

ML Final Project: Water Meter Recognition

LEARNING MACHINE GROUP

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Contents

1.Introduction

2.My Solution: A **Three Stage** Network

2.1 Rotation Regression

2.2 Object Detection

2.3 Digits Recognition

3.Performance & Model Evaluation

4.End Part: **Code, Problems** and **How to improve it**

Introduction

Task description



00537

Annotations



Coordinates of bounding box

$(x_1, y_1, x_2, y_2, x_3, y_3, x_4, y_4)$, "000092", "00093"

Digits

Introduction

Challenges:



A universal solution for tasks like this:

Segmentation: DB + Recognition: CRNN

My Solution:



00202

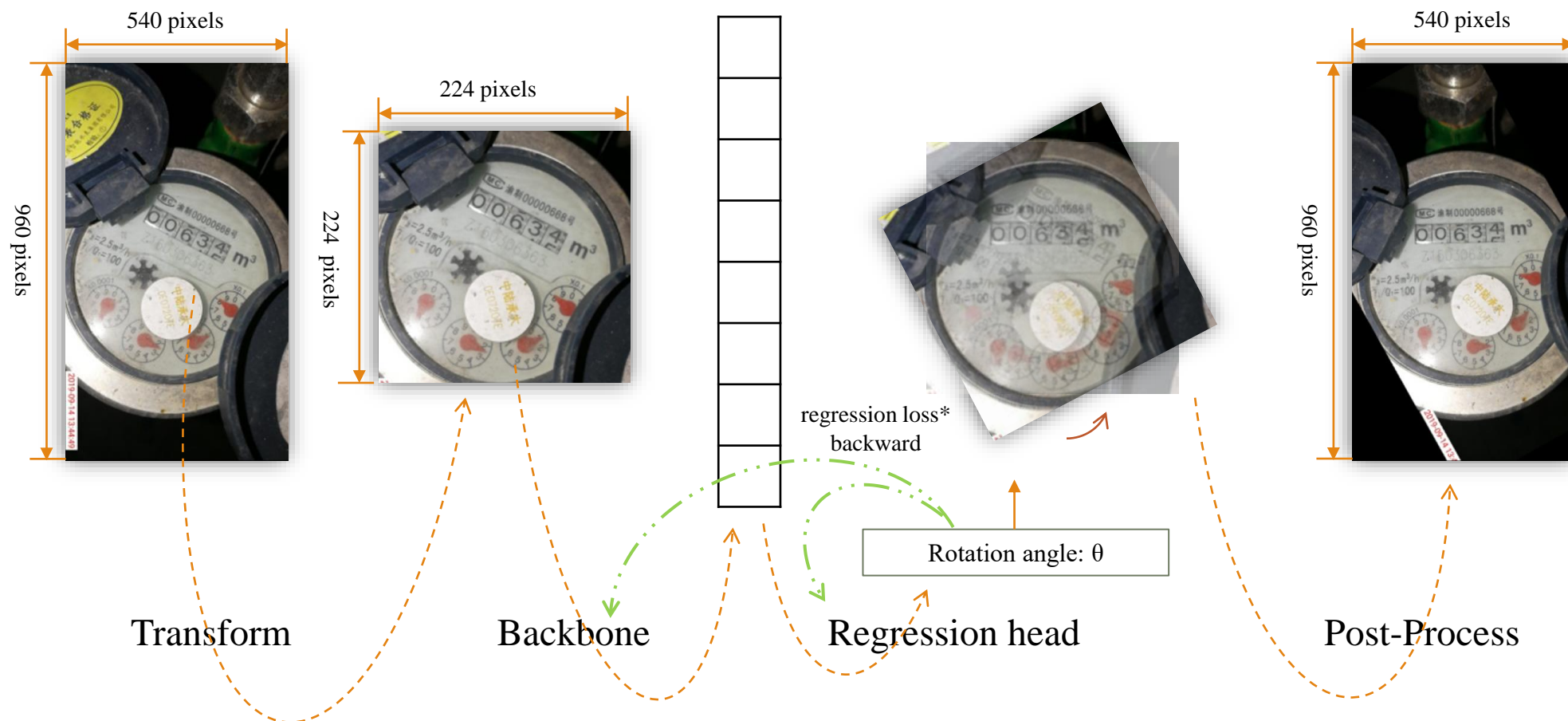
Rotation Regression

Object Detection

Recognition

3-Stage Network

I. Rotation Regression Network



regression loss = MAE Loss(y_{pred} , y_{real}) or Smooth L1 Loss(y_{pred} , y_{real}), y_{real} is computed from label

3-Stage Network

II. Object Detection Network

Preparation

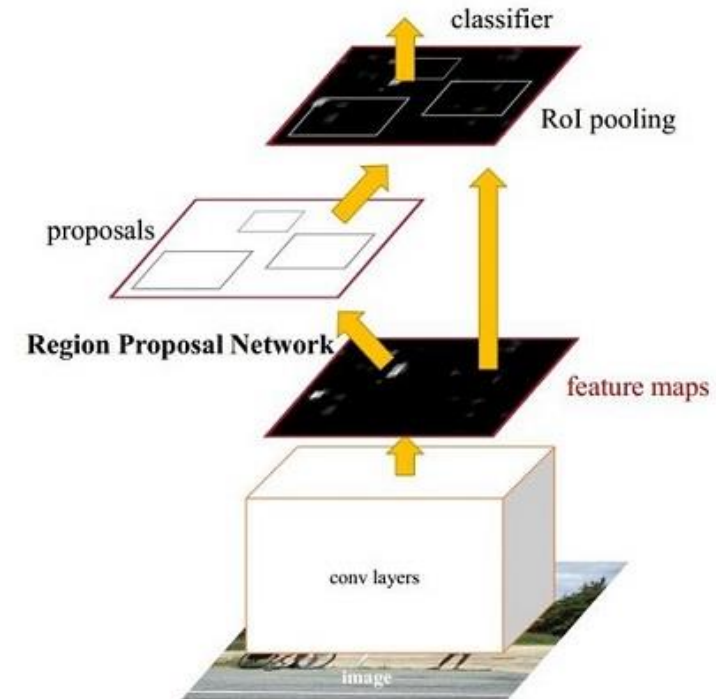
$(x_1, y_1, x_2, y_2, x_3, y_3, x_4, y_4), "000092", "00093"$

