Analog Gauge Reading Using CNN Regression

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Introduction and Abstract

- The marine environment is complex and full of hazardous potential. Using AI and computer vision.
- Captain's Eye recognizes and prevents dangerous situations with a variety of models.
- This project extend the company's ability adding an analog gauge reading ability

Challenges	Objectives
An analog gauge installed onboard a ship cannot supply training images	Use synthetic data to create train, validation and test sets
The calibration process must be easy and quick	Create a custom, specific and light UI for calibration
Model must be light and optimized	Create a custom and optimized CNN model

Methods

Light Custom UI

Image editing — 1 image only

Training the Model
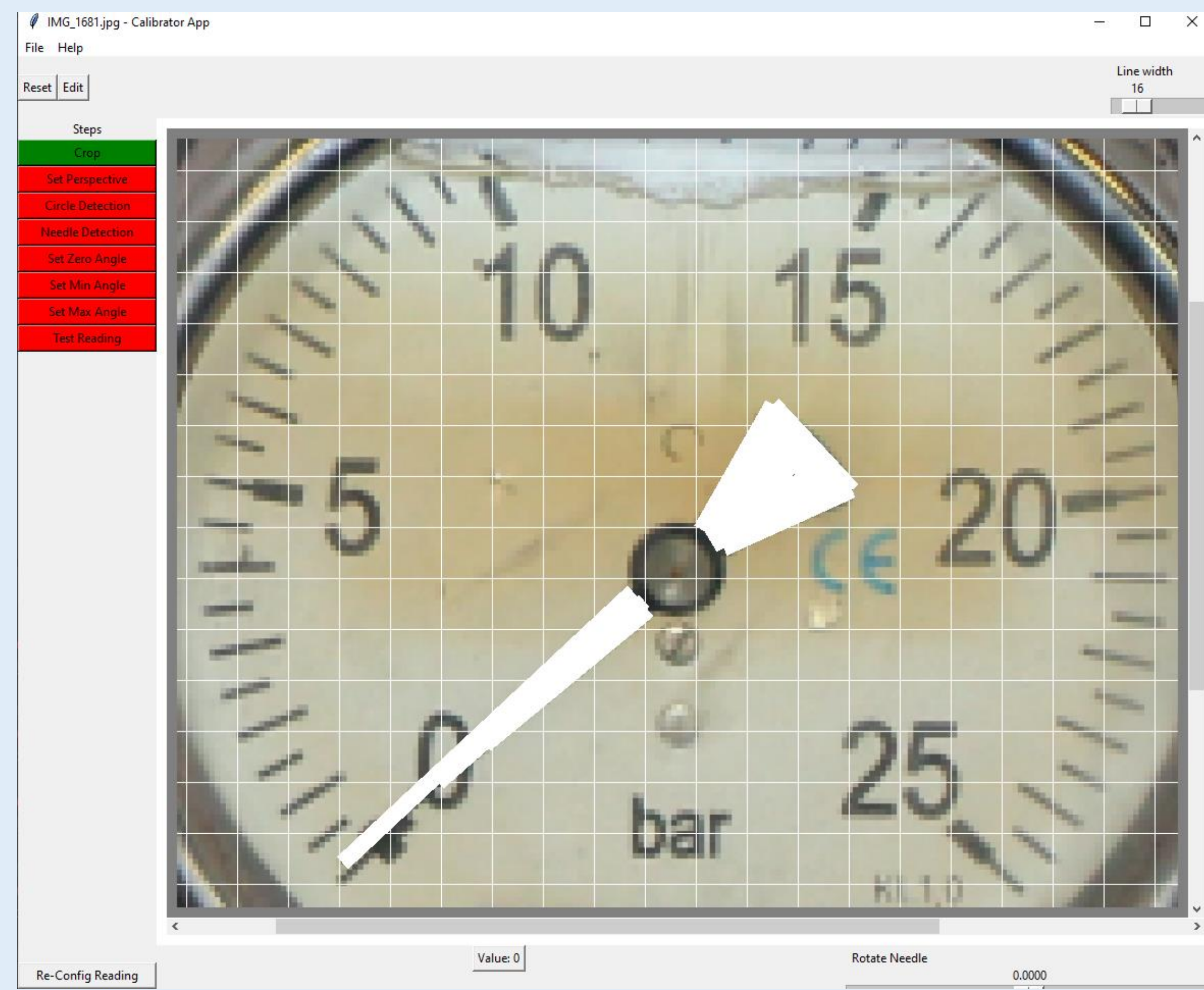
150 epochs — MSE Loss — Pytorch CNN custom model

