

New Release

# Device Control Desktop App

Minor version - V3.1.4

2025/01/17

**Csmart Digit** v.3.1.4

File Name: No file opened

File Location: D:\Csmat\_Digit\Analysis

Last Analysis Model: No previous analysis

Help

1

**Quality Control**

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

**Cloud | Local Server**

- Upload Analysis

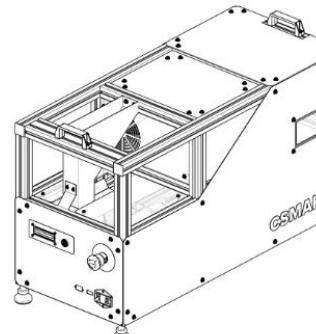
**AI Model | Dataset**

- Edit Model
- Evaluate Model

**System Configuration**

- Acquisition Settings
- General Settings
- About

**CSMART DIGIT**



Welcome to Csmart Digit  
The AI-Enabled Coffee Seed Classifier

Create New Analysis

Open Existing Analysis

1

Open User Manual

Version 3.1.4 | Csmart Coffee Technologies SA 2025

## Knowledge Base

1. It is now possible to access the **User Manual or Knowledge Base** directly from within the application. This can be done by clicking on various locations within the software, which will open an external web browser.

The KB address is:  
<https://csmart.gitbook.io/csmart-digit-kb>

File Name  
No file opened

File Location  
D:\Csmat\_Digit\Analysis

Last Analisys Model  
No previous analysis

Quality Control

Home

**Artificial Intelligence**

Dashboard

Image Mosaic

Lot Info

Classification Report

Export Data

Export Images

Compare

Cloud | Local Server

Upload Analysis

AI Model | Dataset

Edit Model

Evaluate Model

System Configuration

Acquisition Settings

General Settings

About

Quality Control

## Artificial Intelligence

1. Select the AI model to classify the analysis file

Select Model

Selected Model: 224\_ARA\_BRA\_MOGIANA\_WIDENET100\_93\_V4

Classification Methods: COB

Classes: Arrido, Branco, Brocado, Cabeca, Concha, Fox Bean, Imaturo, Marinheiro, Moka, Ok, Palha, Pau, Pedra, Pergaminho, Preto, Quebrado

