STEP-BY-STEP USER GUIDE

CHAPTER 2: AI TRAINING

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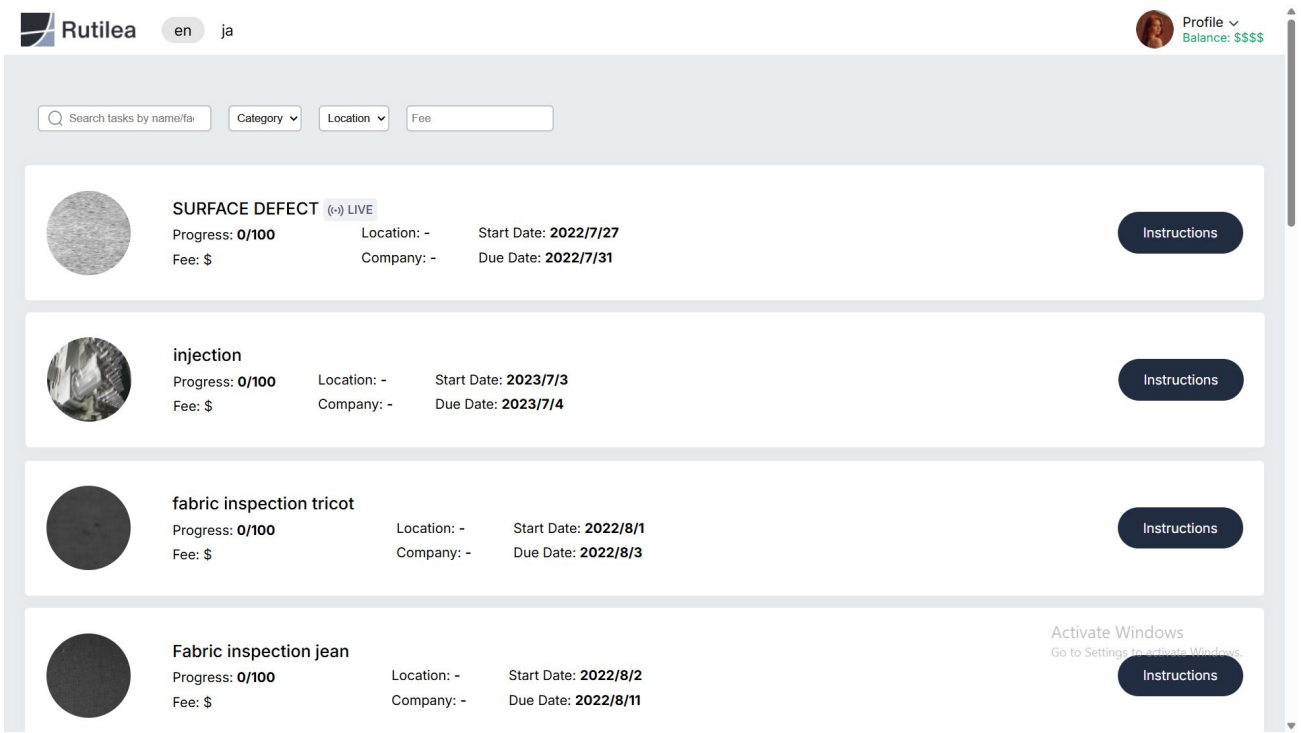
AI TRAINER (The specialist software to train AI)

- **List of the AI tasks ready to be trained**

  On the AI Trainer platform, you'll find a list of AI tasks that are ready for training. Each task and image has a unique identification number, which helps you track and reference them easily. Some tasks are public, while others are private and available only to you. Use the search box to find the specific task you're looking for, then click on "Instruction" to view detailed information, including how and where to annotate.