Test and Save
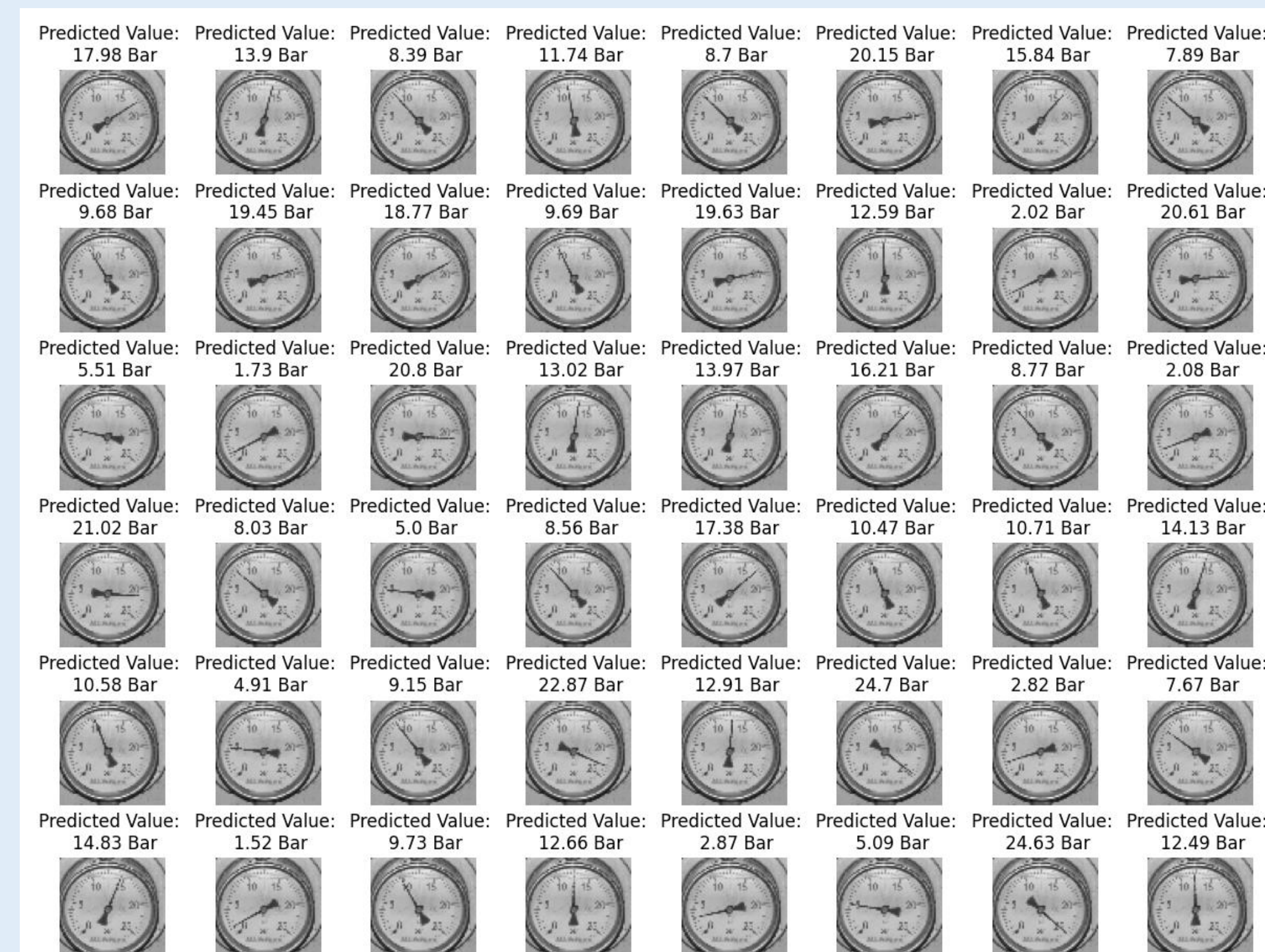
weights.pt file and XML calibration

