Automated Expiry Date Extraction System

Final Presentation

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IHI Team G-RIPS 2025

G-RIPS Sendai 2025

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Problem Statement

The goal of the project is to design an algorithm that detects the expiration date from images of cardboard boxes containing food and beverage items.

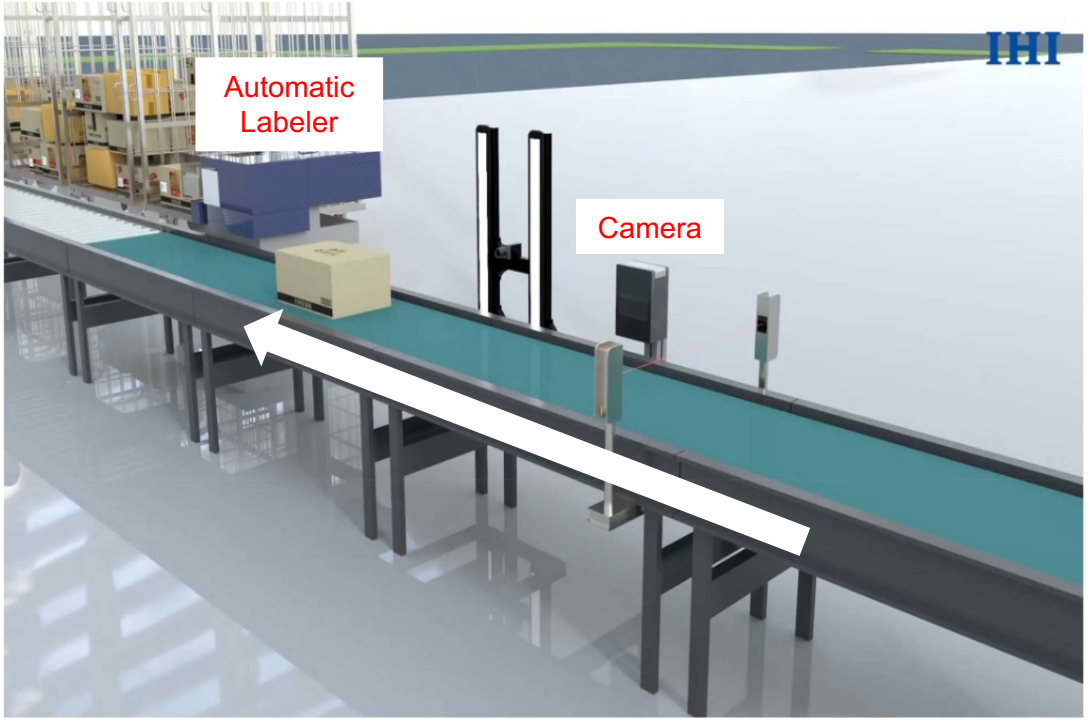
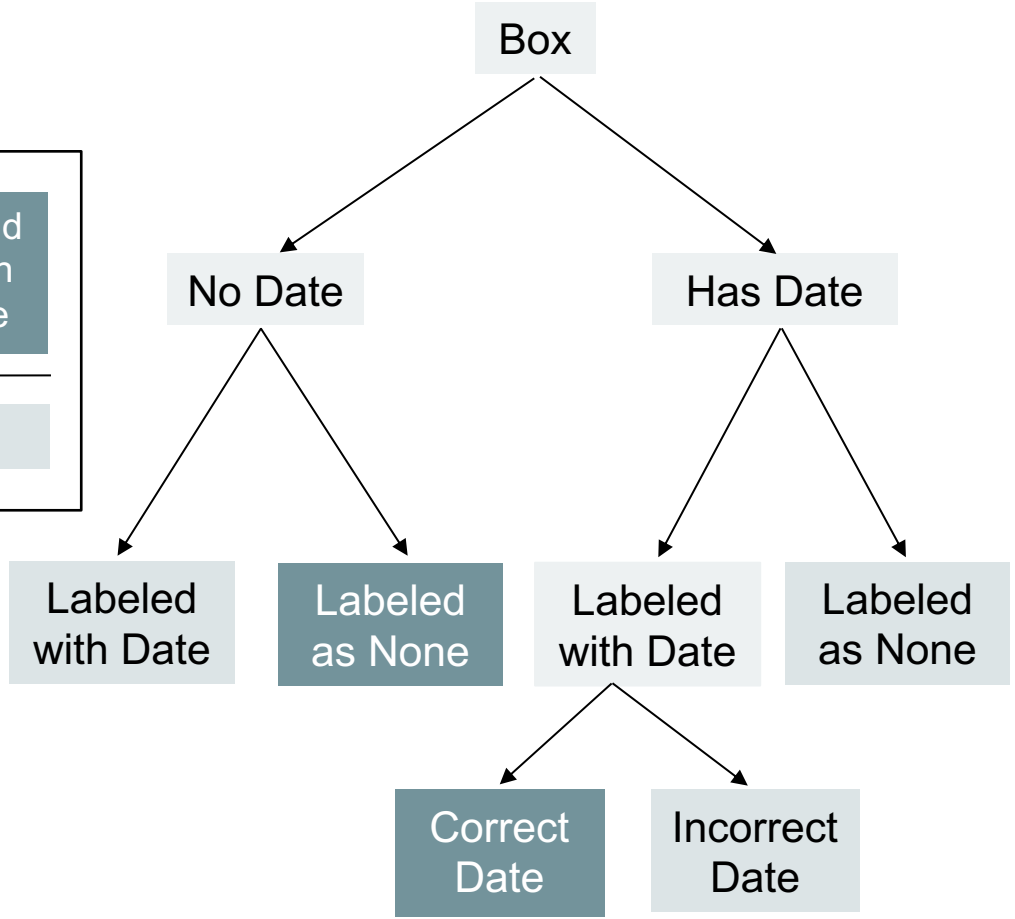


