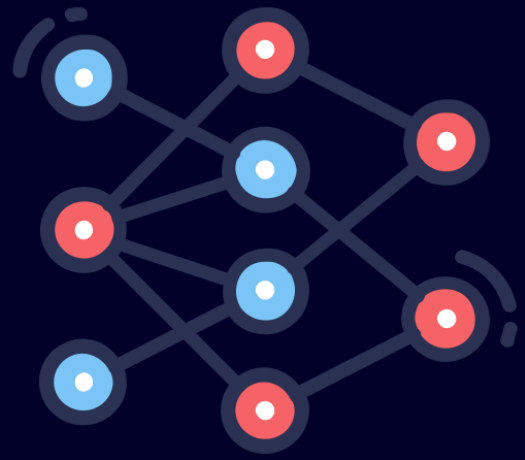
Redes neuronales en controladores SIMATIC

Congreso AADECA Agosto 2025



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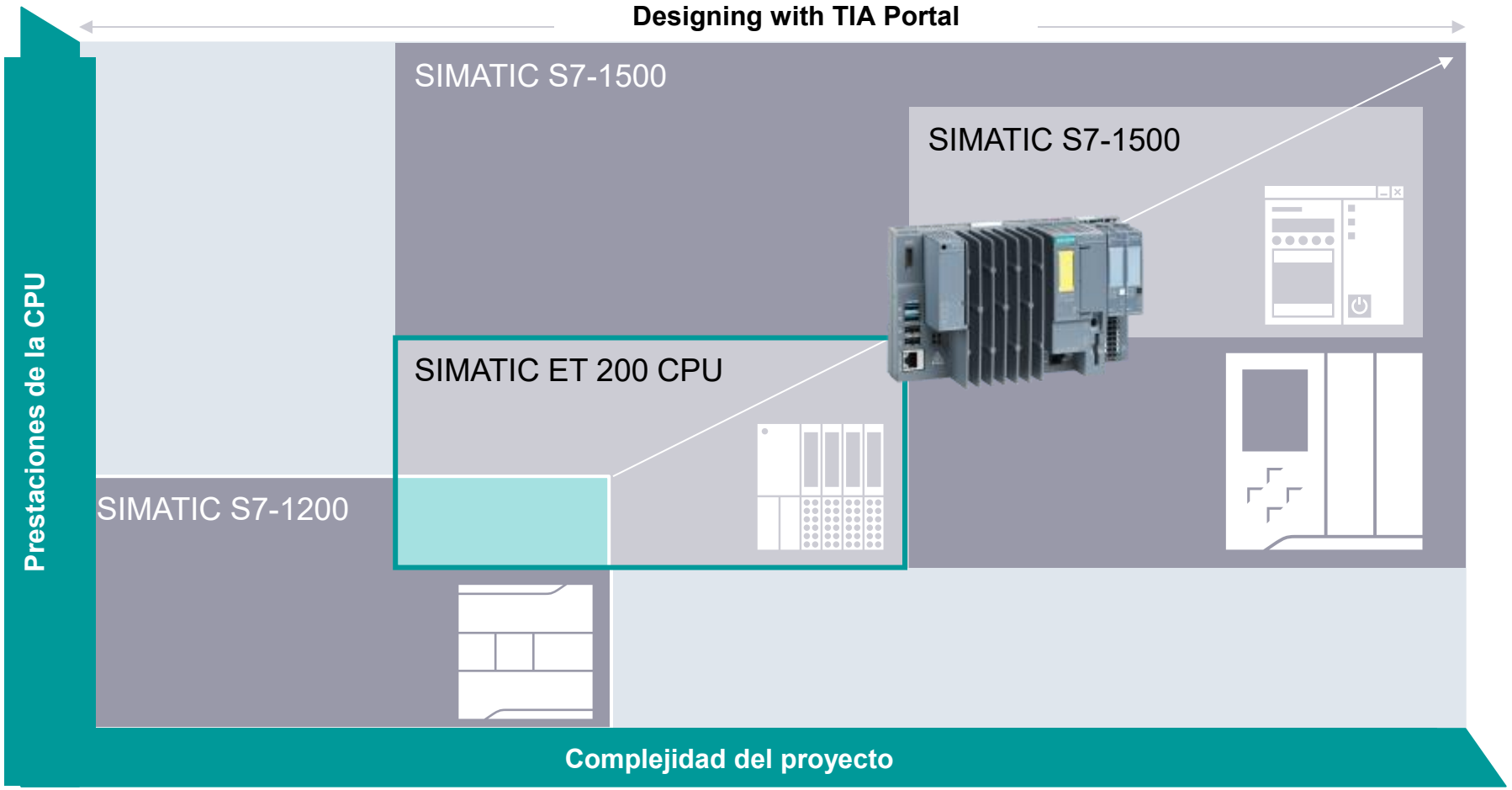
SIMATIC ET 200SP Open Controller