Species: Arabica

Variety: Mixed

Origin: Brazil

Region: Mogiana de Minas

Processing Method: Mixed

Accuracy: 90.0%

Database Name: MOGIANA\_V3\_balanced

Model Issued: September/2024

Model Version: 4

2. Adjust the 'Pixel/cm' in the analysis file

Edit this model

- 260 + Save

3. Select the AI model to remove duplicate seeds

Do Not Remove Duplicates

2

Coffee - Default AI

Generic - Light

Generic - Strict

Do Not Remove Duplicates

Run Analysis

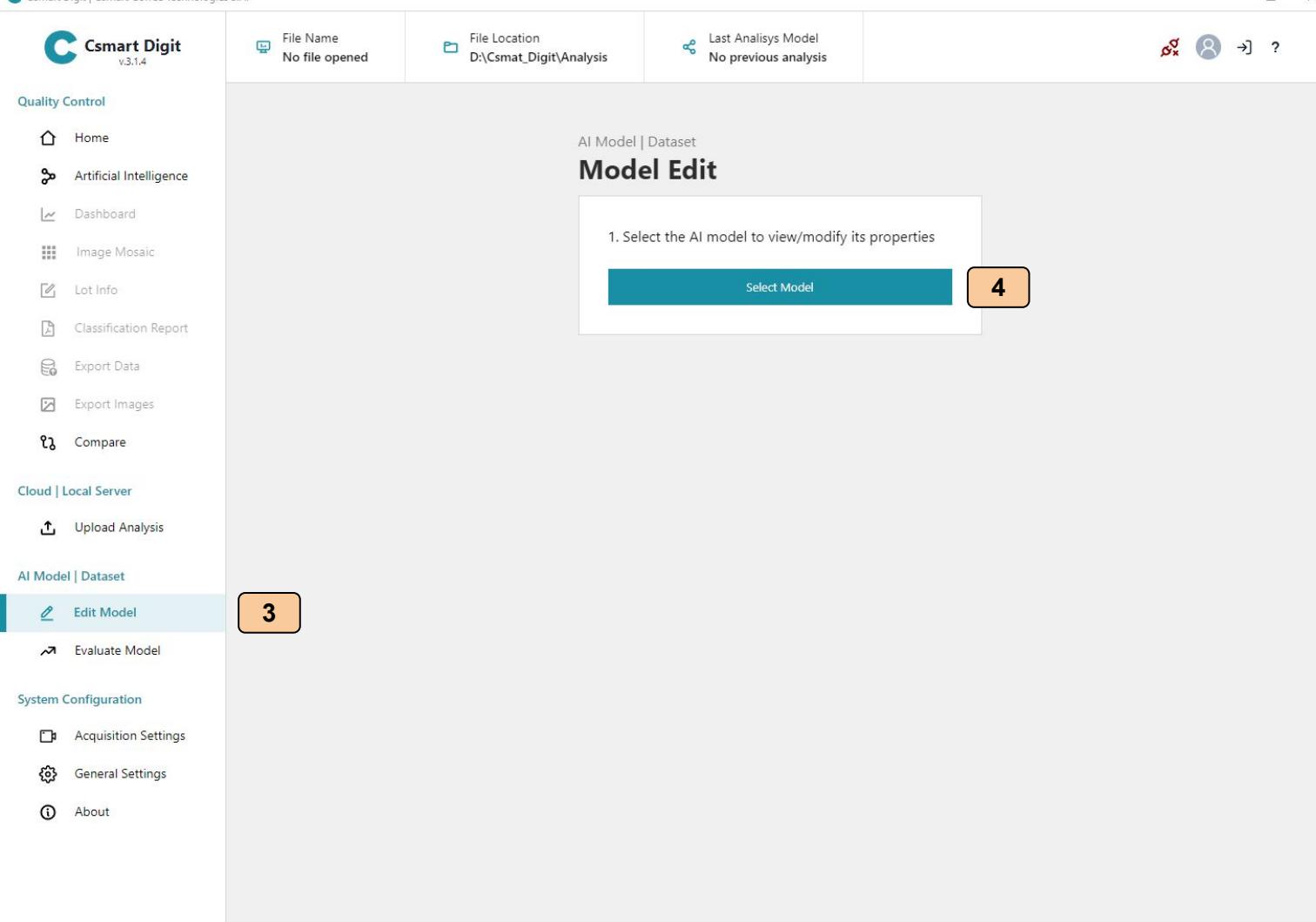
## Duplicate Seeds

2. New methods for removing duplicate seeds have been added. *Duplicate seeds* refer to pictures that contain more than one seed within a single frame.

An AI model, named **Coffee-Default AI**, has been introduced. The previous method, designed for use with other crops, is still available and can be found under two sensitivity levels: Generic - Light and Generic - Severe.

There is also an option to skip the removal of duplicate images, allowing users to review and clean the duplicates later.

It is highly recommended to use the **Coffee-Default AI** option as the standard protocol.



## Edit Model

3. A new side menu button, named **Edit Model**, has been added under the **AI Model | Dataset** group.

It is intended to support continuous efforts to enable users to better visualize and customize AI models, datasets, and all aspects related to the AI component of the software.

4. To visualize and customize an AI model, click on the **Select Model** button and locate the desired model to open it.

File Name  
No file opened

File Location  
D:\Csmat\_Digit\Analysis

Last Analisis Model  
No previous analysis

Home

Artificial Intelligence

Dashboard

Image Mosaic

Lot Info

Classification Report

Export Data

Export Images

Compare

Cloud | Local Server

Upload Analysis

AI Model | Dataset

**Edit Model**

Evaluate Model

System Configuration

Acquisition Settings

General Settings

About

AI Model | Dataset

**Model Edit**

Selected Model:  
**224\_ARA\_BRA\_SULDEMINAS\_SEGFORM5\_94\_V6**  
C:\Users\user\Desktop\modelos

Change model

**Model Description**

Item	Description
Training Database	SULDEMINAS_V3_unbalanced
Database Classes	Ardido <span style="background-color: pink; border: 1px solid black; padding: 2px 5px;">Bom</span> <span style="background-color: green; border: 1px solid black; padding: 2px 5px;">Brocado</span> <span style="background-color: blue; border: 1px solid black; padding: 2px 5px;">Casca</span> <span style="background-color: purple; border: 1px solid black; padding: 2px 5px;">Coco</span> <span style="background-color: orange; border: 1px solid black; padding: 2px 5px;">Concha</span> <span style="background-color: yellow; border: 1px solid black; padding: 2px 5px;">Marinheiro</span> <span style="background-color: lightblue; border: 1px solid black; padding: 2px 5px;">Pau</span> Pedra <span style="background-color: purple; border: 1px solid black; padding: 2px 5px;">Pergaminho</span> <span style="background-color: red; border: 1px solid black; padding: 2px 5px;">Preto</span> <span style="background-color: orange; border: 1px solid black; padding: 2px 5px;">Quebrado</span> <span style="background-color: pink; border: 1px solid black; padding: 2px 5px;">Verde</span>
Species	Arabica
Variety	Nao Informado
Origin	Brasil
Region	Sul de Minas
Processing	Nao Informado
Issued	Dez-2024
Comments	Comments

Save

## Edit Model

5. The first panel indicates the **model name and its location**.

6. The **Model Description** panel contains information that describes the characteristics of the coffee intended to be classified.

