
Ratio: 96.96%

Multiclass Error  
**28**  
Ratio: 3.04%

Confusion Matrix

Analysis Generated on 2024/06/18 at 15:40:00 by DESKTOP-PVBUDNC | 261 pixels per cm | 5 min area | 70 max area

# Dashboard

1. **AI Model Parameters** now presents more features:

**Cohen's Kappa coefficient** measures how well two systems agree when classifying things—in this case, the AI model and Human Analysis (ground truth). It also considers that some agreements might happen by chance. A score near 0 indicates total disagreement, while 100% shows the AI model's predictions are perfectly aligned with human judgment. This metric becomes relevant after the user has adjusted the classification of images in the image mosaic.

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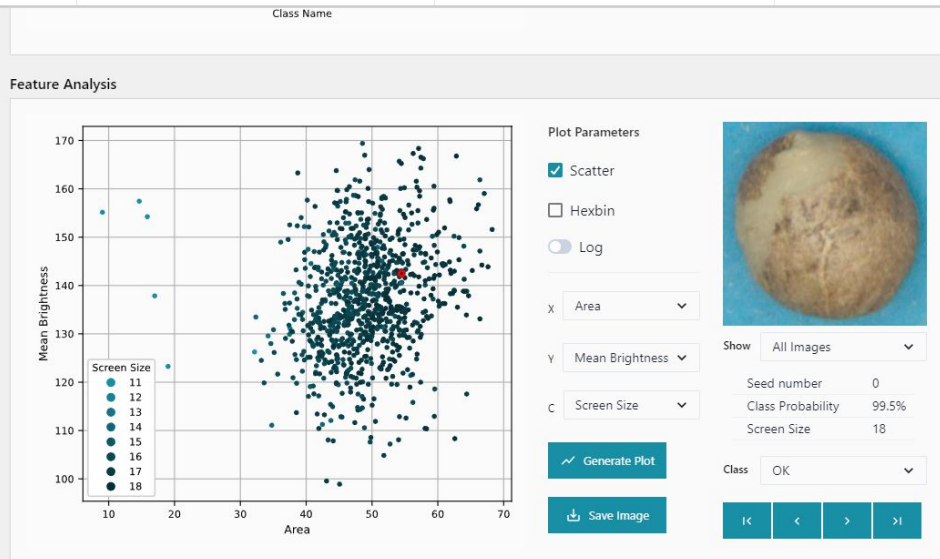
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Confusion Matrix

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# Dashboard

2. **Binary Accuracy and Binary Error** measures are used to evaluate the performance of an AI model when differentiating between good coffee and defective coffee. Binary Accuracy calculates the percentage of correct predictions for defective classes out of all predictions, while Binary Error represents the percentage of incorrect predictions. These metrics are crucial for understanding how well the model distinguishes between good and defective coffees, disregarding errors within these subsets.

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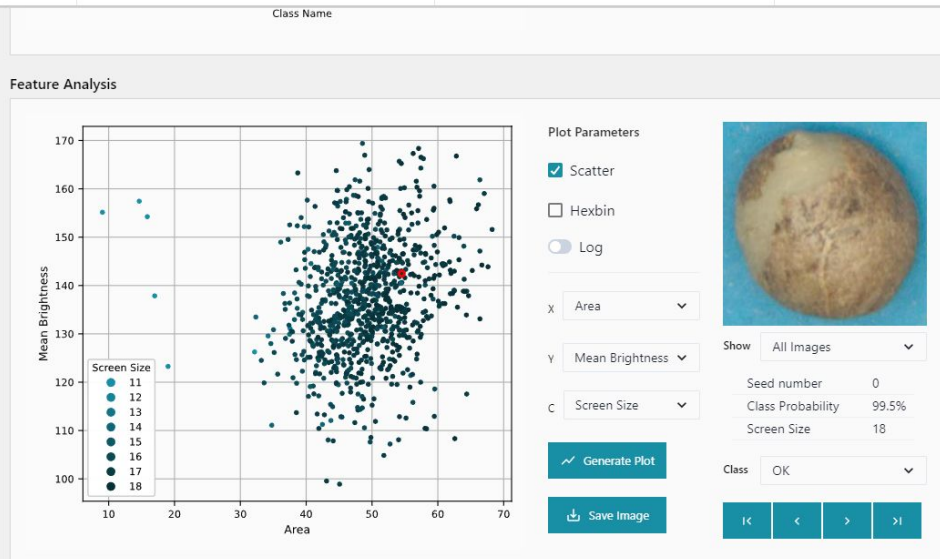
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Multiclass Error  
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Ratio: 3.04%

