# OBJECT DETECTION ASSISTED INSPECTION OF RAILWAY TRACTION VEHICLE IMAGERY AT MÁV-GROUP.

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**Abstract.** The Hungarian State Railways (MÁV-Group) manages a vast collection of train images through the EMIG platform [1], where users submit photos of trains for approval. Manual validation of these images is labor-intensive and inefficient. This study aims to **automate and explain** the approval process using an image processing pipeline with object detection algorithms (*Ultralytics YOLO* [2]) and OCR (*PaddleOCR* [3]) to extract train UIC codes [4] and detect non-compliance. The system also ensures **GDPR compliance** by blurring recognizable faces in submitted images. A suggested "approval rate" will explain non-compliance factors (e.g., incorrect train number, presence of people) and aid inspectors in decision-making. This solution streamlines image review while maintaining data protection standards.

## INTRODUCTION

MÁV-Group utilizes the EMIG platform to oversee train operations and manage images contributed by railway enthusiasts and staff members. However, the current manual approval process is labor-intensive and it sends no feedback to the user why his/her picture has been denied. The primary challenge lies in processing these submissions efficiently while complying with strict guidelines and GDPR regulations. The existing system relies on **manual validation**, lacking both automation and scalability, which results in **significant inefficiencies**. This study proposes a solution to **automate** image validation by integrating object detection algorithms and OCR technology to verify train IDs, blur faces, ensuring privacy and

## LITERATURE REVIEW

Automated image processing has shown promise in industries like railway inspection, where AI streamline defect detection. Object detection algorithms, such as **Ultralytics YOLO**, and OCR tools like **PaddleOCR** have proven effective for real-time image recognition and text extraction [6]. Privacy compliance research underscores the importance of face blurring to meet GDPR standards [5]. While advancements exist, they have not been fully applied to railway image management systems [7]. This study builds on these findings to develop the pipeline, addressing challenges in scalability, automation, privacy and explanation.

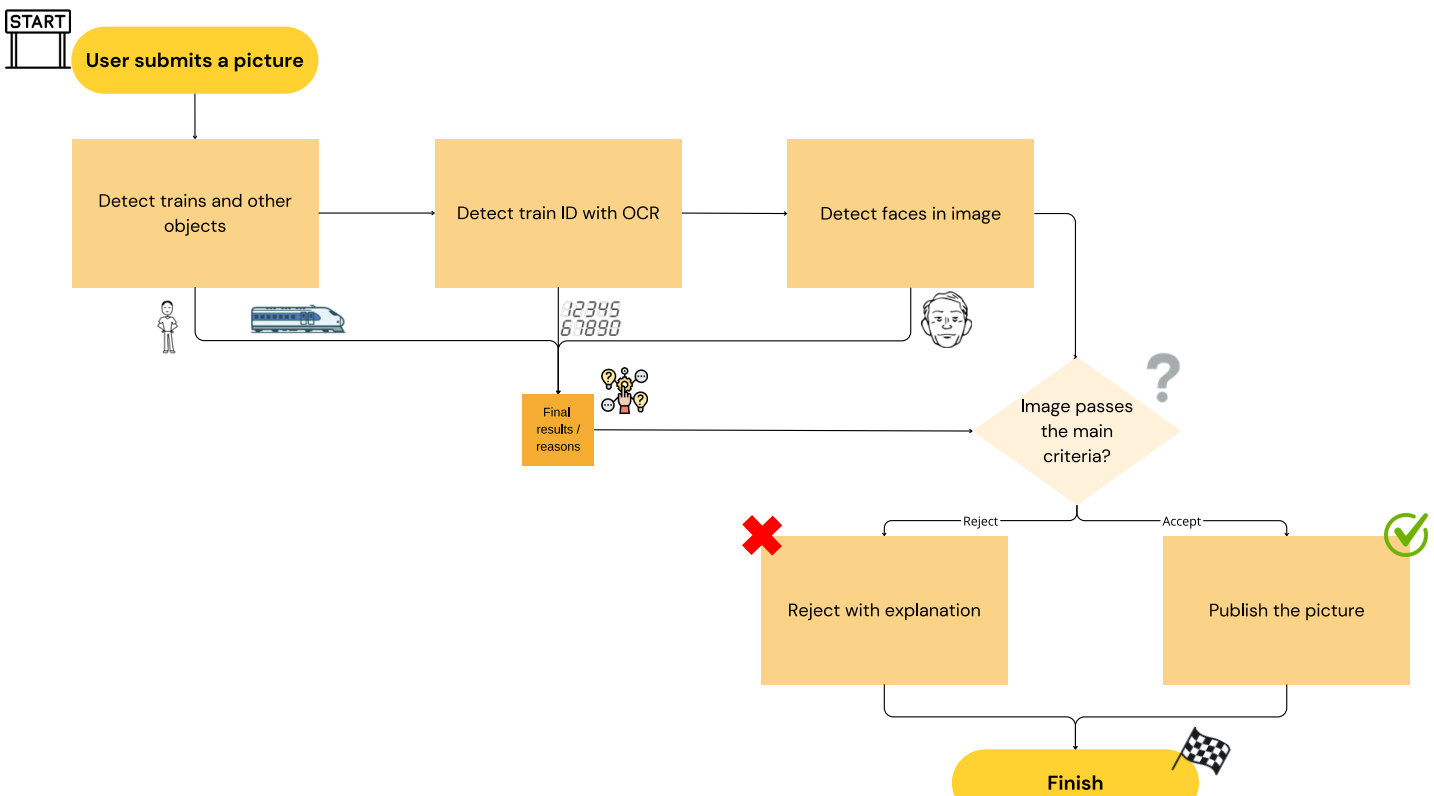


*Fig. 1. The proposed pipeline process*

to explain the reasons behind the suggested result. The hypothesis is that this automated approach will **greatly improve efficiency and accuracy** in approving submissions, reducing the workload for inspectors and **explaining** to them and the user the reasons behind a submission furthermore setting a new standard for similar systems in railway image management.

## IMPLEMENTATION METHODOLOGY

I want to create this pipeline using Python as the main programming language and deploy a microservice architecture using Kubernetes. The pipeline consists of 3 main parts: **detecting objects** on an image, extracting the train's ID with **OCR** and lastly, **detecting and blurring out faces.** The planned structure of the pipeline is shown on *Fig. 1*.

## PRELIMINARY CONSIDERATIONS

The manual validation of railway images in the EMIG platform presents significant inefficiencies due to its labor-intensive nature. Given the increasing volume of submissions, an automated approach might help with the review but we need to consider **„human-override".**


*Fig. 2. The proposed result of an image inspection*

Additionally, ensuring compliance with GDPR regulations, such as face blurring, is crucial in maintaining data privacy standards. The pipeline can suggest an „**approval**" or „**denial**" with a detailed **reason**. Furthermore there must be a manual override function if an employee has to decide on an image where the suggestions are uncertain. A proposed sample image can be seen on *Fig. 2*.

## CONCLUSIONS

The proposed automated pipeline streamlines the image validation process, reducing the workload for inspectors while maintaining compliance with regulatory standards. By integrating this system it improves **efficiency**, **accuracy**, and **scalability**. Additionally the users can see the **reasoning** behind a decision. This approach sets a foundation for further advancements in railway image management, demonstrating the potential of AI-driven automation in similar domains.

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