Training And Validation

- A short calibration process includes cropping, marking the needle, fixing perspective and typing parameters
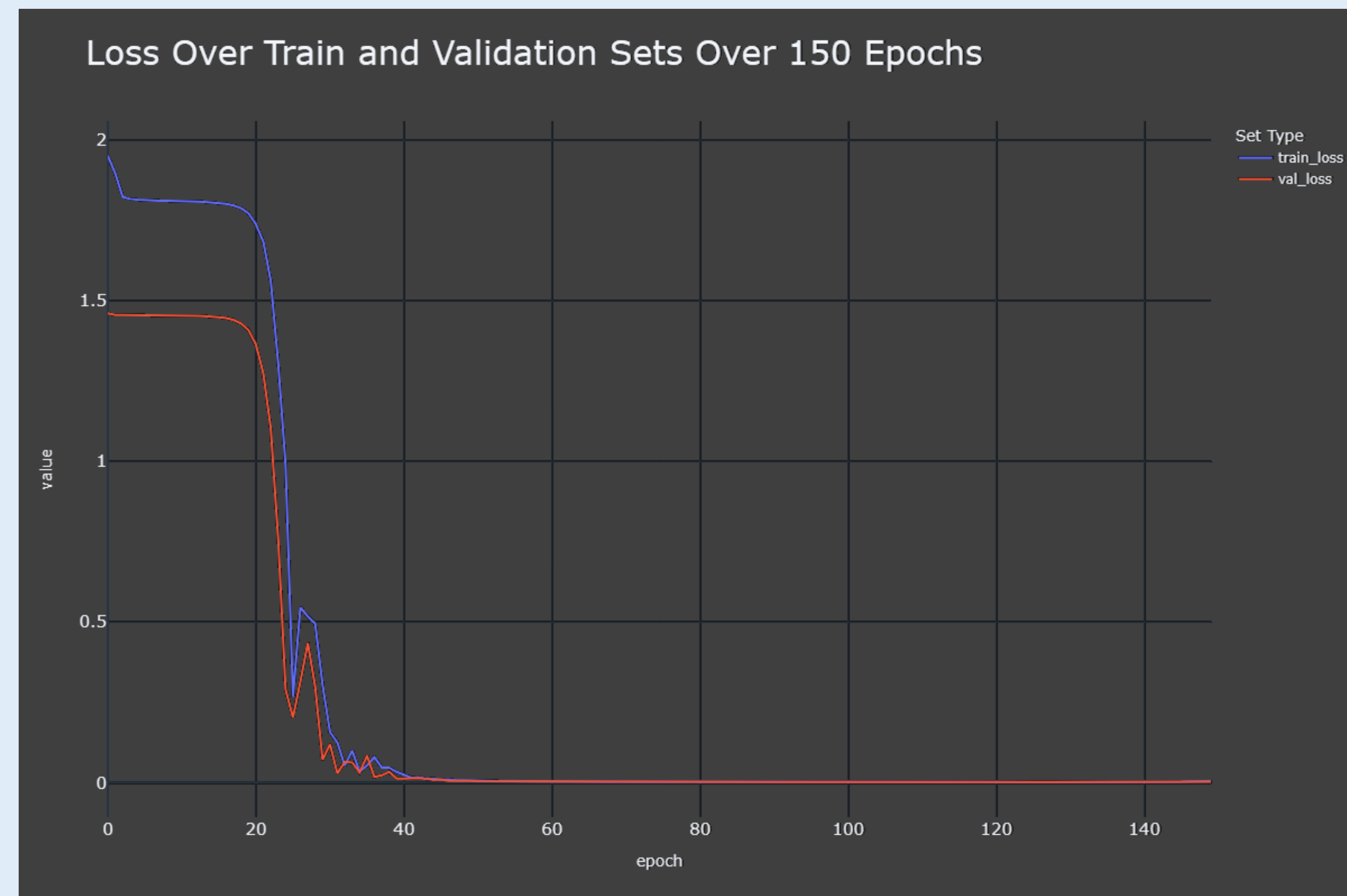- Calibration XML is created at the end of the calibration