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3. **Multiclass Accuracy and Error** are used to evaluate the performance of an AI model when differentiating between all classes present in the model. Multiclass Accuracy calculates the percentage of correct predictions for each class out of all predictions, while Multiclass Error represents the percentage of incorrect predictions across these classes. These metrics are essential for understanding how well the model distinguishes between various classes and assessing the overall model error.

File Name  
 VN\_ROB\_G1S16\_TTDSUPERCL

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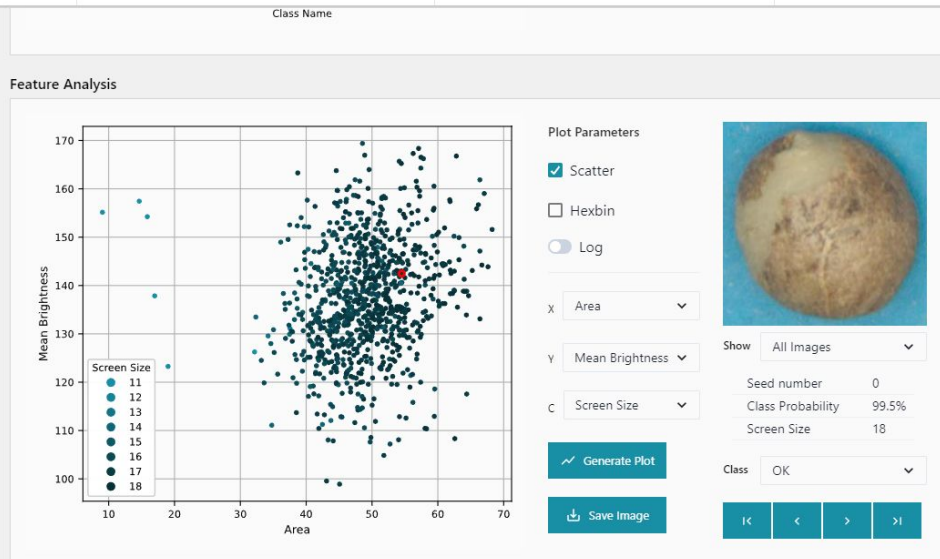
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## AI Model Parameters

Average Entropy: 7.32%

Inference Confidence: **High Confidence**

Cohen's Kappa: 87.3%

Binary Accuracy  
**894**  
 Ratio: 97.17%

Binary Error  
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 Ratio: 2.83%

Multiclass Accuracy  
**892**  
 Ratio: 96.96%

Multiclass Error  
**28**  
 Ratio: 3.04%

Confusion Matrix

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4. Click on **Confusion Matrix** button to open this metric. A confusion matrix is a table used to define the performance of a classification algorithm. A confusion matrix visualizes and summarizes the performance of a classification algorithm by presenting the predicted label on the X-axis and the true label (images that have been adjusted by the user) on the Y-axis. This metric is only relevant if the user changed image classes in the image mosaic.

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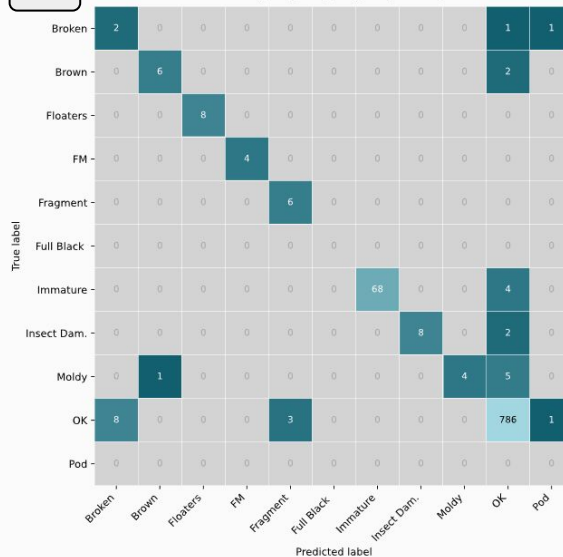
 Multiclass Accuracy  
**892**  
 Ratio: 96.96%

 Multiclass Error  
**28**  
 Ratio: 3.04%

## Confusion Matrix ^

5.