7. It is possible to modify these fields by typing in the selected field and then clicking the **Save** button at the bottom of the panel.

**8.** Every model is divided into five groups of classes: **Ok Classes**, **Primary Defects**, **Secondary Defects**, **Foreign Matter**, and **Disregarded Classes**. Even though a grading method doesn't use this terminology, Csmart-Digit divides classes into these five groups, which can have customized names in this panel.

**Disregarded Classes** have a special characteristic: they are not accounted for in any percentage calculation and are therefore disregarded. This is intended to replicate a condition that might occur in the sample but will certainly not occur in the production lot.

## Edit Model

8. Every model is divided into five groups of classes: **Ok Classes**, **Primary Defects**, **Secondary Defects**, **Foreign Matter**, and **Disregarded Classes**.

Even though a grading method doesn't use this terminology, Csmart-Digit divides classes into these five groups, which can have customized names in this panel.

### Disregarded Classes

have a special characteristic: they are not accounted for in any percentage calculation and are therefore disregarded. This is intended to replicate a condition that might occur in the sample but will certainly not occur in the production lot.

File Name  
No file opened
File Location  
D:\Csmat\_Digit\Analysis
Last Analisys Model  
No previous analysis

**Quality Control**

-  Home
-  Artificial Intelligence
-  Dashboard
-  Image Mosaic
-  Lot Info
-  Classification Report
-  Export Data
-  Export Images
-  Compare

**Cloud | Local Server**

-  Upload Analysis

**AI Model | Dataset**

-  **Edit Model**
-  Evaluate Model

**System Configuration**

-  Acquisition Settings
-  General Settings
-  About

**Model Classes**

9

Id	Class	Color	Group
0	Ardido	<span style="background-color: #c8a234; width: 10px; height: 10px; display: inline-block;"></span> 20	Defeitos Primarios
1	Bom	<span style="background-color: #0072bc; width: 10px; height: 10px; display: inline-block;"></span> 100	OK
2	Brocado	<span style="background-color: #9b59b6; width: 10px; height: 10px; display: inline-block;"></span> 140	Defeitos Secundarios
3	Casca	<span style="background-color: #2ecc71; width: 10px; height: 10px; display: inline-block;"></span> 70	Materia Estranha
4	Coco	<span style="background-color: #e74c3c; width: 10px; height: 10px; display: inline-block;"></span> 160	Materia Estranha
5	Concha	<span style="background-color: #e74c3c; width: 10px; height: 10px; display: inline-block;"></span> 170	Defeitos Secundarios
6	Marinheiro	<span style="background-color: #9b59b6; width: 10px; height: 10px; display: inline-block;"></span> 130	Defeitos Secundarios
7	Pau	<span style="background-color: #2ecc71; width: 10px; height: 10px; display: inline-block;"></span> 80	Materia Estranha
8	Pedra	<span style="background-color: #2ecc71; width: 10px; height: 10px; display: inline-block;"></span> 90	Materia Estranha
9	Pergaminho	<span style="background-color: #27ae60; width: 10px; height: 10px; display: inline-block;"></span> 40	Materia Estranha
10	Preto	<span style="background-color: #3498db; width: 10px; height: 10px; display: inline-block;"></span> 120	Defeitos Primarios
11	Quebrado	<span style="background-color: #e74c3c; width: 10px; height: 10px; display: inline-block;"></span> 150	Defeitos Secundarios
12	Verde	<span style="background-color: #27ae60; width: 10px; height: 10px; display: inline-block;"></span> 50	Defeitos Primarios

 Create Class
 Remove Class
 Save

Descriptive Rules

## Edit Model

9. In the Model Classes panel, it is possible to edit the class name, the color linked to each class (to be displayed in reports and plots), and the group. After editing any information here, it is necessary to click the save button to save the changes to the AI model file.

10. It is also possible to create extra classes that were not initially present in the training dataset classes. This is intended to create descriptive rules (covered in the next section) and modify the model classification. Although it is possible to create and remove extra classes, it is forbidden to exclude original classes, as this would create errors during classification.