Effective design

Innovative design

Integrated Diagnostics

Safety Integrated

Security Integrated

Technology Integrated

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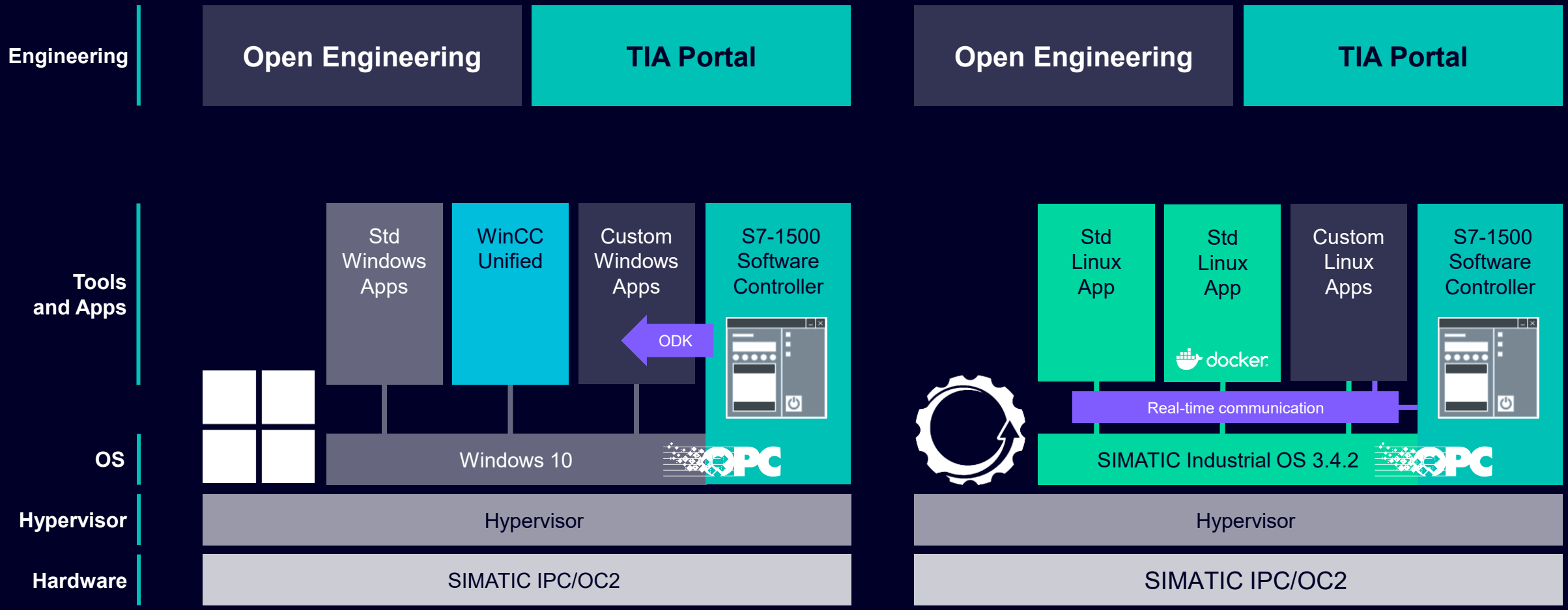
SIMATIC S7-1500 Software Controller
Supported General Purpose OS Combinations