Model 224\_MCL\_RNXT\_CAN\_VNM\_NATV00\_D86



Class	Precision	Recall	F1-Score
Floaters	1.00	1.00	1.00
FM	1.00	1.00	1.00
OK	0.98	0.98	0.98
Immature	1.00	0.94	0.97
Insect Dam.	1.00	0.80	0.89
Brown	0.86	0.75	0.80
Fragment	0.67	1.00	0.80
Moldy	1.00	0.40	0.57
Broken	0.20	0.50	0.29
Full Black	0.00	0.00	0.00
Pod	0.00	0.00	0.00

**Precision:** For a given class, precision is the ratio of correctly predicted instances of that class to the total number of instances predicted as that class. It answers the question, "Of all the times the model predicted a class, how often was it correct?"

**Recall:** For a given class, recall is the ratio of correctly predicted instances of that class to the actual number of instances of that class in the analysis. It addresses the question, "Of all the actual instances of a class, how many did the model correctly predict?"

**F1 Score:** This is the harmonic mean of precision and recall. It is especially useful when the class distribution is uneven. An F1 score reaches its best value at 1 (perfect precision and recall) and its worst at 0.

6.

Save Image

7.

## Dashboard

5. Results in the diagonal represent correct predictions, as the predicted label is equal to the True Label. Every other occurrence represent where and how the model error during prediction.

6. A table with the Classes name, Precision, Recall and F1-Score is presented for each class. The definition of these metrics area presented in the text below the table.

7. The **Save Image button** is intended to save the confusion matrix in .jpg format

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## Model Evaluation

1. Add analysis files to the assessment list

+ Add Analysis

9.

No files selected

Clear List

2. Click 'Evaluate Model' after selecting the appropriate analysis files

Evaluate Model

8.

# Dashboard

8. A new section in the side menu named **Model Evaluation** aims to evaluate the performance of a specific AI model after promoting and demoting classes from different analyses, using the Image Mosaic tool. To access this feature, click on Model Evaluation

9. Click in **+Add Analysis** and select the files that have been adjusted for image classification.



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AI Model

## Model Evaluation

1. Add analysis files to the assessment list

+ Add Analysis

1	VN_ROB_FAQ_TTD	224_MCL_RNXT_CAN_VNM_NATV00_D86	
2	VN_ROB_FAQ_TTD_test	224_MCL_RNXT_CAN_VNM_NATV01_G85	
3	VN_ROB_G1S16_TTDSUPERCL	224_MCL_RNXT_CAN_VNM_NATV00_D86	
4	VN_ROB_S16_28B	224_MCL_RNXT_CAN_VNM_NATV00_D86	
5	VN_ROB_S16_28B_test	224_MCL_RNXT_CAN_VNM_NATV01_G85	
6	VN_ROB02585_3	224_MCL_RNXT_CAN_VNM_NATV00_D86	
7	VN_ROBDAKLAD_CALIB2	224_MCL_RNXT_CAN_VNM_NATV00_D86	
8	VN_ROBDAKLAK_1	224_MCL_RNXT_CAN_VNM_NATV00_D86	
9	VN_ROBDAKLAK_2	224_MCL_RNXT_CAN_VNM_NATV00_D86	
10	VN_ROBDAKLAK_3	224_MCL_RNXT_CAN_VNM_NATV00_D86	
11	VN_ROBDAKLAK_CALIB3	224_MCL_RNXT_CAN_VNM_NATV00_D86	