File Name  
No file opened

File Location  
D:\Csmat\_Digit\Analysis

Last Analysis Model  
No previous analysis

Print  

**Quality Control**

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

**Cloud | Local Server**

- Upload Analysis

**AI Model | Dataset**

- Edit Model**
- Evaluate Model

**System Configuration**

- Acquisition Settings
- General Settings
- About

**Model Classes**

Id	Class	Color	Group
0	Ardido	20	Defeitos Primarios
1	Bom	100	OK
2	Brocado	140	Defeitos Secundarios
3	Casca	70	Materia Estranha
4	Coco	160	Materia Estranha
5	Concha	170	Defeitos Secundarios
6	Marinheiro	130	Defeitos Secundarios
7	Pau	80	Materia Estranha
8	Pedra	90	Materia Estranha
9	Pergaminho	40	Materia Estranha
10	Preto	120	Defeitos Primarios
11	Quebrado	150	Defeitos Secundarios
12	Verde	50	Defeitos Primarios
13	Vazamento	0	OK

**11**

**Create Class** **Remove Class** **Save**

OK  
Defeitos Primarios  
**Defeitos Secundarios**  
Materia Estranha  
Desconsiderado

## Edit Model

11. In this example, a new class named **Vazamento** is created and set as part of the **Defeitos Secundários** group, with its color set to red (0).

## Quality Control

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

## Cloud | Local Server

- Upload Analysis

## AI Model | Dataset

- Edit Model
- Evaluate Model

## System Configuration

- Acquisition Settings
- General Settings
- About

File Name  
No file opened

File Location  
D:\Csmat\_Digit\Analysis

Last Analisys Model  
No previous analysis

9 Pergaminho 40 Materia Estranha

10 Preto 120 Defeitos Primarios

11 Quebrado 150 Defeitos Secundarios

12 Verde 50 Defeitos Primarios

13 Vazamento 0 OK

**Create Class** **Remove Class** **Save**

12

## Descriptive Rules

Grading Methods [?](#)

Id	Method Name	Required Weight	Edit	Delete
0	cob	300	g	 

**Create Method** **Save**

# Descriptive Rules

12. The Descriptive Rule panel is designed to create rules that override the AI classification, changing the class classification based on a linear descriptive rule.

The panel contains the following fields per rule:

**Rule Name**, the **Input Class** (the original class from classification), the **Variable** (where the user can select the variable to be checked), the **Rule** (which contains the condition to be checked), the **Value** (which is related to the Rule), and the **Output Class** (the class to be assigned if the condition created by the user is met).

13

File Name  
No file opened

File Location  
D:\Csmat\_Digit\Analysis

Last Analysis Model  
No previous analysis

9 Pergaminho 40 Materia Estranha

10 Preto 120 Defeitos Primarios

11 Quebrado 150 Defeitos Secundarios

12 Verde 50 Defeitos Primarios

13 Vazamento 0 OK

Create Class Remove Class Save

Descriptive Rules

ID	Rule Name	Input Class	Variable	Rule	Value	Output Class	Delete
0	rock2broken	Pedra	Probability	Less/Equal	0.7	Quebrado	trash
1	ok2Vazamento	Bom	Screen Size	Less/Equal	12	Vazamento	trash

Create Rule Save

Grading Methods ?

ID	Method Name	Required Weight	Edit	Delete
0	cob	300	g	trash

Create Method Save

Quality Control

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

Cloud | Local Server

- Upload Analysis

AI Model | Dataset

- Edit Model
- Evaluate Model

System Configuration

- Acquisition Settings
- General Settings
- About

## Descriptive Rules

13. As an example, a new rule that includes the newly created class is demonstrated:

The rule is named **ok2Vazamento**. The input class is **Bom** (a class without defects), the variable is **Screen Size**, and the Rule, or condition, is **Less/Equal** with a value of **12**. Finally, the output class is **Vazamento**. This rule will classify any coffee that initially has no defects (class **Bom**) into the new class **Vazamento** if the screen size is equal to or less than 12.

This can be used as a way to consider as defective seeds that have very small sizes, even though there are no apparent defects in the seeds.