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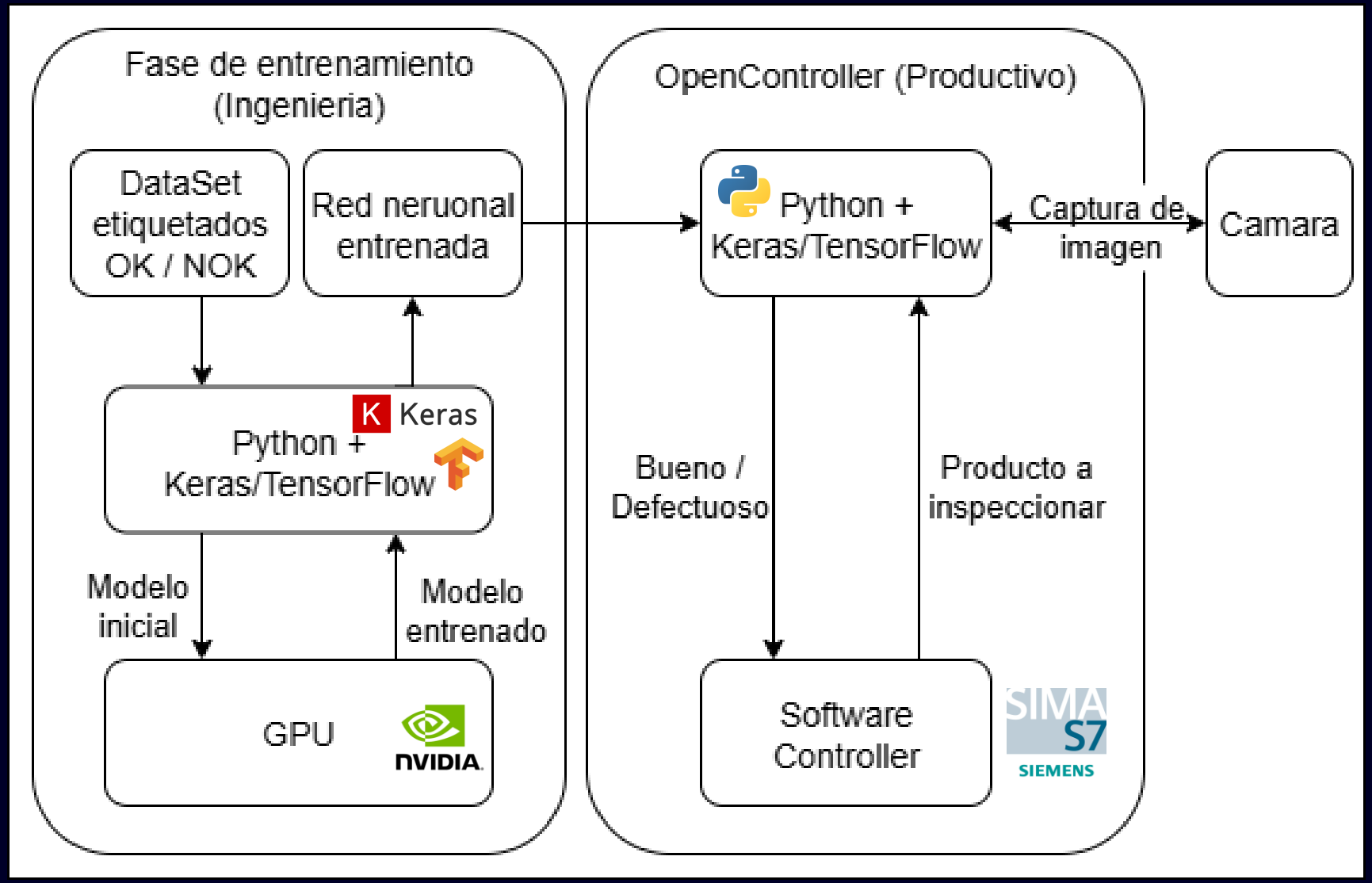
Flujo de trabajo



