Read the indicator value

Read the indicator value with image processing algorithm

Result

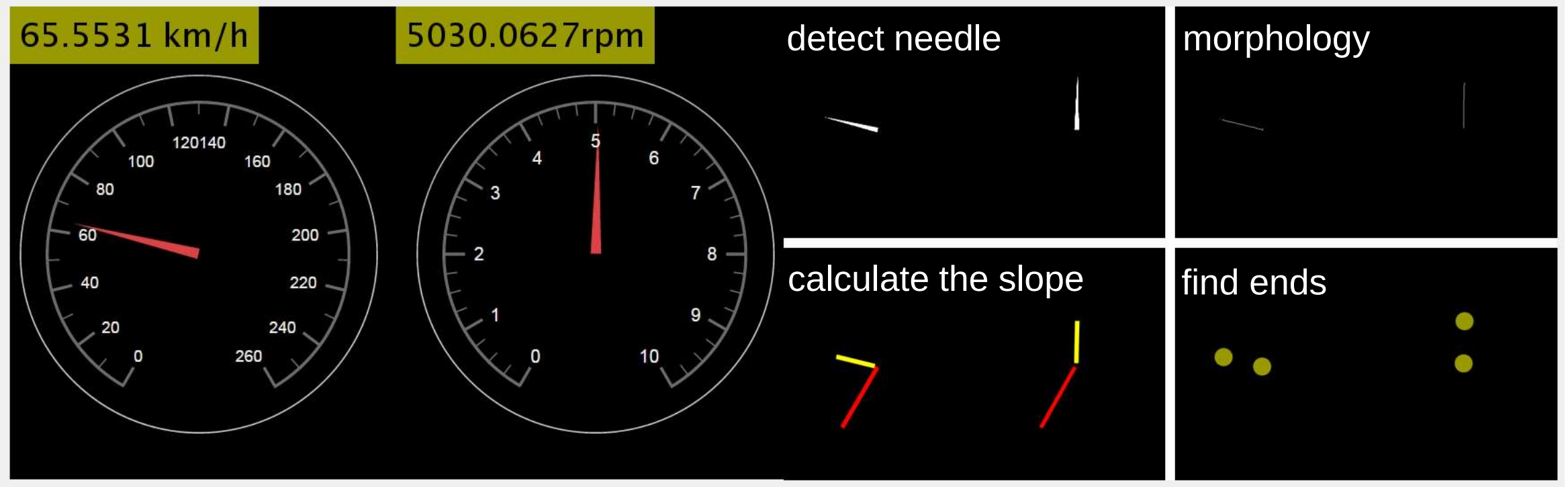


Image Processing

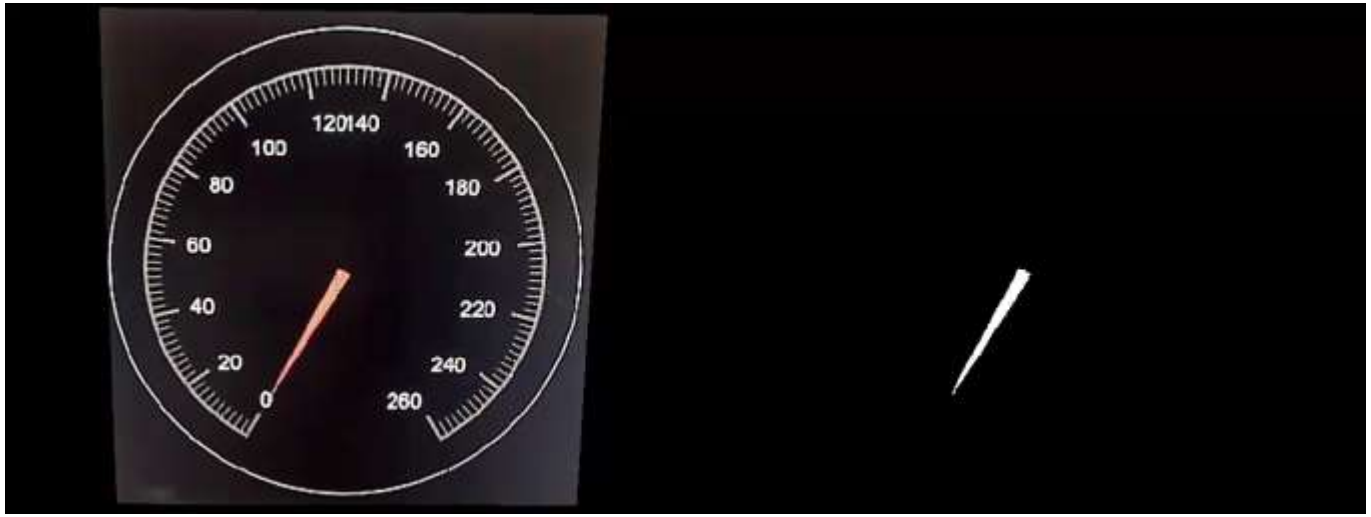
detect needle → morphology → calculate the slope → read the value