Photo credit: IHI Logistics & Machinery Corporation

Accuracy

$$Accuracy = \frac{\text{No Date and Labeled as None} + \text{Has Date and Labeled with Correct Date}}{\text{Total Number of Boxes}}$$



Dataset

Bounding Box Coordinates in (x,y,w,h) format:

```
1 0.3345189296207956 0.5552776191330846 0.20351175621678036 0.027518116074985385
0 0.547505929548074 0.4782751715197483 0.13018160923988376 0.05503623214997063
2 0.7839750572232466 0.5210006675309086 0.1425406349587628 0.13855612830738234
0 0.7489643720136934 0.7738711402630623 0.16602270663208935 0.06371784010757174
```

Labeling Strategies

Not line-separated

Line-separated

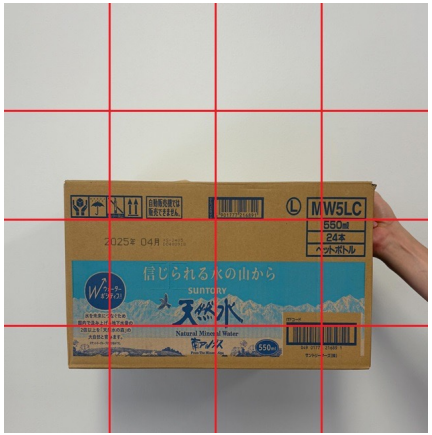
YOLO models for object detection

- YOLO (You Only Look Once) : State-of-the-art **object detection** and image segmentation model built on a deep learning framework.
- Key trade-off : Model size vs. accuracy performance.
- Model variants tested : YOLOv8n, YOLOv8s, YOLOv8m, and YOLOv11m.
- Training approaches: From scratch vs. **transfer learning** methods.
- Dataset: 2500 images with 70% train / 20% validation / 10% test.

YOLO Architecture

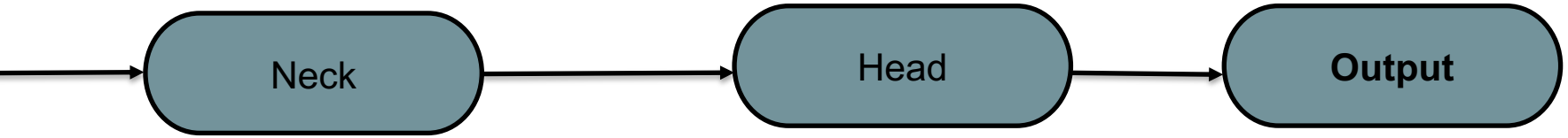
Input: Image

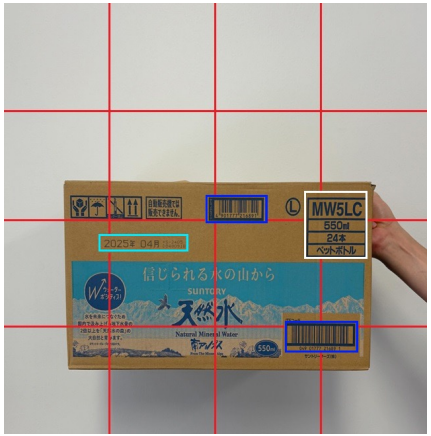
Backbone



- Convolutional neural network.
- Extracts features from input image.

YOLO Architecture



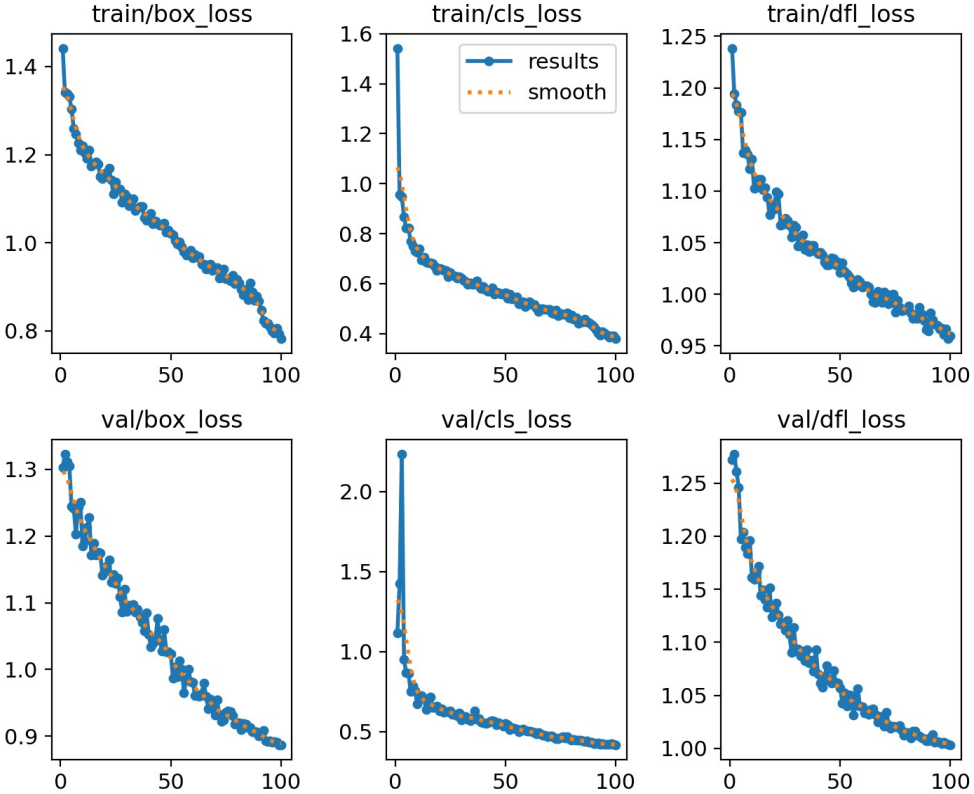


- Merges feature maps to gather information at different scales.
- Uses a C2f module.