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DataSet etiquetados

Buenas

Malas

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Programa de entrenamiento y ejecucion

```python
def make_model(input_shape, num_classes):
    inputs = keras.Input(shape=input_shape)
    x = data_augmentation(inputs)
    x = layers.Rescaling(1./255)(x)
    ....


    # Entry block
    x = layers.Rescaling(1.0 / 255)(inputs)
    x = layers.Conv2D(128, 3, strides=2, padding="same")(x)
    x = layers.BatchNormalization()(x)
    x = layers.Activation("relu")(x)

    previous_block_activation = x  # Set aside residual

    for size in [256, 512, 728]:
        x = layers.Activation("relu")(x)
        x = layers.SeparableConv2D(size, 3, padding="same")(x)
        x = layers.BatchNormalization()(x)

        x = layers.Activation("relu")(x)
        x = layers.SeparableConv2D(size, 3, padding="same")(x)
        x = layers.BatchNormalization()(x)

        x = layers.MaxPooling2D(3, strides=2, padding="same")(x)

        # Project residual
        residual = layers.Conv2D(size, 1, strides=2, padding="same")(
            previous_block_activation
        )
        x = layers.add([x, residual])  # Add back residual
        previous_block_activation = x  # Set aside next residual

    x = layers.SeparableConv2D(1024, 3, padding="same")(x)
    x = layers.BatchNormalization()(x)
    x = layers.Activation("relu")(x)

    x = layers.GlobalAveragePooling2D()(x)
    if num_classes == 2:
        units = 1
    else:
        units = num_classes

    x = layers.Dropout(0.25)(x)
    # We specify activation=None so as to return logits
    outputs = layers.Dense(units, activation=None)(x)
```

```python
import os
os.environ['TF_ENABLE_ONEDNN_OPTS'] = '0'
os.environ['TF_CPP_MIN_LOG_LEVEL'] = '2'
import numpy as np
import keras
from keras import layers
from tensorflow import data as tf_data
import matplotlib.pyplot as plt

image_size = (500, 500)
batch_size = 128

from keras.models import load_model


model = load_model("save_at_999.keras")


img = keras.utils.load_img("Images/mala1.jpg", target_size=image_size)
img_array = keras.utils.img_to_array(img)
img_array = keras.ops.expand_dims(img_array, 0)  # Create batch axis
predictions = model.predict(img_array)
score = float(keras.ops.sigmoid(predictions[0][0]))
print(f"Img1 is {100 * (1 - score):.2f}% Buena and {100 * score:.2f}% Mala.")
text = f"This image is {100 * (1 - score):.2f}% Buena and {100 * score:.2f}% Mala."
plt.imshow(img)
plt.title(text)
plt.show()
```