Synthetic Data

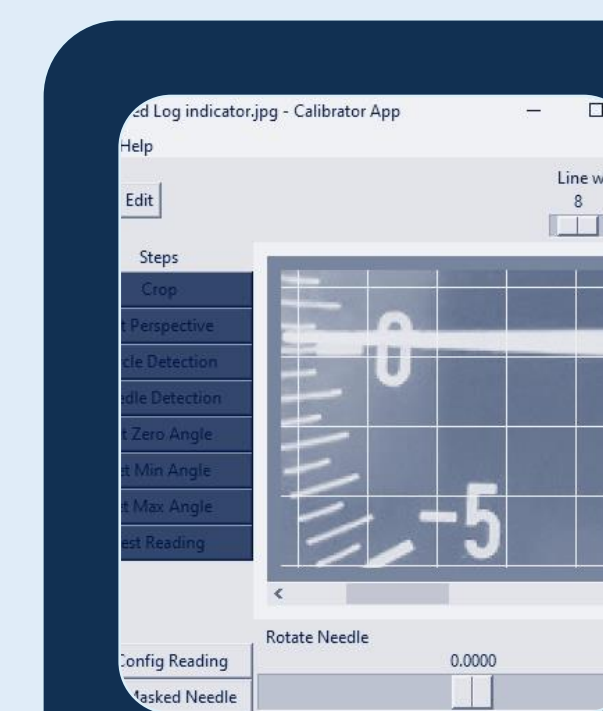- Train, Test and Validation sets – all created synthetically

Results

- The model trains over 150 epochs using a custom architecture built with Pytorch

Loss Over Train and Validation Sets Over 150 Epochs

Conclusions

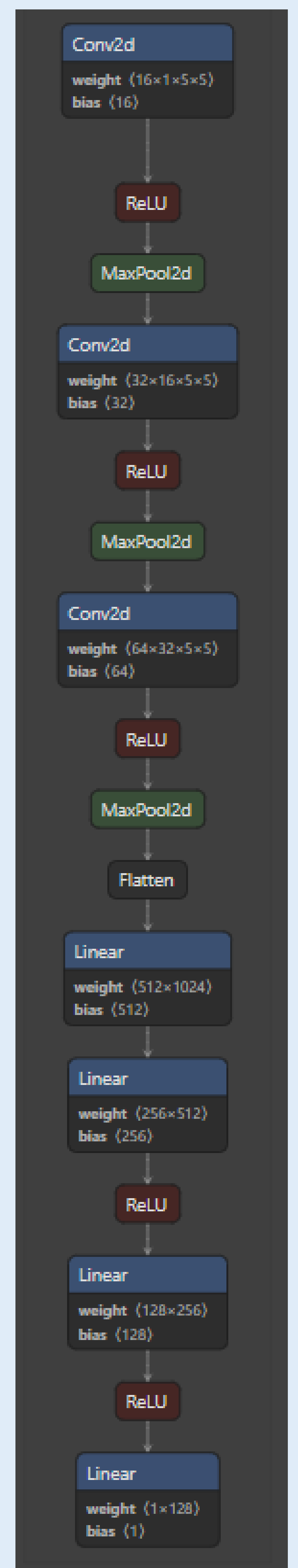Reading the gauges using the synthetic data is feasible

The process is light and creates a quick reading framework ready for deployment

Future improvements: Augmentation, digital gauges reading

Architecture

Conv2d — weight (16×1×5×5) — bias (16)
ReLU
MaxPool2d
Conv2d — weight (32×16×5×5) — bias (32)
ReLU
MaxPool2d
Conv2d — weight (64×32×5×5) — bias (64)
ReLU
MaxPool2d
Flatten
Linear — weight (512×1024) — bias (512)
Linear — weight (256×512) — bias (256)
ReLU
Linear — weight (128×256) — bias (128)
ReLU
Linear — weight (1×128) — bias (1)

GitHub

Demo