- Makes predictions for bounding boxes.
- Classifies bounding boxes.

- Bounding boxes for detected objects.
- Class for each object detected.
- Objectness loss.
- Classification loss.
- Distributed focal loss.

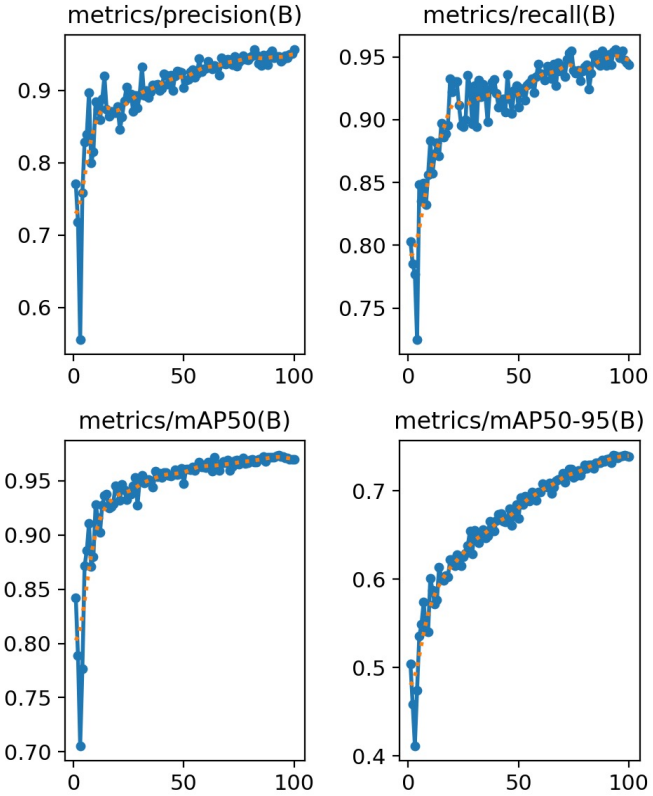
YOLOv11m Metrics



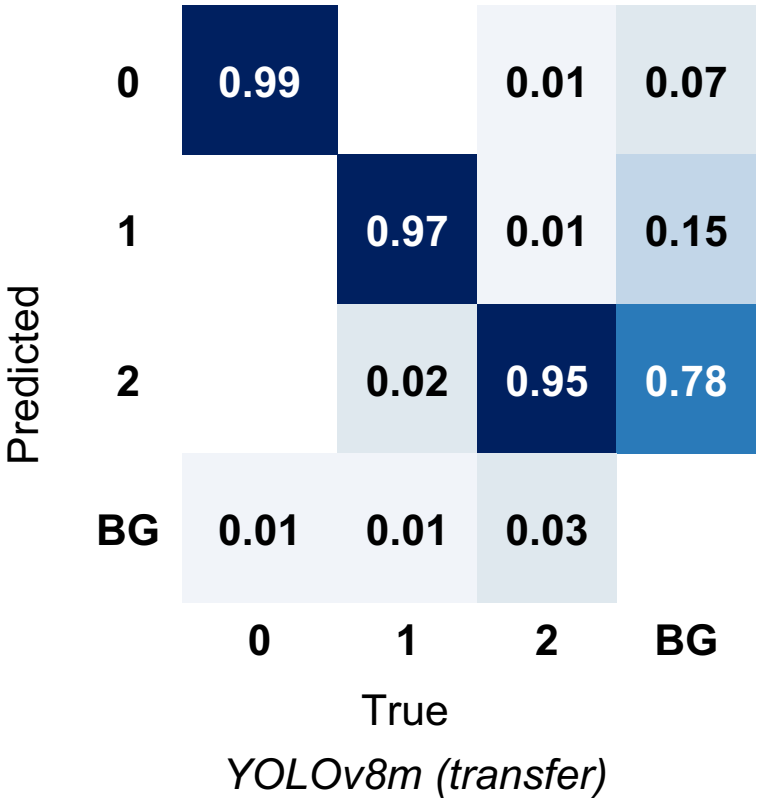
- **Loss Minimization**
- 100 Epochs
- Total Loss = λ_1 × Box Loss + λ_2 × Class Loss + λ_3 × DFL Loss
- Where λ_i is a loss weight to balance the components

YOLOv11m Metrics

- **Metric Maximization**
- mAP : mean Average Precision



Confusion Matrices for YOLOv8m and YOLOv11m



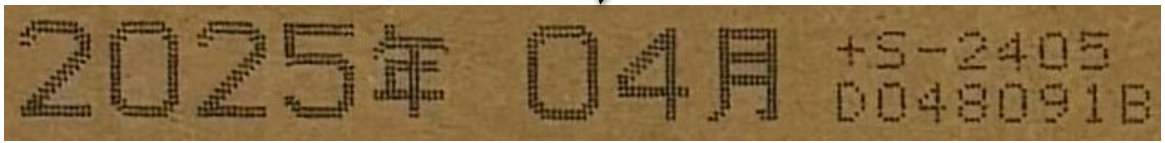
YOLOv8m (transfer)