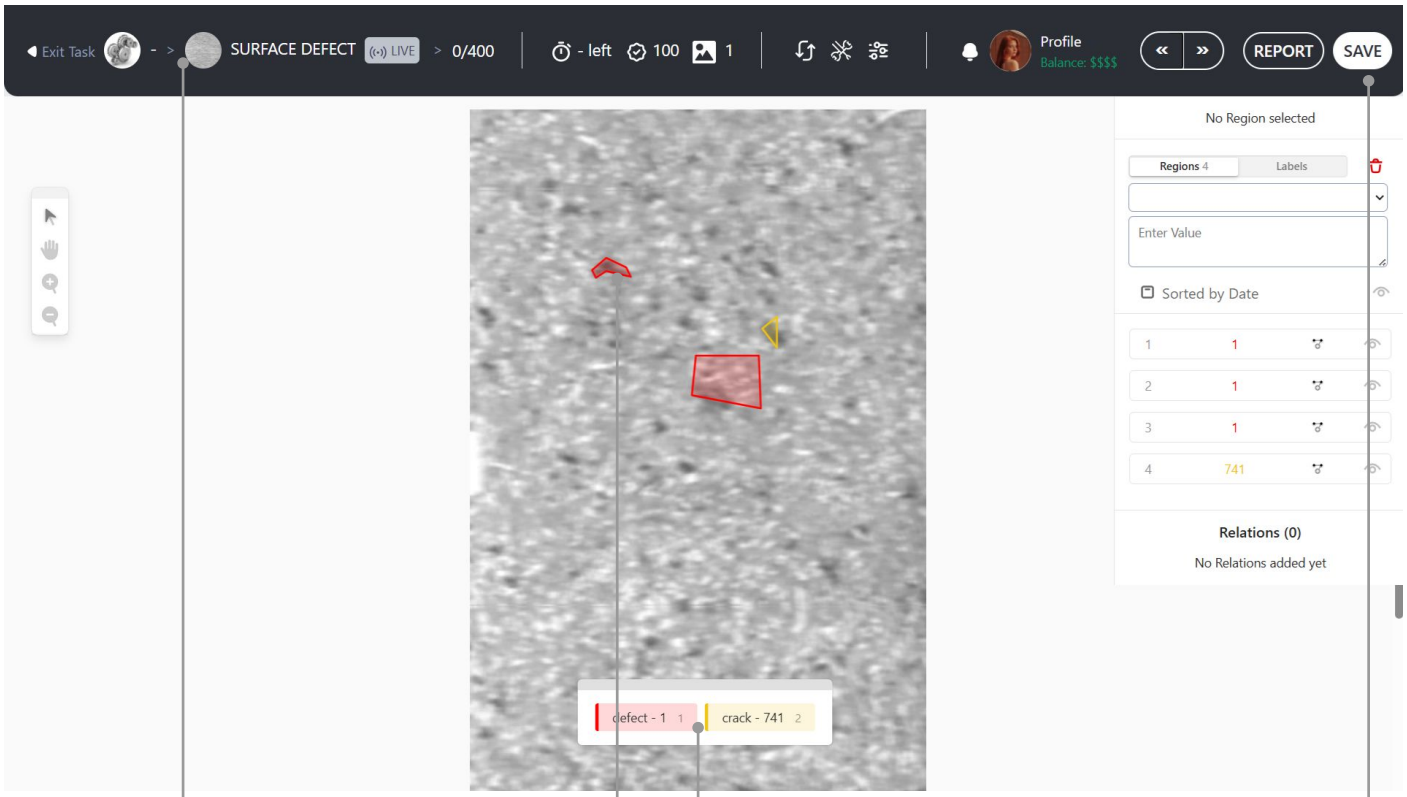
  You will also see a unique task ID, a unique image ID for each image, and a unique category ID for each category.

  Take note of these numbers — they are useful for tracking your work and managing your projects efficiently.



Step 1: AI TRAINING PLATFORM

Basic Tools and How to use



Step 1:

Be sure you are in the right AI task

Step 2:

Choose the Category

Step 3:

Draw the area

Step 4:

Save and navigate to the next Image

Advance Tools and How to use

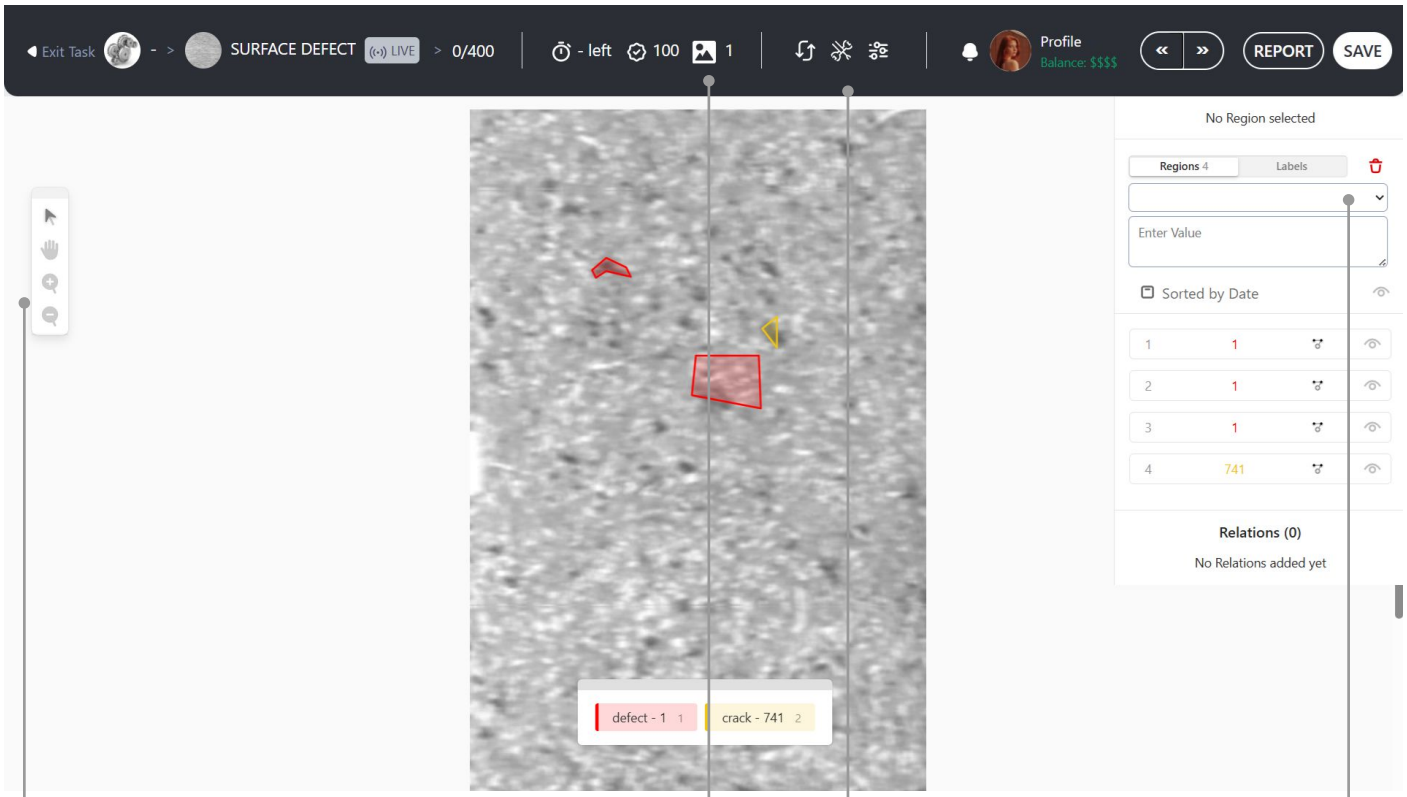


Image ID

Universal Unique ID to be addressed

Pan

Zoom in/out/pan

(ctrl+mouse scroll)

Show/Hide

To toggle the annotation/category panels

Delete/ Modify

Edit/change category/delete a category

Tips and Hints

Keyboard shortcuts:

To speed up the annotation process, you can use your keyboard as a shortcut. For example, press 1, 2, 3, 4, Q, W, E, R, T, Y, U, I to quickly select a category instead of clicking with the mouse.

Drawing boxes:

Click at the starting point of the box, move the mouse, and click again at the opposite corner to create the box.

Overlapping objects:

If you want to draw one object on top of another, first draw the box somewhere else, then click and drag it to the target area. Alternatively, use the eye icon to hide other annotations temporarily.

Adding metadata:

Use the right panel and click "+" to add metadata (optional).

No images visible:

If you can't see any images, it means all images are annotated. Use the < or > buttons to navigate to the previous or next image.