## Quality Control

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

## Cloud | Local Server

- Upload Analysis

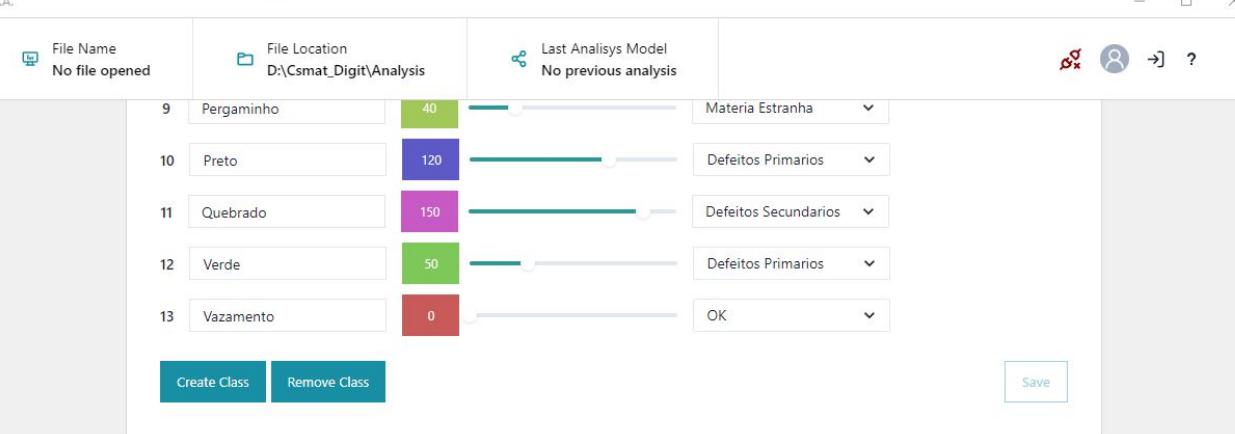
## AI Model | Dataset

- Edit Model
- Evaluate Model

## System Configuration

- Acquisition Settings
- General Settings
- About

14



## Descriptive Rules

Id	Rule Name	Input Class	Variable	Rule	Value	Output Class	Delete
0	rock2broken	Pedra	Probability	Less/Equal	0.7	Quebrado	
1	ok2Vazamento	Bom	Screen Size	Less/Equal	12	Vazamento	
2	verde2ok	Verde	Probability	Less/Equal	.85	Bom	

**Create Rule** **Save**

## Grading Methods ?

Id	Method Name	Required Weight	Edit	Delete
0	cob	300	g	

**Create Method** **Save**

## Descriptive Rules

14. Another useful example of how to use a descriptive rule is to change a class classification based on a probability threshold.

For instance, if a model is too sensitive when classifying immatures, it is possible to create a rule that changes the Immature class to Ok based on the probability of the classification. In this case, every seed initially classified as **Verde** (immature) that does not reach **85% probability**—indicating the model is not confident it is immature—will be reclassified as **Bom** (Ok).

The screenshot shows the Csmart Digit software interface with the following panels:

- Grading Methods:** A table showing two grading methods: 'cob' (Required Weight: 300 g) and 'sca' (Required Weight: 350 g). A 'Create Method' button is available.
- Weight Estimation:** A table showing weight per screen size for various screen numbers (10 to 18). The 'Weight per Screen Size' is set to 300 g. A 'Save' button is available.
- Edit Model:** A table showing rules for an AI model. The rules are:
 

ID	Rule Name	Input Class	Variable	Rule	Value	Output Class	Delete
0	rock2broken	Pedra	Probability	Less/Equal	0.7	Quebrado	
1	ok2Vazamento	Bom	Screen Size	Less/Equal	12	Vazamento	
2	verde2ok	Verde	Probability	Less/Equal	0.85	Bom	

 Buttons for 'Create Rule' and 'Save' are present.

## Grading Methods

14. The next panel is the **Grading Method** panel, which presents all the grading methods attached to the AI model. In this panel, users can only change the name of the method and adjust the required weight for each protocol within the method.

15. Users can create as many grading methods as necessary and later visualize the results in the dashboard. To create a new grading method, simply click the **Create Method** button.

16. To modify an existing method, click the edit icon to access its properties. It is also possible to completely remove a method by clicking the delete icon.

File Name: melitta | File Location: D:\Csmat\_Digit\Analysis | Last Analysis Model: 224\_MCL\_CNVNXT\_L\_ARA\_BRA\_MIXEDV4\_E97

Quality Control

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

Cloud | Local Server

- Upload Analysis

AI Model | Dataset

- Edit Model**
- Evaluate Model

System Configuration

- Acquisition Settings
- General Settings
- About

**17** Equivalent Defects - COB ?

Id	Class Name	Seeds	Defect	Eq.Defect
0	Ardido	2	1	= 0.5
1	Bom	1	0	= 0
2	Brocado	5	1	= 0.2
3.1	Casca - Pequena	3	1	= 0.33
3.2	Casca - Media	3	1	= 0.33
3.3	Casca - Grande	1	1	= 1
4	Coco	1	1	= 1
5	Concha	3	1	= 0.33
6	Marinheiro	2	1	= 0.5
7.1	Pau - Pequeno	3	1	= 0.33
7.2	Pau - Medio	1	2	= 2
7.3	Pau - Grande	1	5	= 5
8.1	Pedra - Pequena	3	1	= 0.33
8.2	Pedra - Media	1	2	= 2
8.3	Pedra - Grande	1	5	= 5
9	Pergaminho	3	1	= 0.33
10	Preto	1	1	= 1
11	Quebrado	5	1	= 0.2
12	Verde	5	1	= 0.2
13	Vazamento	1	0	= 0