YOLO v11m (transfer)

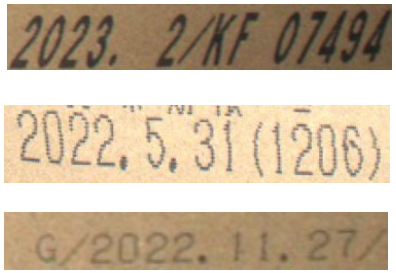
Legend	
0	BarCode
1	DateInfo
2	ProdInfo
BG	Back-ground

Text Extraction

Crop ROI from detections before reading text from the image.



Optical Character Recognition



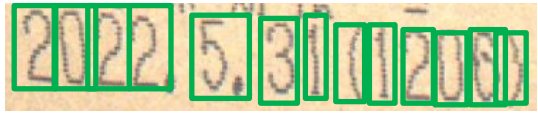
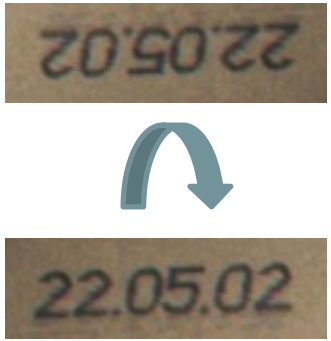


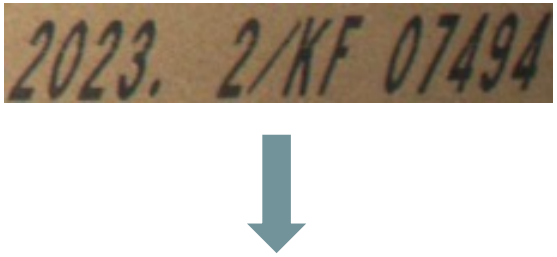
Image → Label Text → Detect Text

- Cropped ROI from YOLO

- PPOCR Label
- StyleText

- DB
- EAST
- SAST





['2023.', '2/KF', '07494']

{
"rec_texts":
['2023.', '2/KF', '07494'],
"rec_score":
[0.91, 0.98. 0.88]
}

Classify Direction → Recognize Text → Output

- Identify text orientation

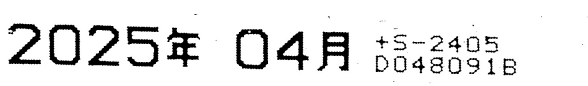
- Rosetta
- StarNet
- CRNN
- RARE
- SRN

- Detected texts
- Confidence scores

Reproduced from: https://2021.desosa.nl/projects/paddleocr/posts/paddleocr-e2/

EasyOCR vs. PaddleOCR

- Our first pipeline using EasyOCR plateaued at around 70% accuracy.
- OCR Engine Switching: **EasyOCR → PaddleOCR.**

	Raw	Preprocessed
Input Image		
EasyOCR	)1/) . ::2:: 7- . 年 (.	2025年04月 64398
PaddleOCR	2025年04月 +5-2405 D048091B	2025年04月 +5-2405 D048091B

Ground Truth : 2025年04月 +S-2405 D048091B

Post-processing: regex patterns

Dates with Separators

2024○8○1

- 2-4 digits (year)
- Separator*
- 1-2 digits (month)
- *(Optional)* Separator*
- *(Optional)* 1-2 digits (day)

Chinese Dates

2025年04月

- 2-4 digits (year)
- 年 or 4
- 1-2 digits (month)
- 月
- *(Optional)* 1-2 digits (day)

Dates without Separators

21122

- 5-8 digits

* ○ is a placeholder for space, comma, midpoint(·), period(.) , slash(/), and hyphen (-).

