
Industrial Data Science 2

Use Case III

PartikelART Solutions

GROUP 3

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Introduction

- Welcome to the use case analysis of **PartikelART Solutions GmbH**.
- Main task is to analyze the challenges faced by PartikelART in technical cleanliness through digital solutions.
- Particles within industrial settings can significantly impact product quality, operational efficiency, and overall safety. Therefore, accurate and efficient identification of these particles is important.
- Our **objective** is to explore the details of image segmentation and classification techniques, understand their application in the context of technical cleanliness, and propose innovative solutions

Company Overview

- Welcome to the use case analysis of PartikelART Solutions GmbH, a pioneering company at the forefront of **technical cleanliness solutions**.
- Founded with a mission to **digitize all aspects** of technical cleanliness and generate knowledge from data, PartikelART combines expertise from the fields of technical cleanliness, industrial engineering, and quality assurance.
- With a focus on digitalization, artificial intelligence, and image processing, PartikelART is revolutionizing the way industries approach cleanliness standards and quality control.

Problem Statement

- In industries where precision and reliability are crucial, the presence of contaminants such as particles can lead to significant quality issues.
- Traditional methods of identifying and mitigating particle sources are often time-consuming, inefficient, and prone to human error.
- There is a clear need for innovative solutions that can quickly and accurately analyze cleanliness levels to ensure optimal product quality and operational efficiency.

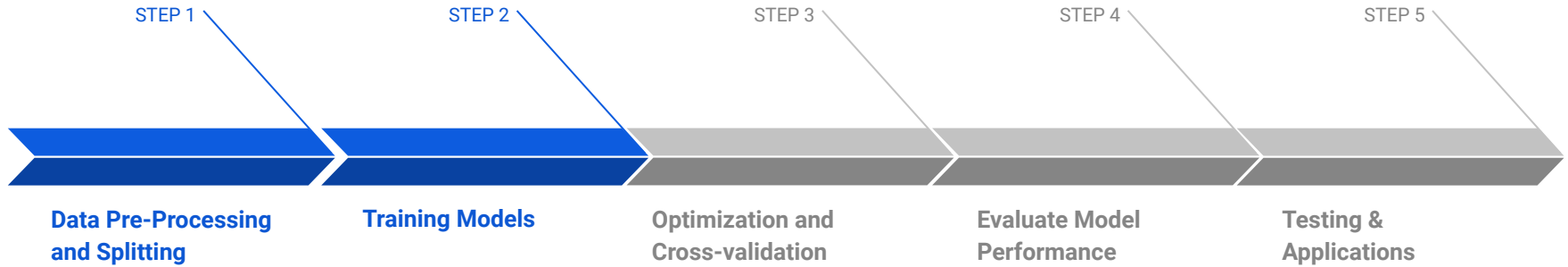
Solution

- Industries require advanced tools and techniques that can provide real-time, actionable insights into cleanliness levels.
- To address the challenge of particle analysis, we use.
- Pre trained model on our custom dataset.
 - You Only Look Once (**YOLO**)
- Deep learning model
 - Convolutional Neural Network (**CNN**)

Our Approach

- Data-driven Approach:
 - Leveraging existing datasets and real-world insights to inform our analysis and decision-making process.
- Image Classification:
 - Utilizing advanced image processing and artificial intelligence techniques to classify particles and contaminants accurately.
 - For image processing, we aim to utilize **YOLO** and **CNN** models subsequently, and hence attempt to compare the results obtained from each, and finally choose the classification model that classifies the object(s) better. Further, based on the results, we improve the model efficiency, if required.