Define Tasks and Upload images

- **List of the AI tasks ready to be trained**

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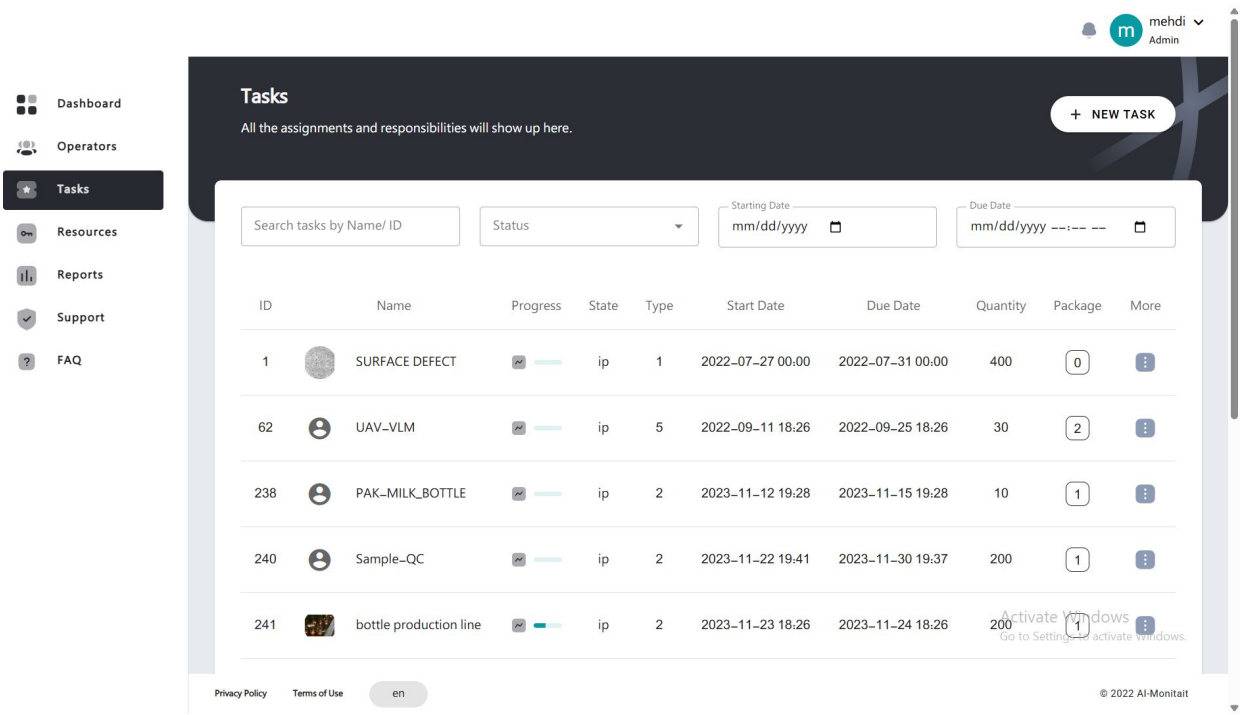
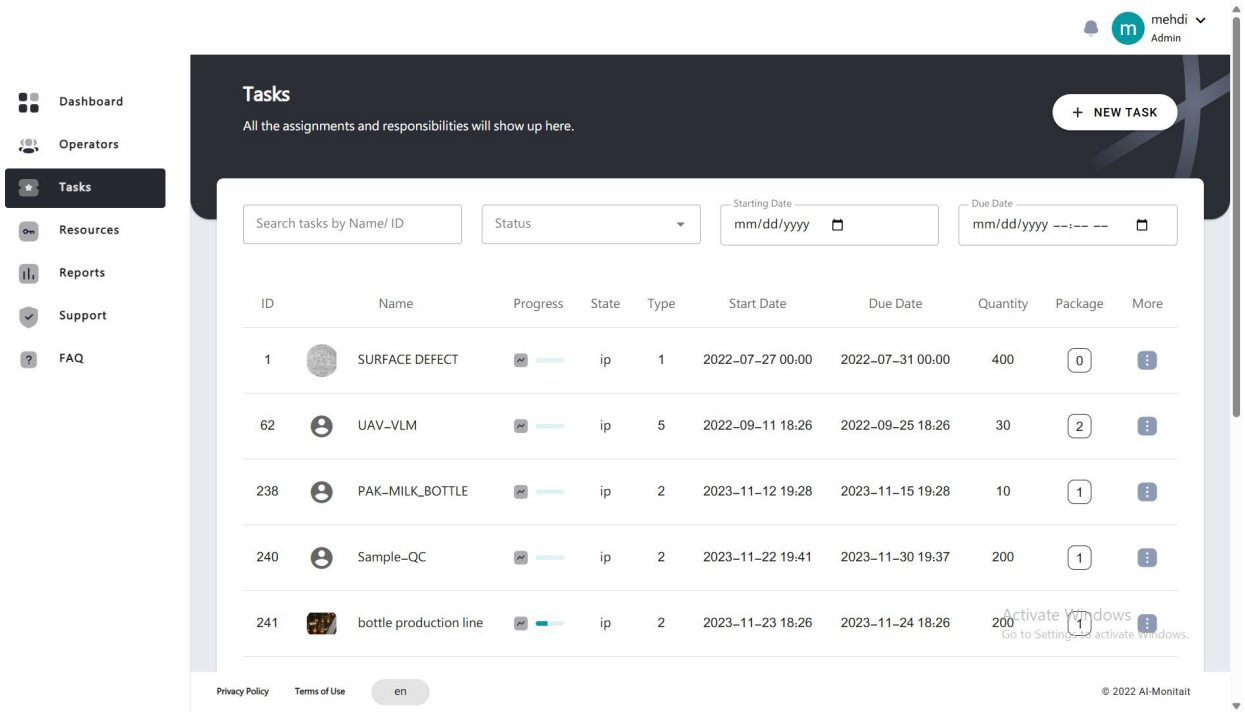