Post-processing: regex patterns

Dates with Separators

2024◦8◦1

2024-08-01

Chinese Dates

2025年04月

2025-04-30

Dates without Separators

21122

2021-01-22
2021-12-02

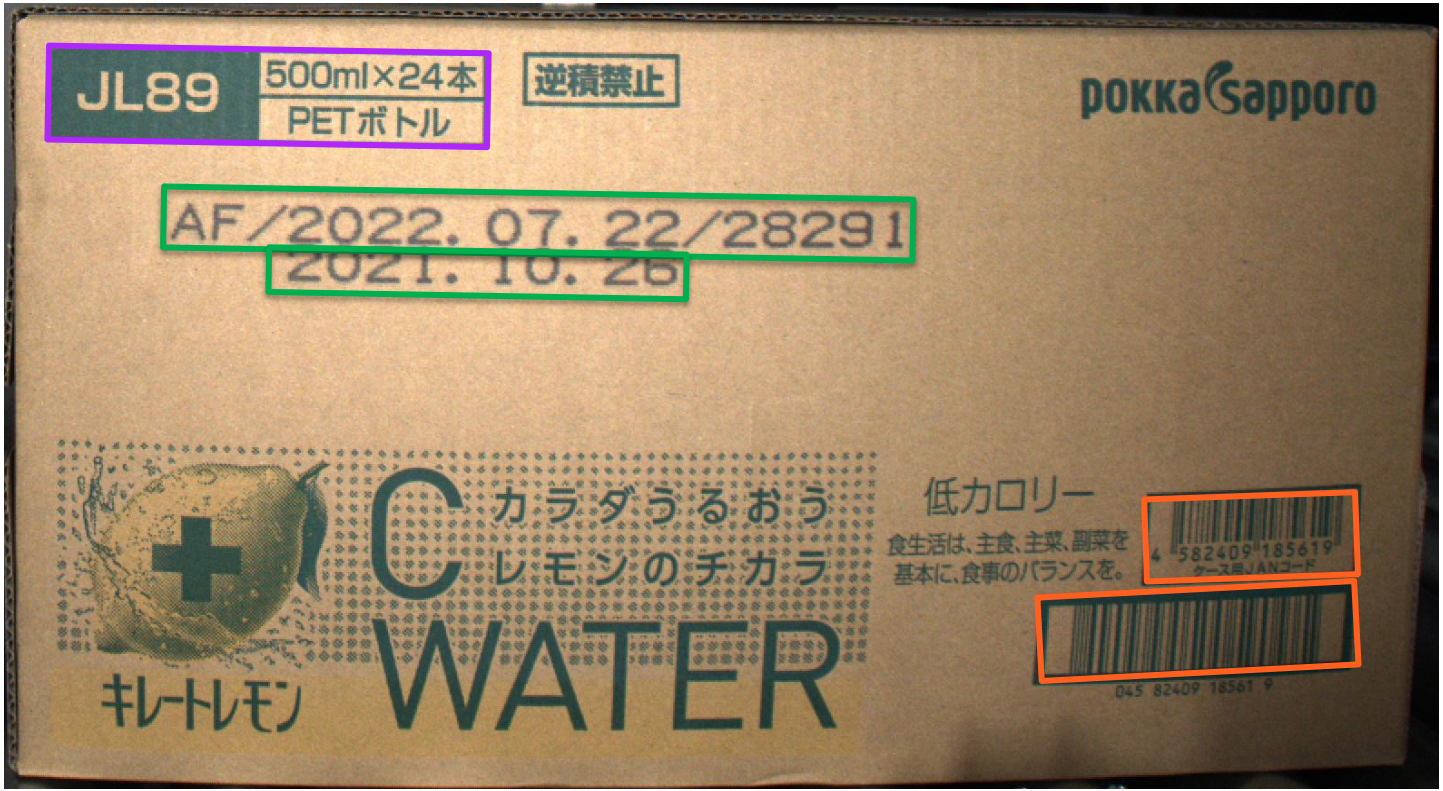
* ◦ is a placeholder for space, comma, midpoint(·), period(.) , slash(/), and hyphen (-).

Input Image

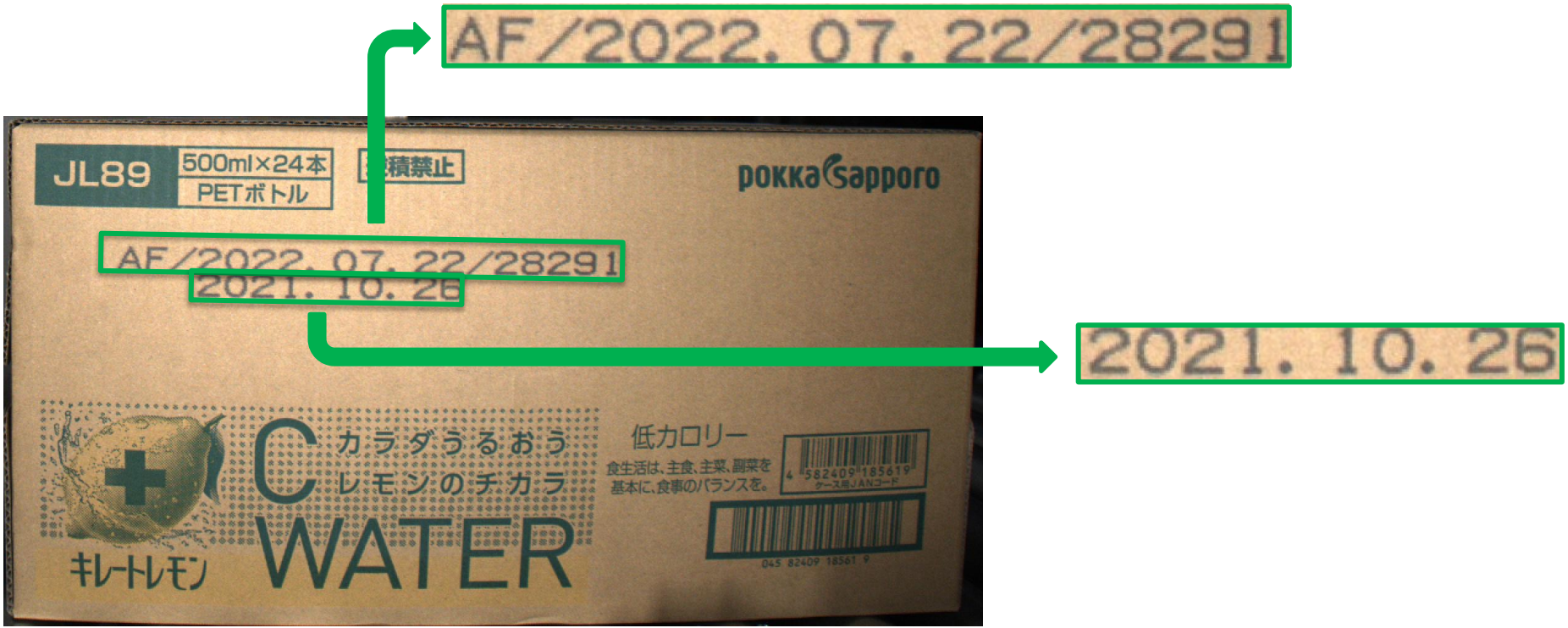

JL89
500ml×24本
PETボトル
逆積禁止
pokka sapporo
AF/2022. 07. 22/28291
2021. 10. 26
C
カラダうるおう
レモンのチカラ
WATER
キレートレモン
低カロリー
食生活は、主食、主菜、副菜を
基本に、食事のバランスを。
4 582409 185619
ケース用JANコード
045 82409 18561 9