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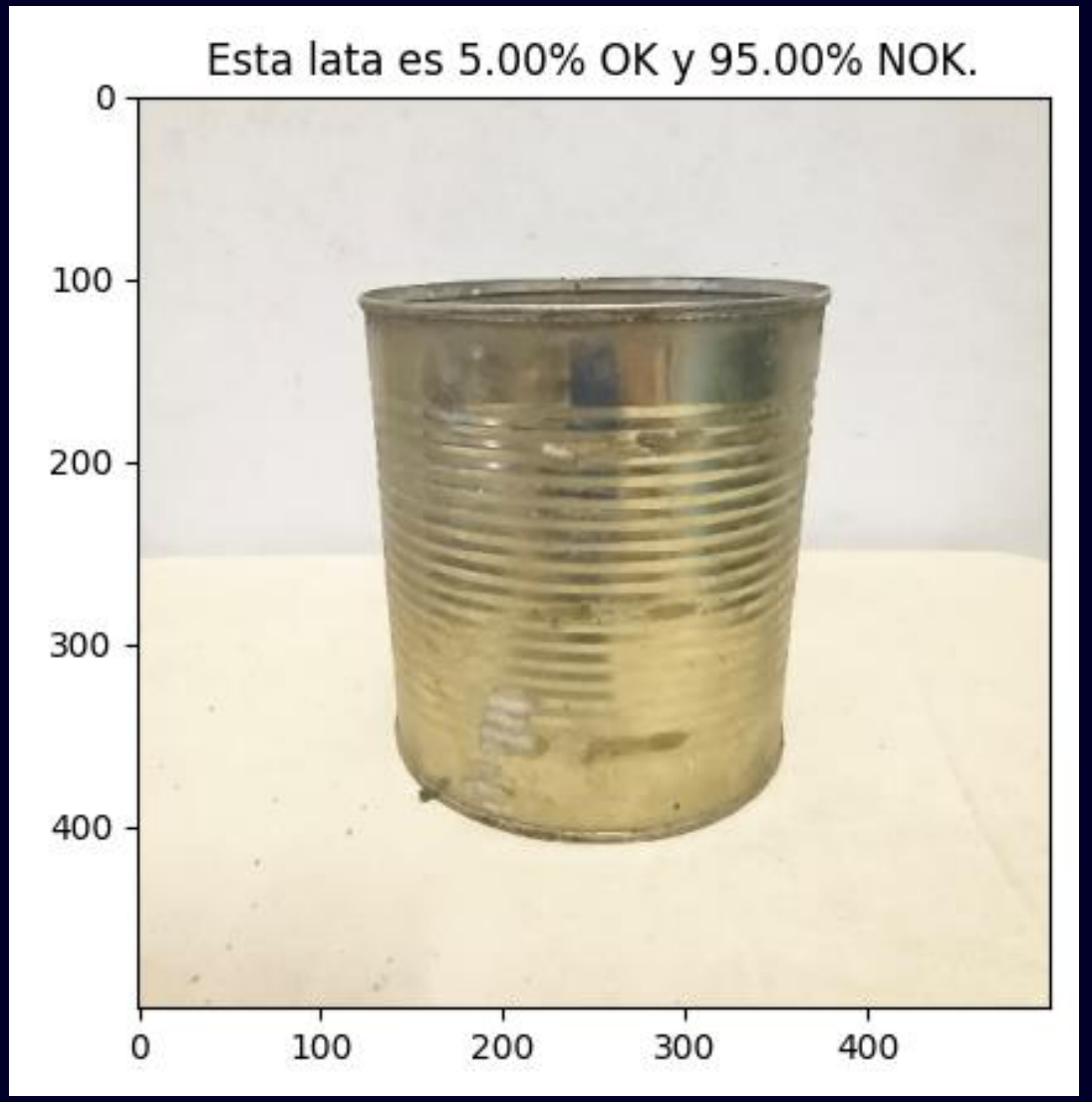
Resultado del modelo



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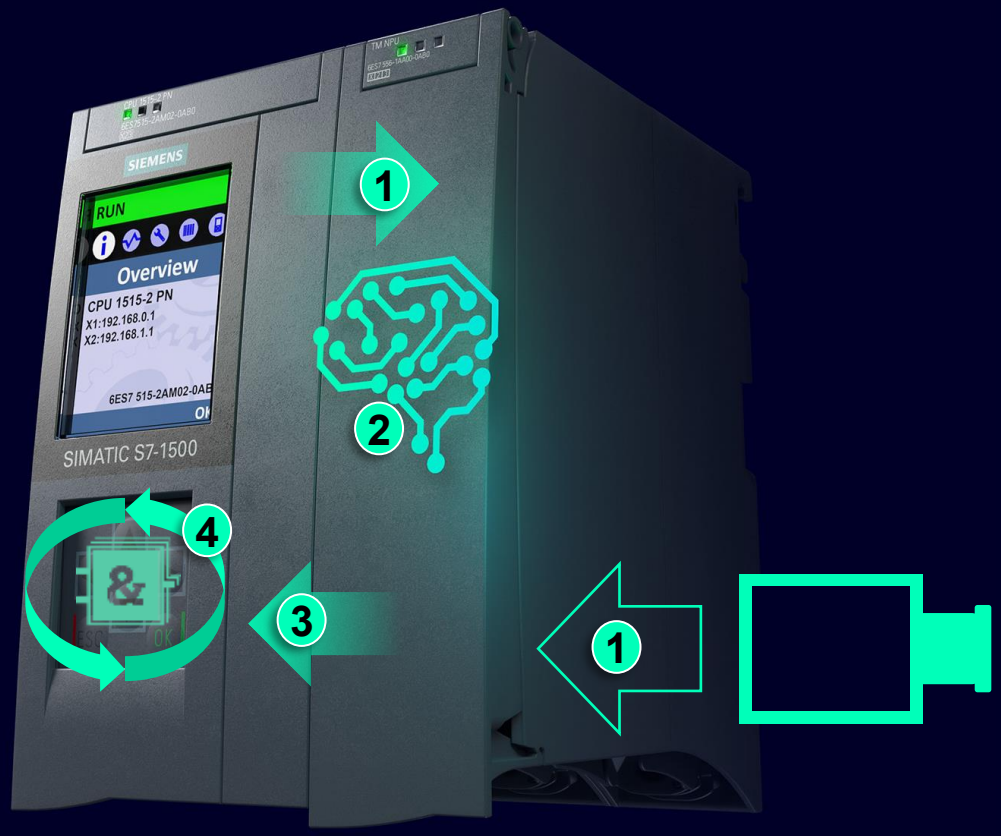
Artificial Intelligence in SIMATIC
S7-1500 TM NPU (Neural Processing Unit)