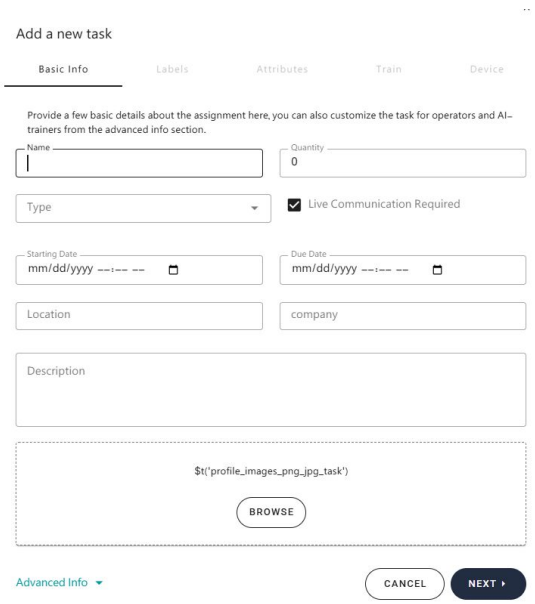
Define Tasks and Upload images

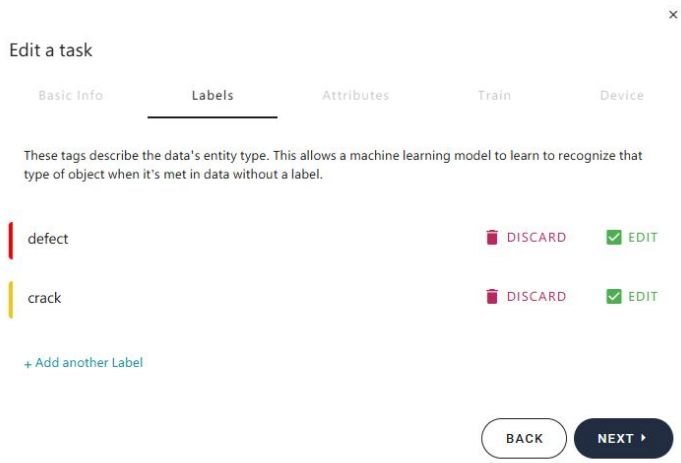
To define a task, category, and upload images in AI-Trainer (Monitait.com), start by navigating to the Tasks page from the left-hand menu and clicking on the "+ NEW TASK" button at the top-right corner. In the Basic Info tab, enter the main details of your project. Choose a descriptive name, such as "Bottle Defect Detection," and set the quantity to indicate how many images you want to include in the task. From the Type dropdown, select the kind of task you're creating—for example, image classification or object detection. You can also specify the starting and due dates if needed, and optionally fill in the Location, Company, and Description fields to provide more context for your team. If you have sample or reference images, you can upload them by clicking the BROWSE button. When everything is ready, click NEXT to continue.