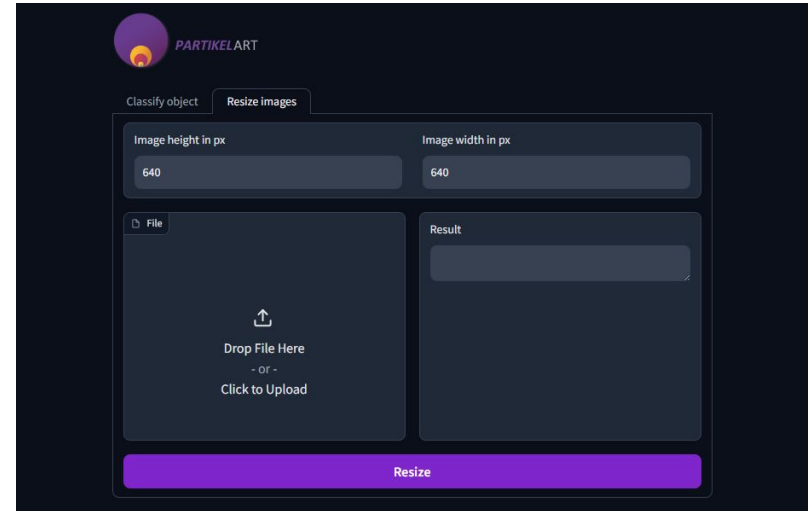
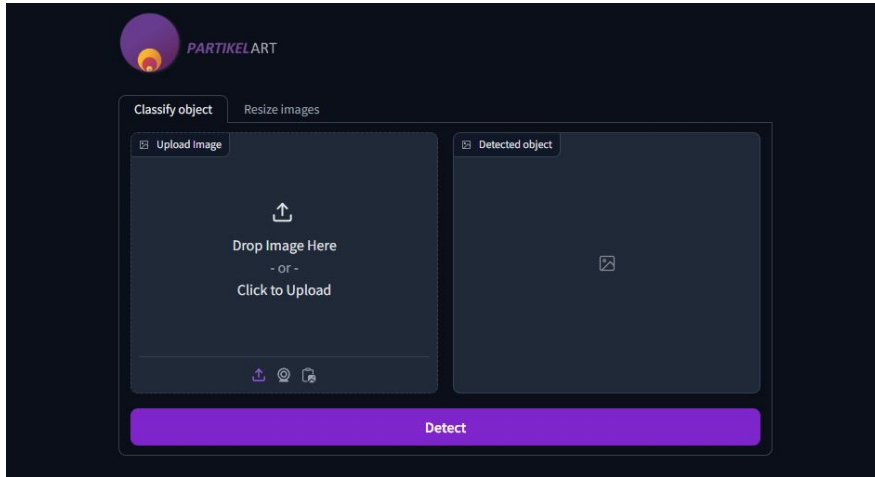
Project Flow