Goal

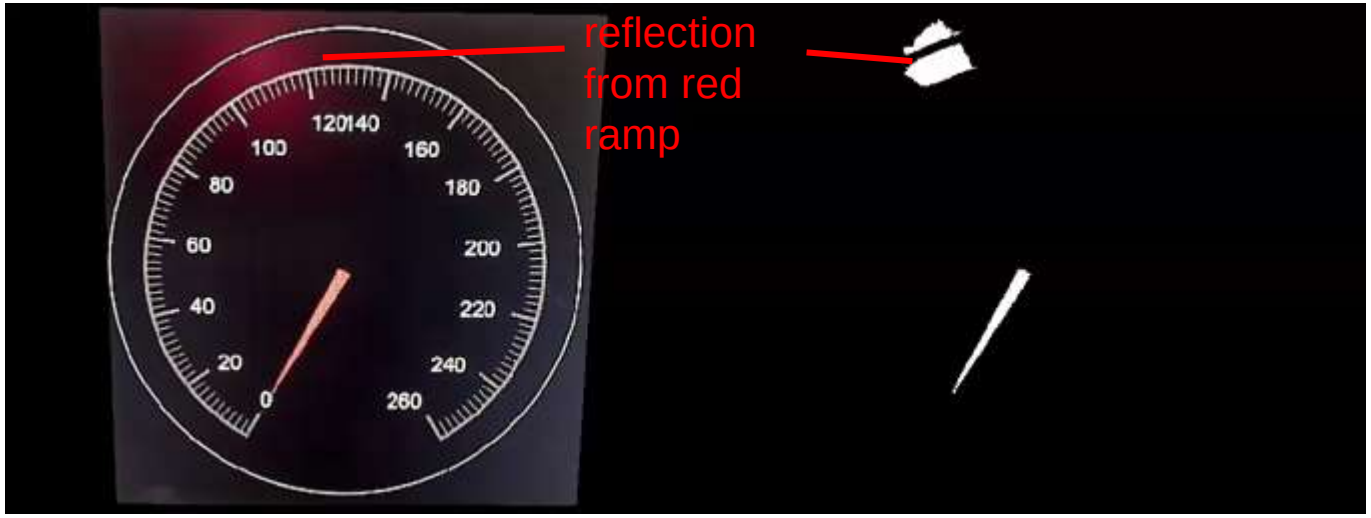
Affected by the environment

Result of image processing

Environment A



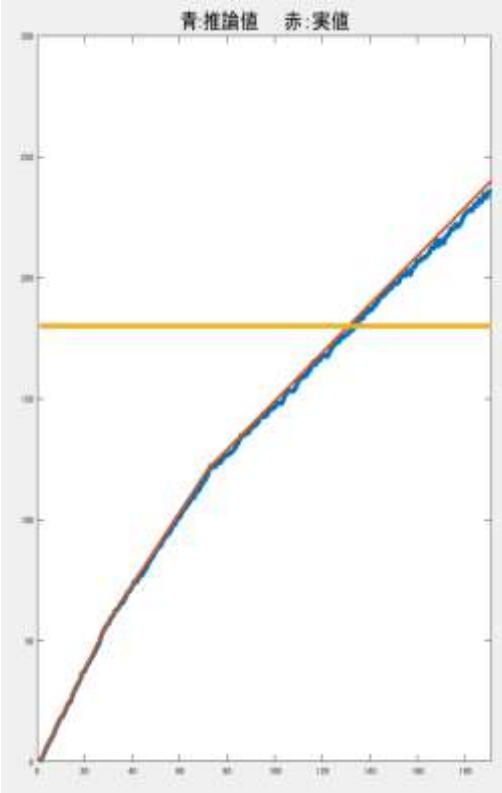
Environment B

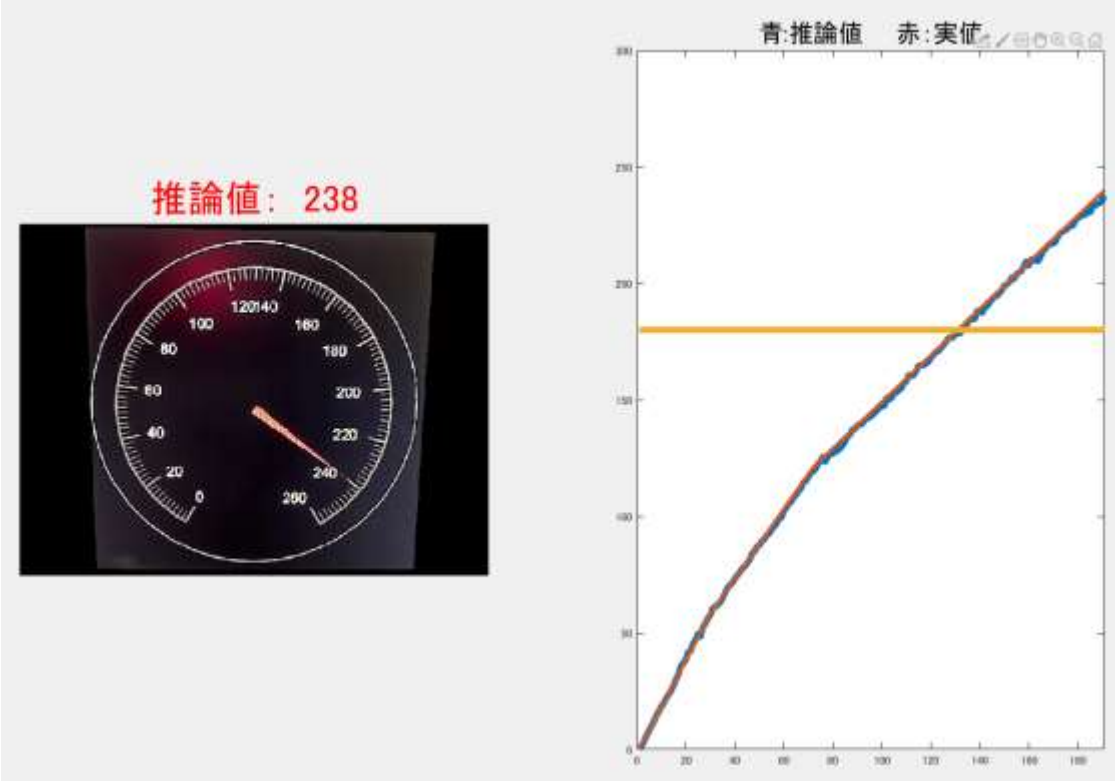


- Result is affected by reflection
- You have to customize algorithm for each environment

Read the indicator value using deep learning

Without reflection



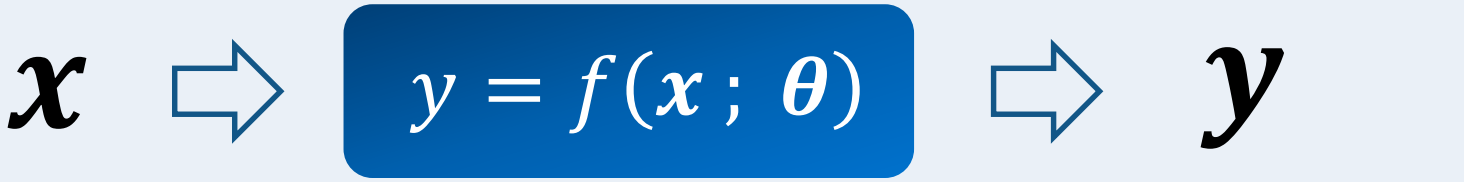


With reflection

You could get stable result using deep learning.

Regression・Classification

Regression

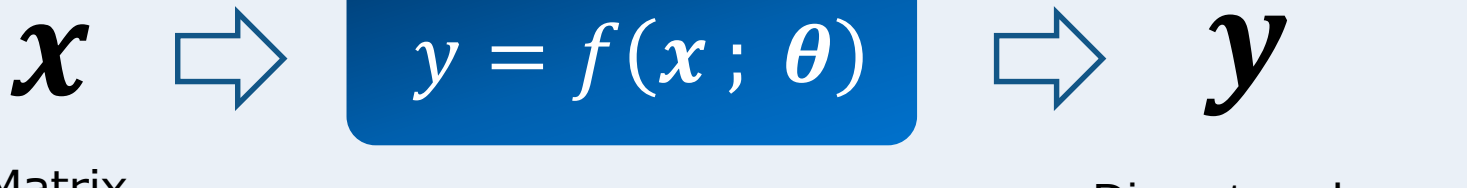


Matrix

Continuous value

1 2 3 4 5 …

Classification



Matrix

Discrete value

Dog

Cat

Prepare and train CNN regression network

```
%% load pretrained network
alex = alexnet;
layers = alex.Layers;
%% customize for regression
layers = [
    layers(1:22)
    fullyConnectedLayer(1)
    regressionLayer];
```

・Transfer learning is available
・Replace the classificationLayer with regressionLayer

・Prepare data
Combine files and predictors as table data

image	Y
...¥1.jpg	230
⋮	⋮

load all data into variables

```
myNet = trainNetwork(trainingimage, Y,layers, opts);
```

train the network with trainNetWork function

A lot of data increase the accuracy.