**18**

## Grading Methods

17. The first panel indicates the equivalent defects present in the selected method.

The **?** icon serves as a button that opens the user manual, specifically in the "Equivalent Defect" section.

18. Users can change every defect equivalence for each class. Keep in mind that all equivalences are calculated based on the number of seeds required to produce a specific number of defects. Both the seed and defect values must be equal to or greater than 0.

The equivalent defect result is automatically calculated and displayed in the last column.

File Name: melitta

File Location: D:\Csmat\_Digit\Analysis

Last Analysis Model: 224\_MCL\_CNVNXT\_L\_ARA\_BRA\_MIXEDV4\_E97

Quality Control

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

Cloud | Local Server

Upload Analysis

AI Model | Dataset

**Edit Model**

Evaluate Model

System Configuration

Acquisition Settings

General Settings

About

19

Class Sizes Rules - COB

3 Casca

Label Small	Pequena	Small Area	30
Label Medium	Media	Large Area	60
Label Large	Grande	Remove Rule	

7 Pau

Label Small	Pequeno	Small Area	30
Label Medium	Medio	Large Area	60
Label Large	Grande	Remove Rule	

8 Pedra

Label Small	Pequena	Small Area	30
Label Medium	Media	Large Area	60
Label Large	Grande	Remove Rule	