Clear List

2. Click 'Evaluate Model' after selecting the appropriate analysis files

Evaluate Model

# Dashboard

10. Make sure only files that were analyzed with the same AI model are selected in the list. Remove those that are not.



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## Model Evaluation

1. Add analysis files to the assessment list

+ Add Analysis

1	VN_ROB_FAQ_TTD	224_MCL_RNXT_CAN_VNM_NATV00_D86	
2	VN_ROB_G1S16_TTDSUPERCL	224_MCL_RNXT_CAN_VNM_NATV00_D86	
3	VN_ROB_S16_2B8	224_MCL_RNXT_CAN_VNM_NATV00_D86	
4	VN_ROB02585_3	224_MCL_RNXT_CAN_VNM_NATV00_D86	
5	VN_ROBDAKLAD_CALIB2	224_MCL_RNXT_CAN_VNM_NATV00_D86	
6	VN_ROBDAKLAK_1	224_MCL_RNXT_CAN_VNM_NATV00_D86	
7	VN_ROBDAKLAK_2	224_MCL_RNXT_CAN_VNM_NATV00_D86	
8	VN_ROBDAKLAK_3	224_MCL_RNXT_CAN_VNM_NATV00_D86	
9	VN_ROBDAKLAK_CALIB3	224_MCL_RNXT_CAN_VNM_NATV00_D86	
10	VN_ROBFAQ_02585_2	224_MCL_RNXT_CAN_VNM_NATV00_D86	
11	VN_ROBFAQ_TTD02585_1	224_MCL_RNXT_CAN_VNM_NATV00_D86	

Clear List

2. Click 'Evaluate Model' after selecting the appropriate analysis files

Evaluate Model

11.

# Dashboard

11. Click in **Evaluate Model** button to generate the evaluation

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VN\_ROB\_G1S16\_TTDSUPERCL

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AI Model

## Model Evaluation

Selected Analysis: 37

Average Entropy 8.2%  
Inference Confidence **High Confidence**  
Cohen's Kappa 77.9%

Binary Accuracy  
**44204**  
Ratio: 92.05%

Binary Error  
**3819**  
Ratio: 7.95%

Multiclass Accuracy  
**42714**  
Ratio: 88.94%

Multiclass Error  
**5309**  
Ratio: 11.06%

## Confusion Matrix ^

Model 224\_MCL\_RNXT\_CAN\_VNM\_NATV00\_D86

True label \ Predicted label	Broken	Brown	Floater	FM	Fragment	Full Black	Immature	Insect Dam.	Moldy	OK	Pod
Broken	762	0	0	0	33	0	3	1	1	25	1
Brown	41	1499	0	9	51	18	809	17	89	108	8
Floater	4	0	760	0	18	0	6	0	2	56	0
FM	0	0	0	1390	4	1	3	0	0	0	6
Fragment	6	0	0	15	2315	0	2	1	0	3	0
Full Black	1	15	0	4	10	132	36	2	20	3	4
Immature	8	1	0	4	17	1	3554	2	9	111	0
Insect Dam.	5	0	0	0	15	3	101	355	8	86	0
Moldy	5	8	0	4	4	2	22	14	406	34	0
OK	166	9	1	16	201	23	2900	30	41	31478	6
Pod	0	0	0	14	2	0	0	0	0	0	63

Class	Precision	Recall	F1-Score
FM	0.95	0.99	0.97
Floater	1.00	0.90	0.95
OK	0.99	0.90	0.94
Fragment	0.87	0.99	0.92
Broken	0.76	0.92	0.84
Moldy	0.70	0.81	0.76
Pod	0.72	0.80	0.75
Brown	0.98	0.57	0.72
Insect Dam.	0.84	0.62	0.71
Full Black	0.73	0.58	0.65
Immature	0.48	0.96	0.64

12.

**Precision:** For a given class, precision is the ratio of correctly predicted instances of that class to the total number of instances predicted as that class. It answers the question, "Of all the times the model predicted a class, how often was it correct?"

**Recall:** For a given class, recall is the ratio of correctly predicted instances of that class to the actual number of instances of that class in the analysis. It addresses the question, "Of all the actual instances of a class, how many did the model correctly predict?"

**F1 Score:** This is the harmonic mean of precision and recall. It is especially useful when the class distribution is uneven. An F1 score reaches its best value at 1 (perfect precision and recall) and its worst at 0.

## Dashboard

12. Similar to the resources present in the dashboard for a single file, this tool concatenates the reading for multiple files, presenting a thorough evaluation of the selected Model, its accuracy and ability to generalize to new data. It is important to note that the table presents, from top to bottom, the most accurate class predictions, thus indicating classes at the bottom that require more images to increase the model's performance.



CSMART COFFEE TECHNOLOGIES SA

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