Define Tasks and Upload images

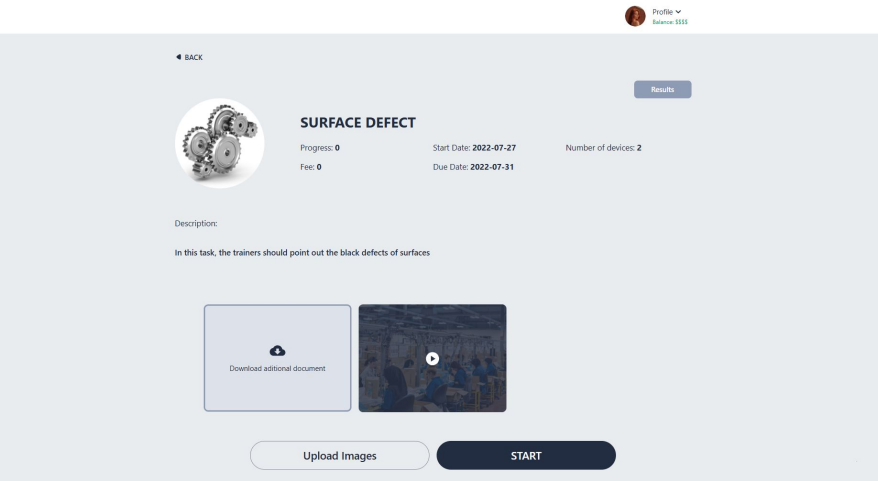
In the Labels tab, you can define the categories or classes that will be used during annotation. Each label represents a type of object or defect that the system should learn to recognize. For example, you might create categories like “defect,” “crack,” or “dust,” each with a different color. To add a new label, click “+ Add another Label” and type in the name of the new category. You can edit or delete any existing label at any time using the EDIT or DISCARD options. After you’ve added all the necessary labels, click NEXT to proceed.

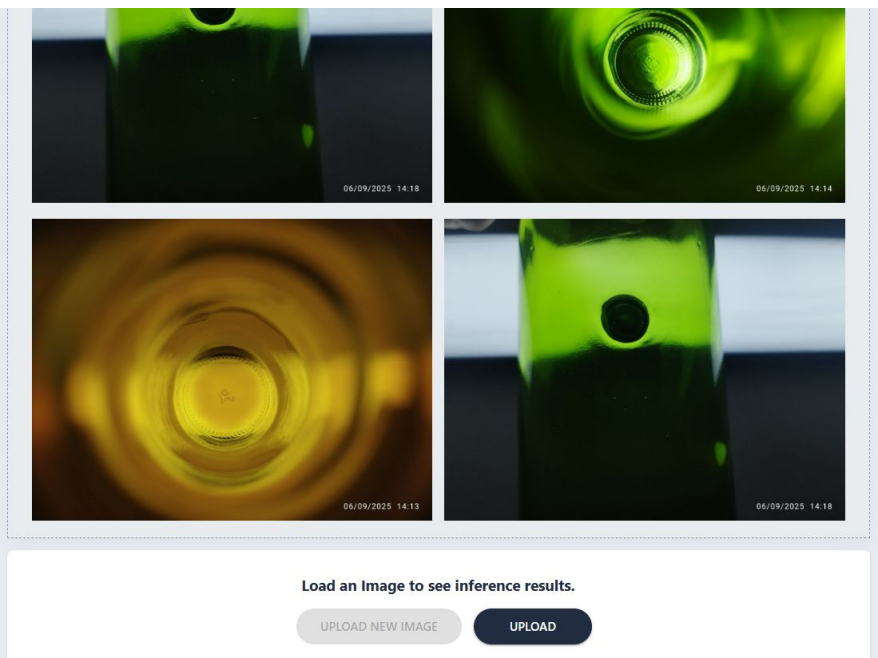




Define Tasks and Upload images

Once the task has been created, you can upload the images that will be annotated. Return to the Tasks page, find the task you just created, and click the three-dot icon (⋮) in the “More” column. From the menu that appears, select Upload Images. Choose the image files you want to upload (supported formats include .jpg, .png, and .jpeg). After the upload is complete, the task will become available for annotators or operators to start labeling.





Tips and Hints

When defining categories, always consider the visual cues of your objects. I**f two objects look very similar, separating them into different categories can cause confusion and lead to inaccurate results.** Choose your categories wisely — the more categories you define, the more sample images you'll need to train each one effectively. It's best to focus on the most important and visually distinct categories first.

For each image, it is recommended to **define a category for the main object** as well, such as bottle, fabric, or box. This helps the AI understand the overall context and improves detection accuracy.