Create Size Rule

Save

Grade Types - COB

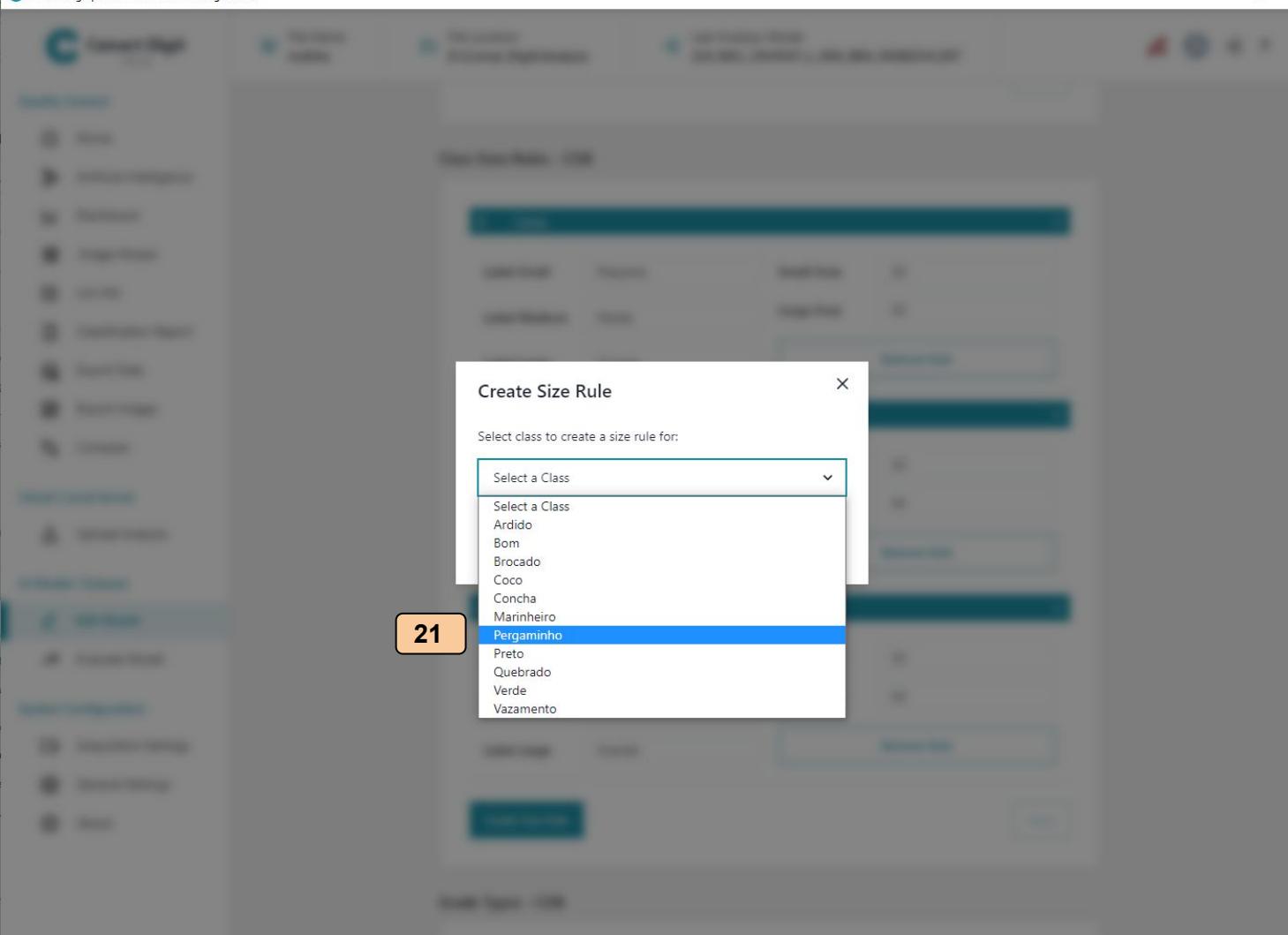
20

## Grading Methods

19. Some grading methods specify distinct defect equivalences within a single class based on size. The **Class Size Rules** panel is designed to indicate the classes that comply with this requirement.

Users can modify the labels for small, medium, and large groups, as well as define the area of the bins to divide the class into three groups.

20. To remove a rule for a class, click the **Remove Rule** button. The equivalent defects form will automatically update to reflect this change, now providing a single defect equivalence.



## Grading Methods

21. To create a new size rule, click the **Create Size Rule** button and select the desired class to create the size-specific division.

After saving the changes, the **Equivalent Defects** panel will display the division, allowing users to define three defect equivalences based on size.

22. In the **Grade Types** panel, users can specify type labels based on the sum of equivalent defects in the sample.

23. This approach relies on defect occurrences, such as determined by methods like SCA, GCA, and COB (Brazil). However, the software currently does not account for methods based on the percentage of weight to specify a grade. Future updates will include this functionality.

Id	Max. Allowed Defects	Type label			
0	Defects	4	=	Type	Tipo 2
1	Defects	8	=	Type	Tipo 2/3
2	Defects	12	=	Type	Tipo 3
3	Defects	19	=	Type	Tipo 3/4
4	Defects	26	=	Type	Tipo 4
5	Defects	36	=	Type	Tipo 4/5
6	Defects	46	=	Type	Tipo 5
7	Defects	64	=	Type	Tipo 5/6
8	Defects	86	=	Type	Tipo 6
9	Defects	123	=	Type	Tipo 6/7
10	Defects	160	=	Type	Tipo 7
11	Defects	260	=	Type	Tipo 7/8
12	Defects	360	=	Type	Tipo 8

**22** Grade Types - COB

**23**

## Grade Types

22. In the **Grade Types** panel, users can specify type labels based on the sum of equivalent defects in the sample.

This approach relies on defect occurrences, such as determined by methods like SCA, GCA, and COB (Brazil). However, the software currently does not account for methods based on the percentage of weight to specify a grade. Future updates will include this functionality.

23. A type is defined as the maximum allowed occurrence of equivalent defects, except for the last type, which has no upper limit. For example, a sample with 6 total equivalent defects is classified as **Tipo 2/3** in the COB methodology.

File Name: melitta

File Location: D:\Csmat\_Digit\Analysis

Last Analysis Model: 224\_MCL\_CNVNXT\_L\_ARA\_BRA\_MIXEDV4\_E97

Quality Control

- Home
- Artificial Intelligence
- Dashboard
- Image Mosaic
- Lot Info
- Classification Report
- Export Data
- Export Images
- Compare

Cloud | Local Server

- Upload Analysis

AI Model | Dataset

- Edit Model**
- Evaluate Model

System Configuration

- Acquisition Settings
- General Settings
- About

Grade Types - COB

Id	Max. Allowed Defects	Type label
0	Defects 4	= Type Tipo 2
1	Defects 8	= Type Tipo 2/3
2	Defects 12	= Type Tipo 3
3	Defects 19	= Type Tipo 3/4
4	Defects 26	= Type Tipo 4
5	Defects 36	= Type Tipo 4/5
6	Defects 46	= Type Tipo 5
7	Defects 64	= Type Tipo 5/6
8	Defects 86	= Type Tipo 6
9	Defects 123	= Type Tipo 6/7
10	Defects 160	= Type Tipo 7
11	Defects 260	= Type Tipo 7/8
12	Defects 360	= Type Tipo 8

Create Size Rule

Create Type Remove Type 24 Save

## Grade Types

24. Users can create and remove grade types by clicking the **Create Type** and **Remove Type** buttons, respectively.

The final type descriptions must be arranged in ascending order, meaning a subsequent defect value cannot be smaller than the previous defect value.