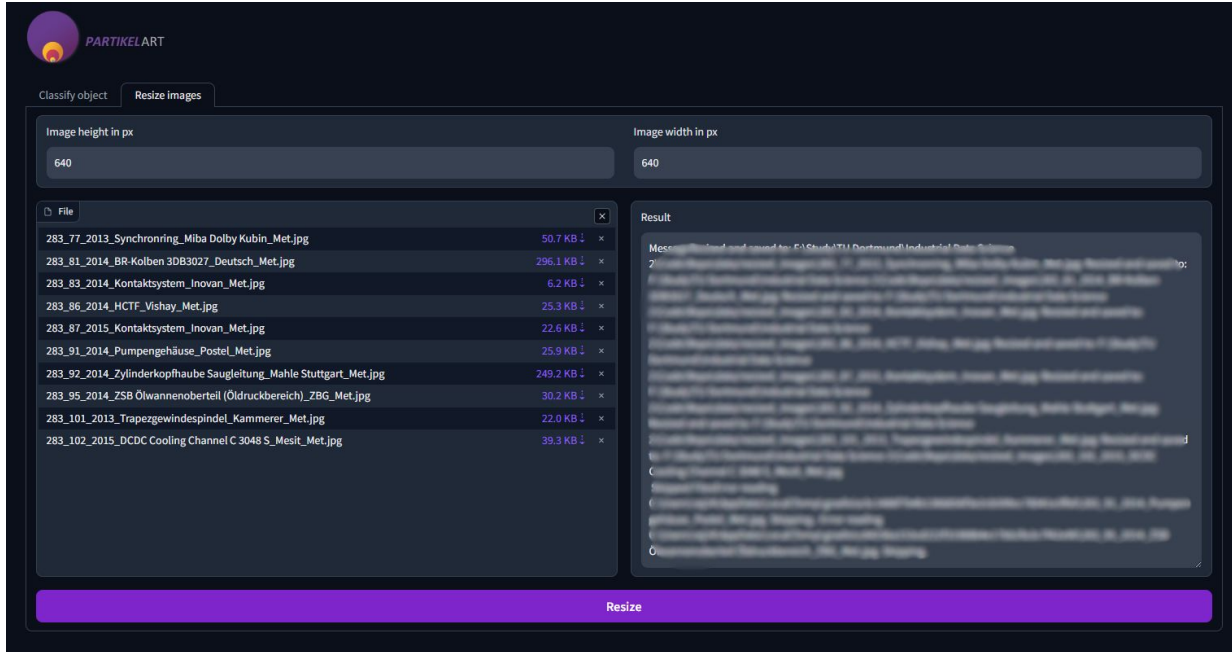


Exploratory Data Analysis

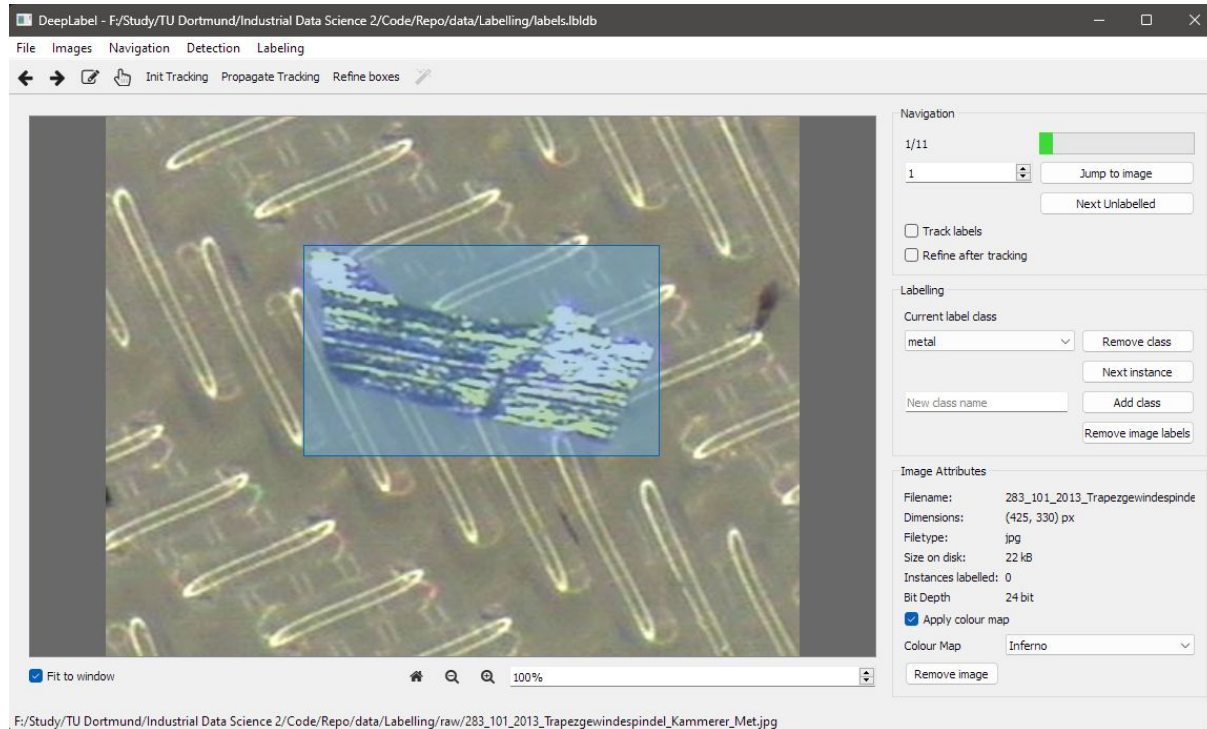
- Image dimensions and aspect ratios (**YOLO - 640 x 640 px**)
- Labels composition
 - Bounding box sizes
 - Aspect ratios (for instance a lot of small particles / Overlapping particles)