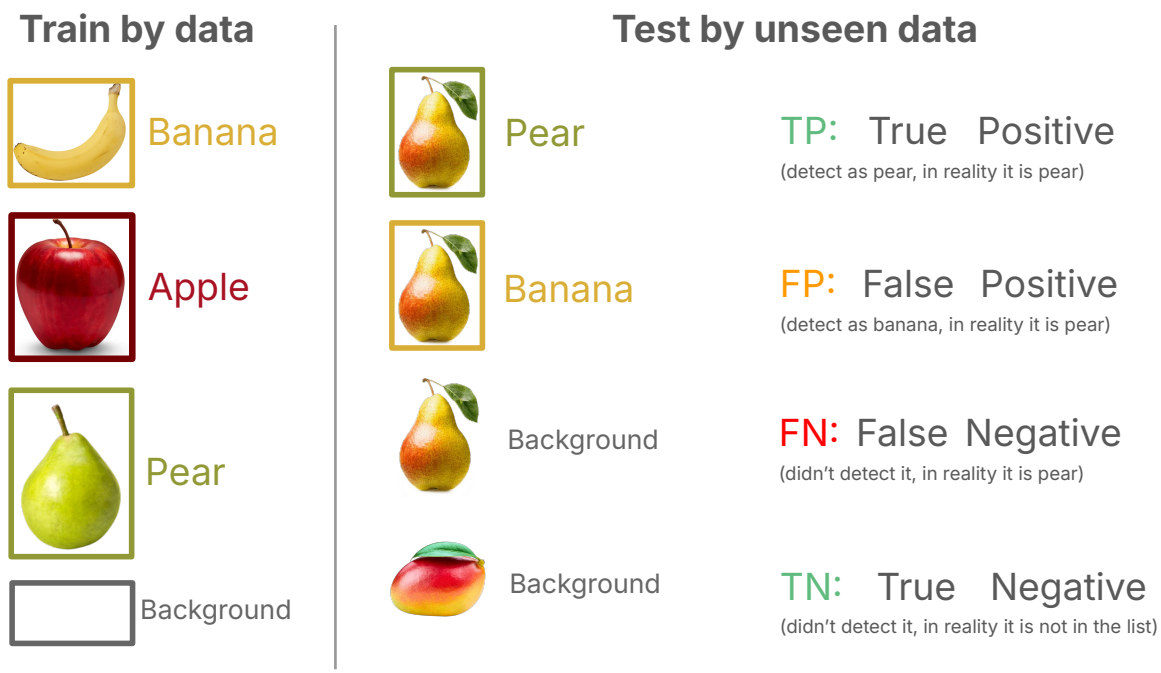
Whenever possible, assign a specific ID to each main object or product type — for example, bottle-pk-100 or pen-dp-105. Using consistent and descriptive IDs helps organize your data better and can significantly enhance the model's accuracy during training and evaluation.

The training process will be handled by the Monitait team, who will select the most effective augmentation strategies for your dataset. It's recommended to consult with the Monitait team to ensure the best possible training results and fine-tuned model performance.

What is evaluation in AI

Imagine you're teaching a child to recognize different fruits. After some practice, you show them new fruits they haven't seen before — an apple, a banana, and a pear — and ask what each one is. If they answer correctly, it means they've really learned. But if they get confused, you know what needs more practice. **This checking step is called "evaluation."** It tells us how well the AI has learned from its training and whether it can recognize things correctly in new situations.

In artificial intelligence, evaluation means **testing a trained model** to measure how well it performs on **unseen** data. It helps confirm whether the model can accurately identify objects, detect defects, or make predictions in real-world conditions. During evaluation, important metrics such as **precision, recall, F1-score, and mAP** (mean Average Precision) are calculated to show how balanced and accurate the model's predictions are.



Confusion Matrix, FP, FN, mAP

Each row represents the actual (true) class.

Each column represents the predicted class.

Diagonal cells (top-left to bottom-right) are correct predictions.

Off-diagonal cells represent misclassifications.

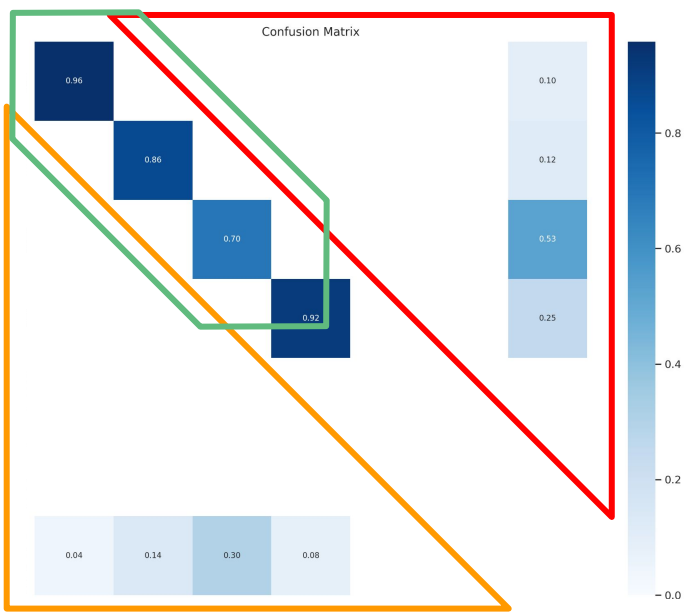
- **Precision** = How many of the detected objects were correct.
- **Recall** = How many of the real objects were found.
- **F1-Score** = Single score that rewards models that do both well
- **mAP** = The average precision over all object classes and confidence thresholds. (0-1)