For further reading on the topic of weight estimation, please open the following link of Csmart-Digit KB:

<https://csmart.gitbook.io/csmart-digit-kb/csmart-fundamentals/csmart-methodology-or-weight-estimation>

The screenshot shows the Csmart Digit software interface with the following sections:

- Left Sidebar:**
  - Quality Control: Home, Artificial Intelligence, Dashboard, Image Mosaic, Lot Info, Classification Report, Export Data, Export Images, Compare.
  - Cloud | Local Server: Upload Analysis.
  - AI Model | Dataset: Edit Model, Evaluate Model.
  - System Configuration: Acquisition Settings, General Settings, About.
- Top Header:** File Name (melitta), File Location (D:\Csmat\_Digit\Analysis), Last Analisys Model (224\_MCL\_CNVNXT\_L\_ARA\_BRA\_MIXEDV4\_E97), and a toolbar with icons for export, user, and help.
- Weight Estimation Panel (25):** A table for defining seed occurrence rules. The table has columns: Id, Name, Probability, Less/Equal, Value, and Status. Rows include:
 

0	rock2broken	Pedra	Probability	Less/Equal	0.7	Quebrado	
1	ok2Vazamento	Bom	Screen Size	Less/Equal	12	Vazamento	
2	verde2ok	Verde	Probability	Less/Equal	0.85	Bom	

 Buttons: Create Rule, Save.
- Grading Methods Panel (26):** A table for defining grading methods. The table has columns: Id, Method Name, Required Weight, and Status. Rows include:
 

0	cob	300	g		
1	sca	350	g		

 Buttons: Create Method, Save.
- Weight Estimation Panel (27):** A panel for calculating seed distribution. It shows a target weight of 300g and a distribution across screen sizes 10 to 18. The distribution table is:
 

Screen Size	300	g
Screen 10	3738	10
Screen 11	3524	11
Screen 12	3309	12
Screen 13	2970	13
Screen 14	2910	14
Screen 15	2775	15
Screen 16	2535	16
Screen 17	2235	17
Screen 18	1920	18

 Buttons: Save.

## Weight Estimation

25. The **Weight Estimation** panel is designed to describe the occurrence of seeds per screen size required to obtain a specific weight value.

26. The **Weight per Screen Size** input represents the total weight to be used in the subsequent distribution.

27. Users must specify the seed occurrence for each screen size to achieve the previously specified weight. For example, to reach 300g of this coffee, it is necessary to have 3,738 seeds of screen size 14 or 3,524 seeds of screen size 11, and so on, **with each occurrence resulting in exactly 300g**.

File Name: melitta

File Location: D:\Csmat\_Digit\Analysis

Last Analisys Model: 224\_MCL\_CNVNXT\_L\_ARA\_BRA\_MIXEDV4\_E97

Weight Estimation ?

Weight per Screen Size: 300 g

Single Distribution  Class Distribution **28**

Class Name	Screen 10	Screen 11	Screen 12	Screen 13	Screen 14	Screen 15	Screen 16	Screen 17	Screen 18
Broken	10 5500	11 4575	12 3729	13 2794	14 2449	15 2654	16 2360	17 1885	18
Brown	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Floaters	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Fragment	10 9533	11 7274	12 6283	13 4228	14	15	16	17	18
Full Black	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Husk	10	11 1476	12 1476	13	14	15	16	17	18
Immature	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Insect Dam.	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Moldy	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
OK	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Pod	10	11 856	12 856	13	14	15	16	17	18
Silver Skin	10	11 6190	12 5070	13 3500	14 2663	15 2307	16 1981	17 1731	18 1345
Stick	10	11 3326	12 3326	13	14	15	16	17	18
Stone	10 6533	11 3597	12 2989	13 2361	14 1809	15 1541	16 1321	17 1102	18 633

Save

## Weight Estimation

28. It is also possible to switch from a single distribution to a class-specific distribution by clicking the designated switch button. Please note that switching between distribution methodologies will result in the loss of previously entered data.

29. In the class-specific distribution, users can include specific values for each class. All classes must have at least one entry, but if more than one entry is provided, the entries must be consecutive (e.g., 14, 15, 16). Non-filled values (e.g., empty, zero, or null) are ignored during validation and will receive min and max values of that row.



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