YOLO Detections

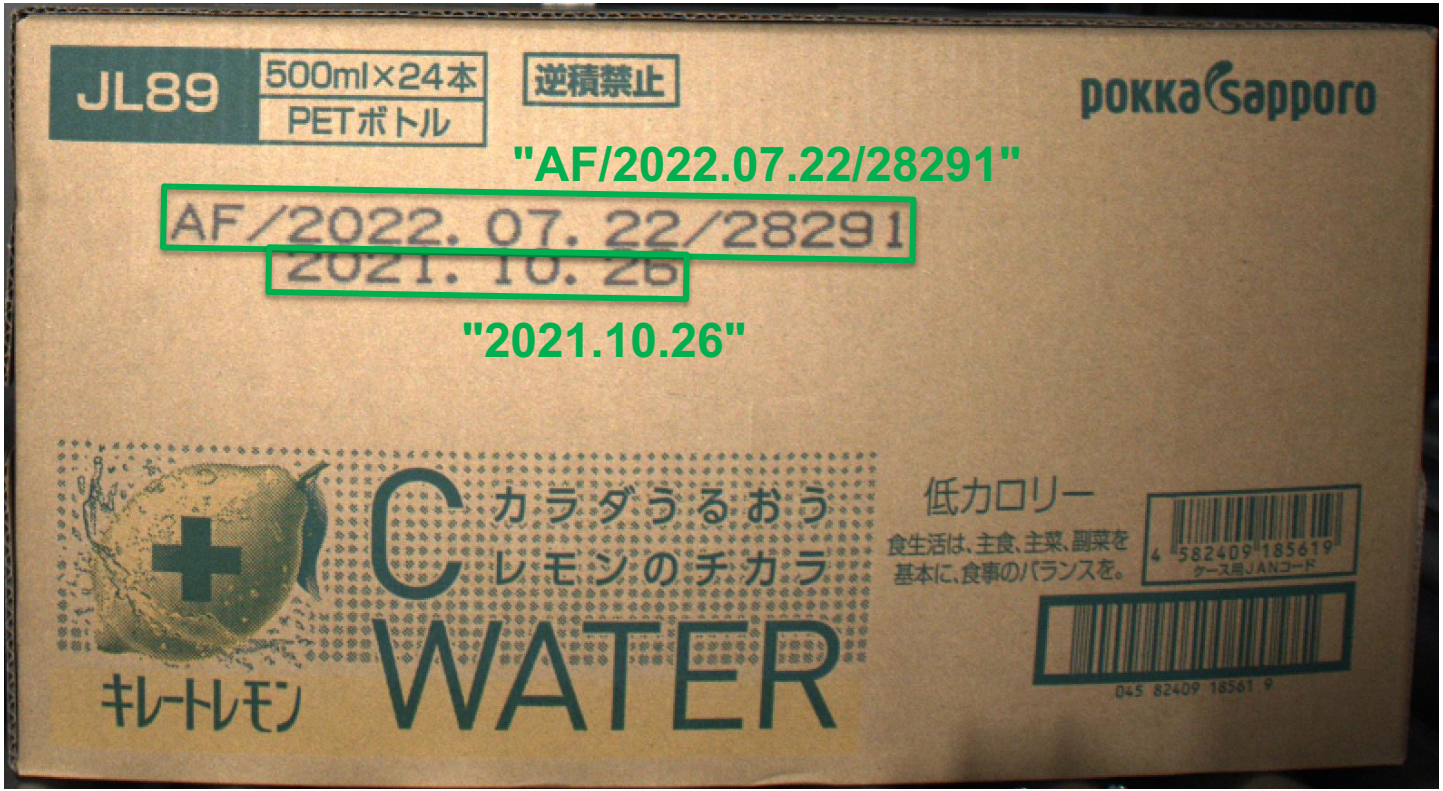
BarCode
DateInfo
ProdInfo



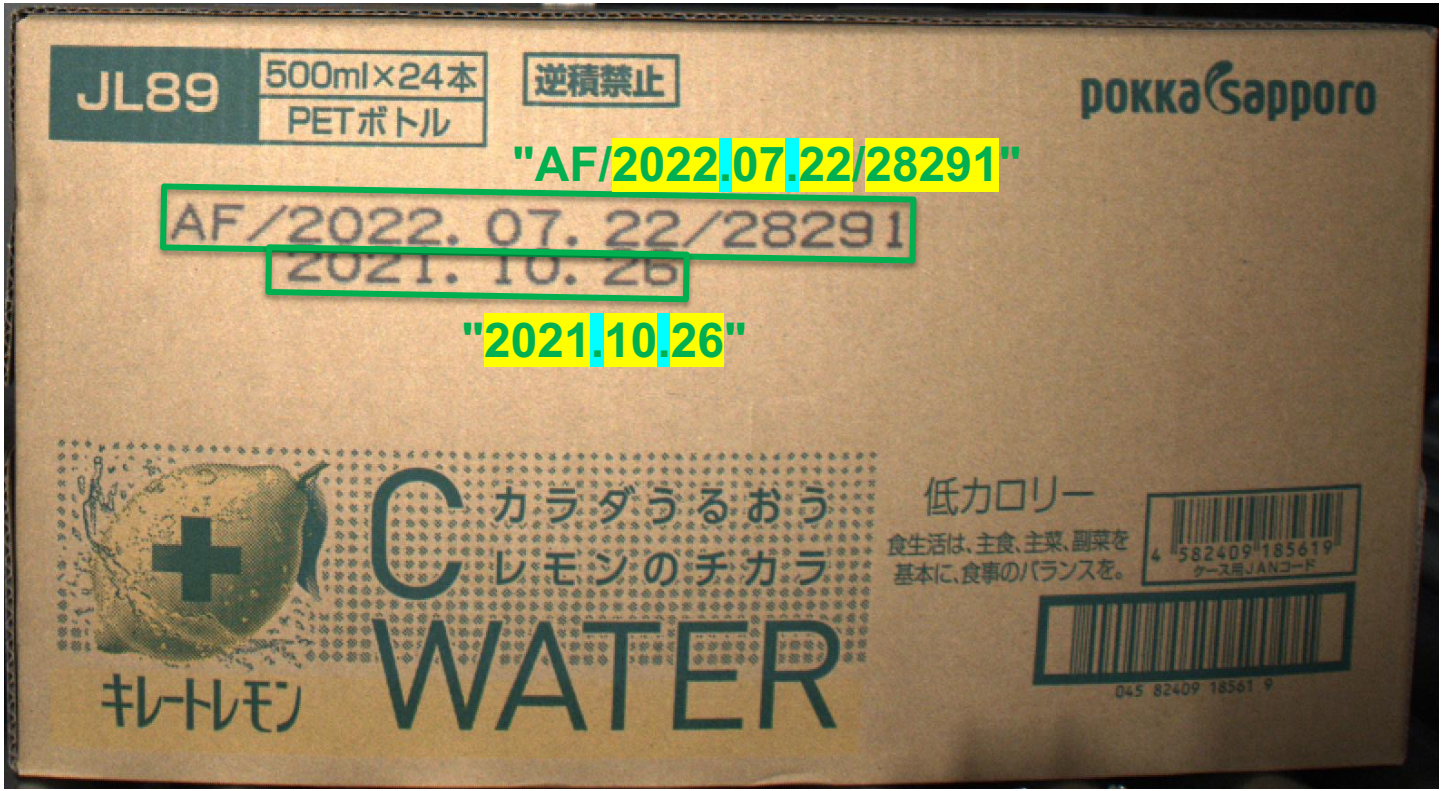
Cropped Detections



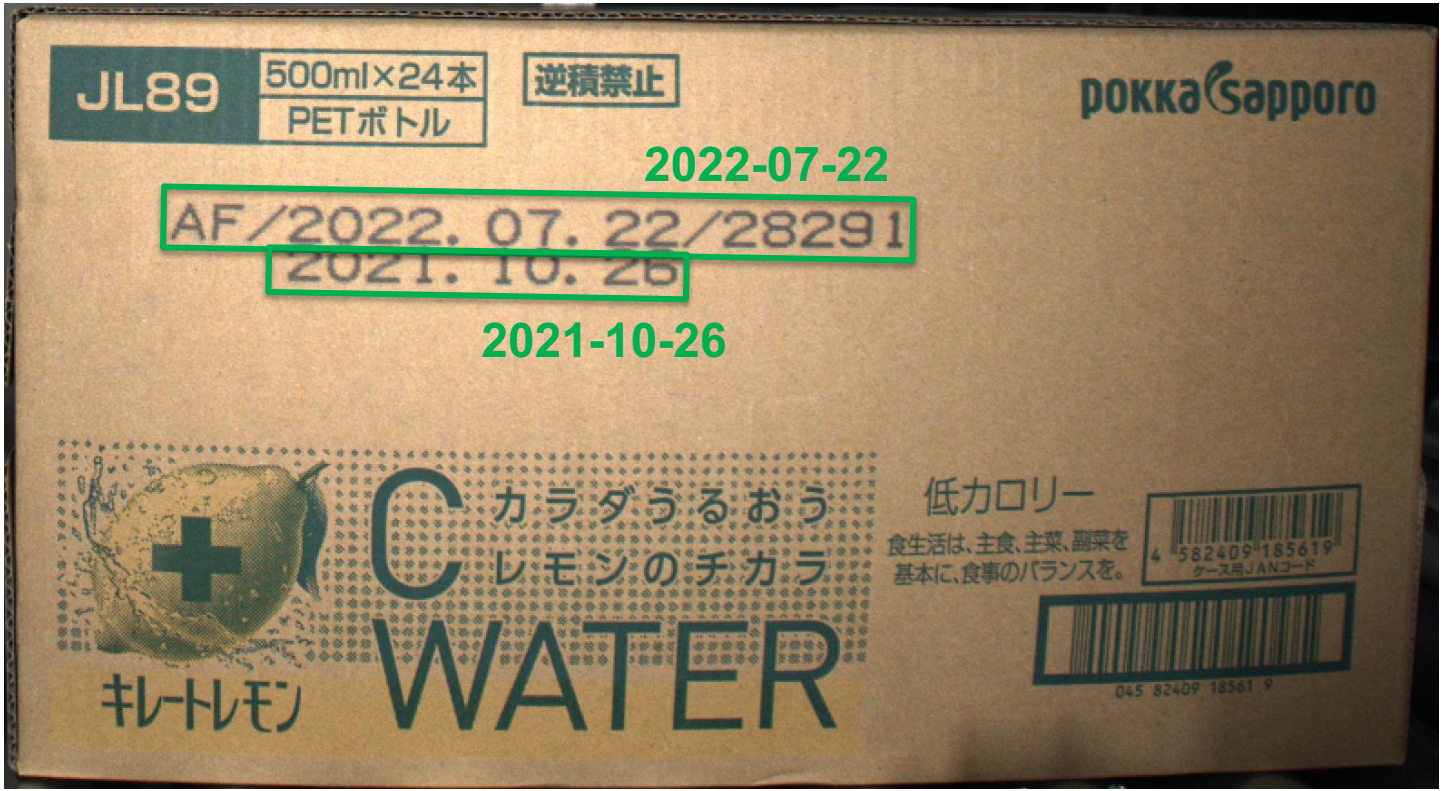
Extracted Texts from OCR



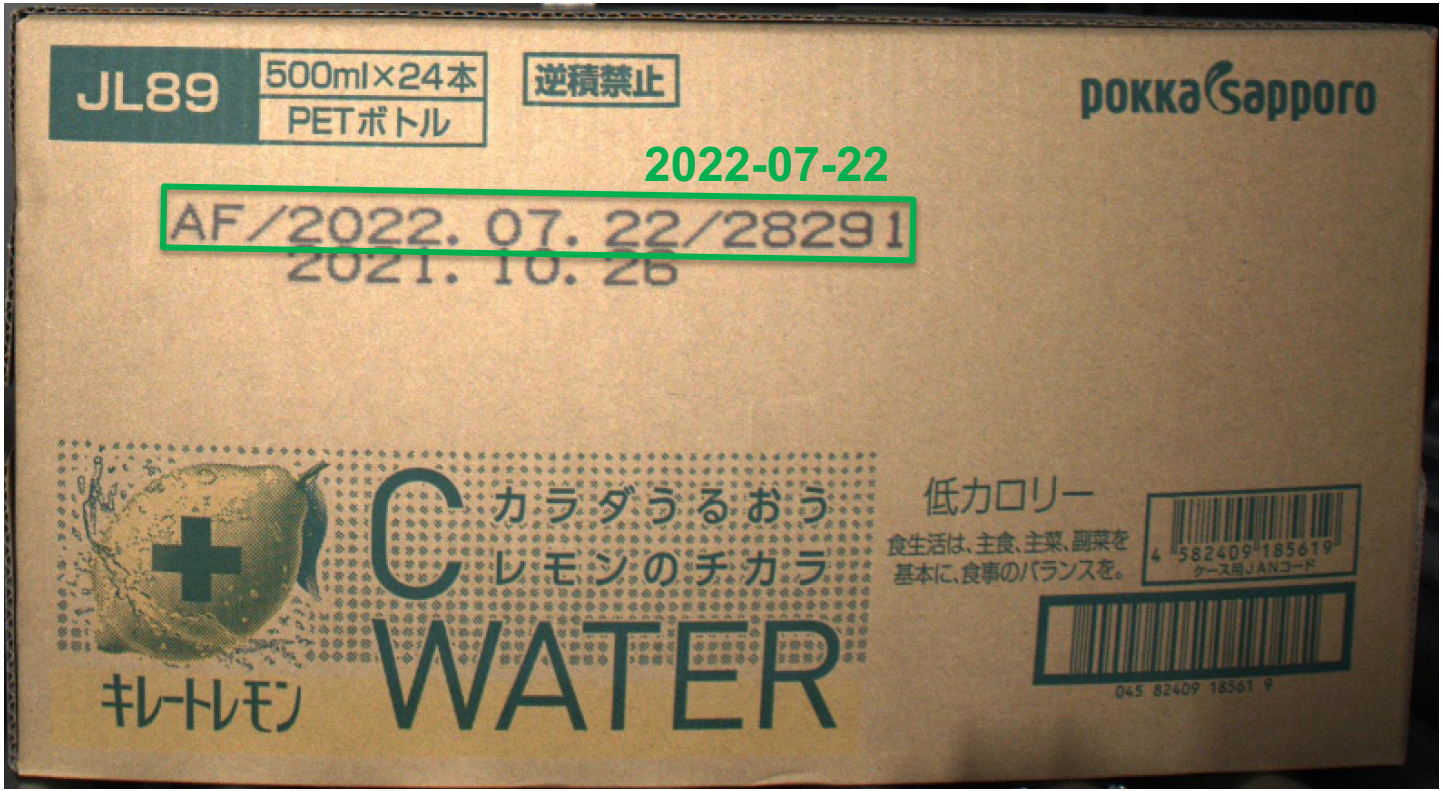
Regex Pattern Matching



Date Parsing



Final Output



Overall Performance

Pipeline Version	OCR Engine	Year-Month-Day Accuracy [%]	Year-Month Accuracy [%]
First	EasyOCR	70.8	76.2
Latest	PaddleOCR	96.7	98.1

Accuracies calculated from a test set of 1000 images.

Future Works

- Extraction of other kinds of information: **ITF-14 Barcode**.
- Resource Optimization: CPU or lower tier GPUs than A100.
- Processing speed: Improving real-time processing speed.
- Improving the **robustness** of the **regex** operation.
- Robustness to various image conditions: YOLO retraining with expanded data diversity.

Thank You

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