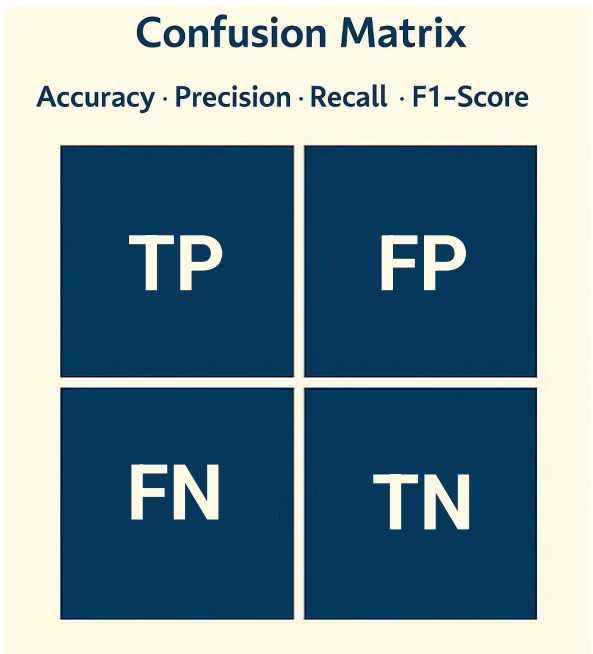
A higher mAP means the model is performing better at finding and labeling all types of objects accurately.

$$\text{Precision} = \frac{TP}{TP + FP}$$

$$\text{Recall} = \frac{TP}{TP + FN}$$

$$\text{F1-Score} = 2 \times \frac{\text{Precision} \times \text{Recall}}{\text{Precision} + \text{Recall}}$$





Tips and Hints to increase Accuracy and Recall

Improving accuracy and recall starts with the quality and diversity of your training data. Make sure your dataset includes enough examples of each category under different conditions — lighting, angles, sizes, and backgrounds. A well-balanced dataset helps the model generalize better and recognize real-world variations. Avoid using only similar-looking samples, as the model might overfit and fail to detect new appearances of the same object. The goal is to let the model “see” all possible forms of your object during training.

Another important factor is the quality of annotations. Ensure that bounding boxes are tight around the objects, categories are correctly assigned, and overlapping or duplicated annotations are avoided. Even small annotation mistakes can mislead the model and lower both accuracy and recall. It’s also good practice to have multiple reviewers check the labeled data before training — this helps reduce labeling bias and ensures consistency.

Category design also plays a big role. Avoid creating too many similar or confusing categories, as this can cause the model to mix them up and reduce overall precision. Instead, focus on the most important categories that are visually distinct and relevant to your application. If needed, merge similar categories or use hierarchical naming (for example, “defect–scratch” and “defect–hole”) to make training clearer.

Finally, consult with the Monitait team to optimize your training setup. They can help choose the best augmentation strategies, such as brightness changes, rotations, or blurs, to make your model more robust. They may also recommend adjustments in image size, confidence t

Software setup

Each trained AI model generates a **best.pt** file, which contains the final weights representing the model's learned parameters. Every training process is assigned a unique **training ID**, which should be carefully recorded to track the accuracy, recall, and overall performance of that training session. Keeping this ID allows you to review historical results, compare improvements, and ensure proper version control across different experiments.

Before updating any machine, make sure you have verified that the new best.pt file comes from a training session with satisfactory results. It is recommended to test the model's inference performance on sample images first to ensure that accuracy and recall metrics have improved compared to previous versions.

When ready to deploy, copy the new best.pt file into the directory:

/home/projects/inference/best.pt.

This path is where the active inference model is stored, and replacing the file here effectively updates the AI model running on the system. Be careful to overwrite the existing file only when you are confident in the new model's performance.

After copying the file, restart the system to ensure the new weights are loaded correctly into memory. The AI inference engine will automatically start using the updated model for predictions. This process ensures a smooth transition between training and production, maintaining a reliable and trackable AI deployment workflow.