Exploratory Data Analysis

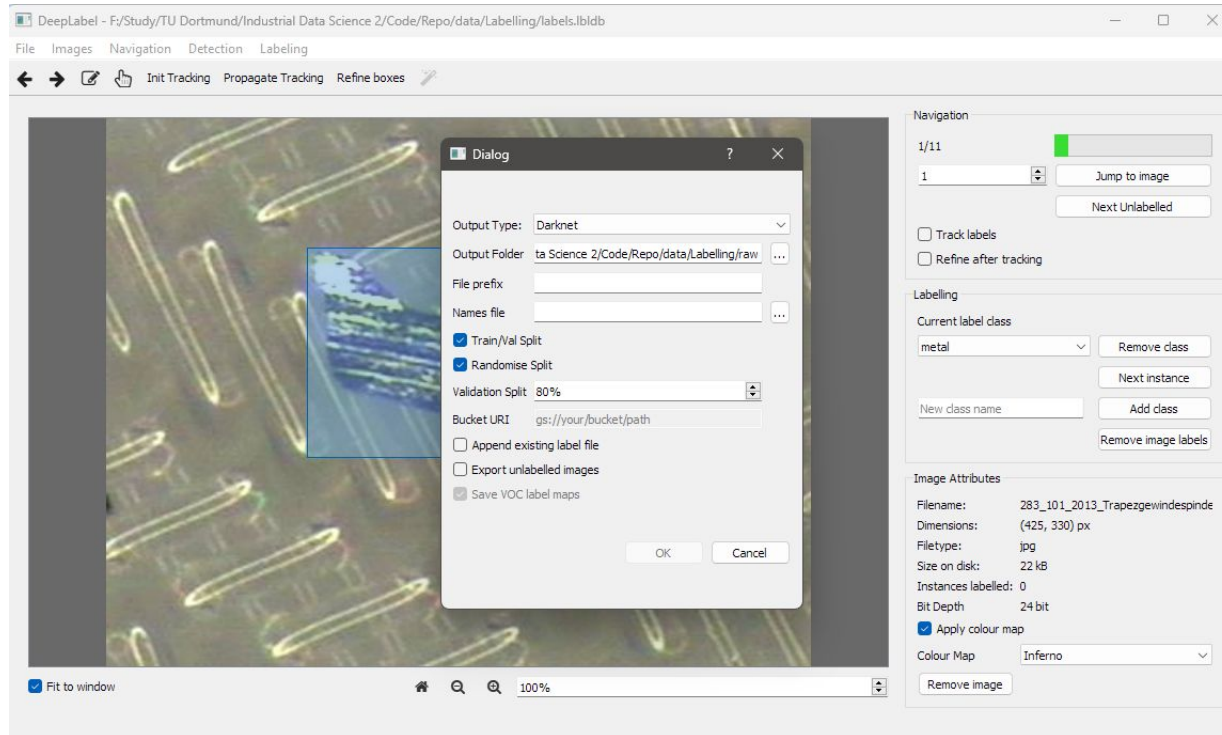




Exploratory Data Analysis



Exploratory Data Analysis



Future Work

Train and assess the results from Yolo and CNN models with tuning of hyperparameters.

Summary

PartikelART Solutions GmbH addresses challenges in technical cleanliness through digital solutions, aiming to identify and mitigate particle contamination affecting product quality, efficiency, and safety.

The problem statement highlights the urgency for innovative solutions to assess cleanliness levels accurately and swiftly, overcoming inefficiencies of traditional methods.

Our approach combines real-time insights with pre-trained models like YOLO and CNNs to analyze cleanliness levels effectively.

We leverage existing datasets for decision-making and enhance model efficiency through exploratory data analysis, focusing on image dimensions, label composition, bounding box sizes, and aspect ratios, particularly emphasizing YOLO's dimensions and particle characteristics.

References

- <https://opencv.org/>
- <https://www.gradio.app/>
- [jveitchmichaelis/deeplabel: A cross-platform desktop image annotation tool for machine learning \(github.com\)](#)
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Q&A!