+ SIMATIC S7-1500 Technology Module for use in central and distributed configurations
+ Engineering and handling via TIA Portal
+ Connection of Camera via Ethernet interface

TM NPU processing procedure:

1. Data of the PLC (sensors, actors, ...) is sent to the module / Connected Camera takes pictures of the production process
2. Processing of input data (images, PLC data) by the **TM NPU** via trained neural networks
3. Results of the inference are sent from TM NPU to the PLC
4. Function blocks in the PLC evaluate the results



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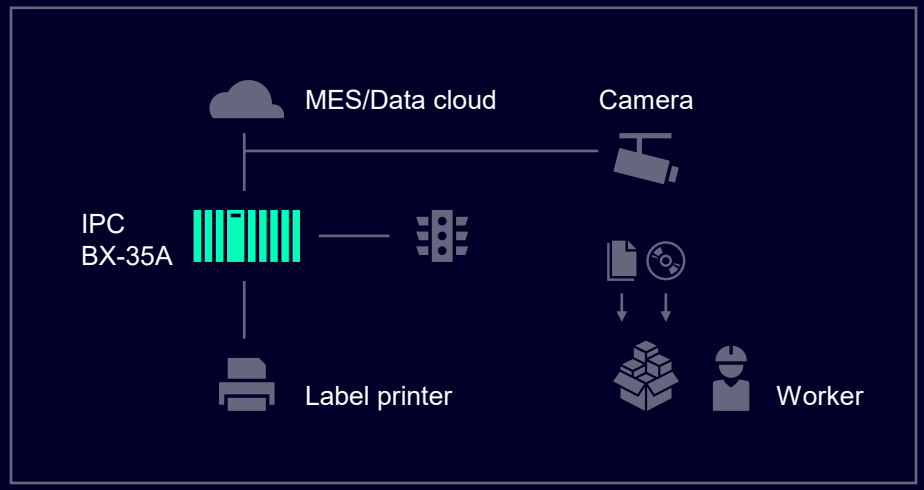
Use case Vision inspection
Packaging, detection and warning of missing components

Task
- At the end of a PLC production line, the PLC and other components are manually packed into a transport carton
- Main faults are missing parts in the box
- To prevent this from happening, detection and verification is required at several key control points
- Checking the MAC address of each device is necessary manually

Solution
- To solve this problem, an image processing system was implemented in the packaging station that recognizes the MAC address of the device and monitors the packaging process
- The workers receive a red light for each step of the work if parts are missing and a green light if everything is in order. Only then will the label to seal the package be printed



Benefits
- Ensuring Correct Packaging
- No subsequent weighing or similar necessary
- Automatic, error-free recording of device MAC
- Saves time and effort and thus reduces production costs

SIMATIC IPC BX-35A
- Use case of the IPC BX-35A
- With Vision Scenario and Deep Learning Pipeline connection to MES to verify MAC address
- IPC BX-35A
- IFP2200 Basic

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Gracias por su tiempo!

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