coordinates (rotation) transformation

$(x'_1, y'_1, x'_2, y'_2, x'_3, y'_3, x'_4, y'_4), "000092", "00093"$

to 'xyxy' bounding box format

$(x'_1, y'_1, x'_3, y'_3), "000092", "00093"$



Faster RCNN

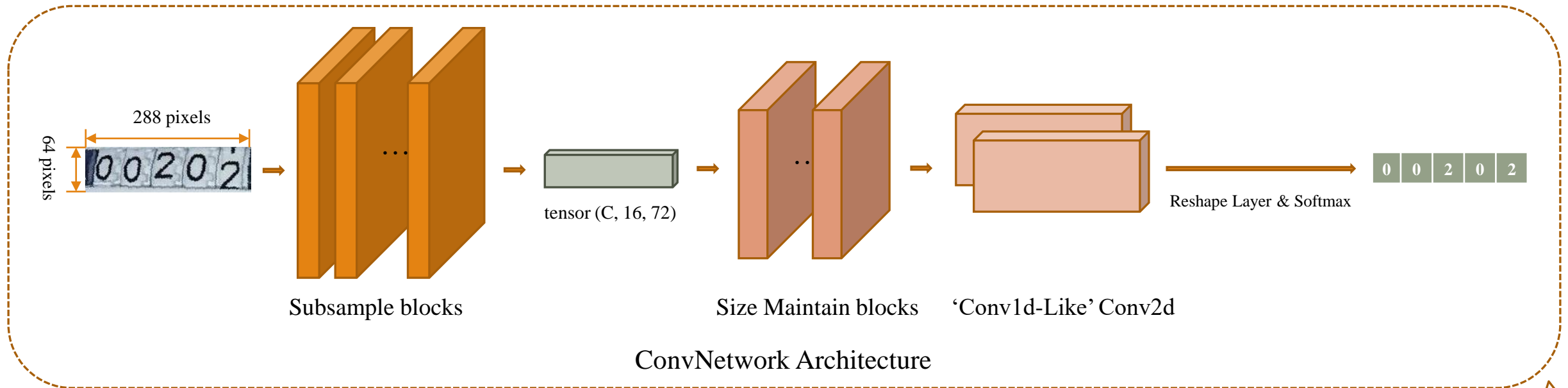
3-Stage Network

III. Digits Recognition Network

ConvNet

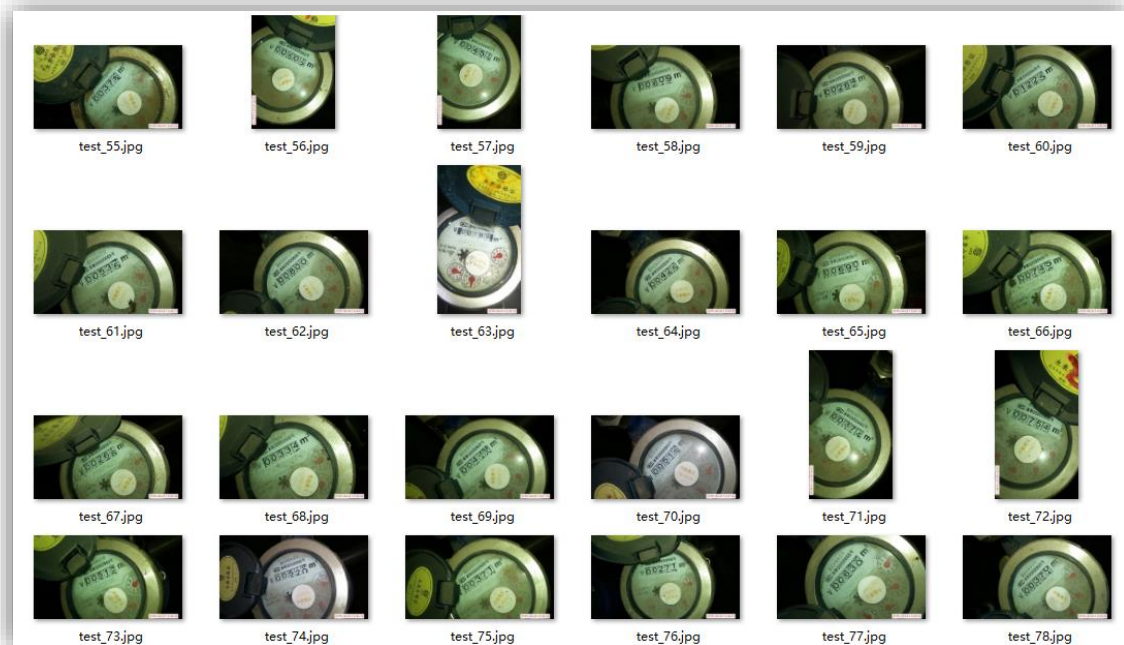
Fixed length → convolution only works not bad.

↓ (Casually designed by myself)

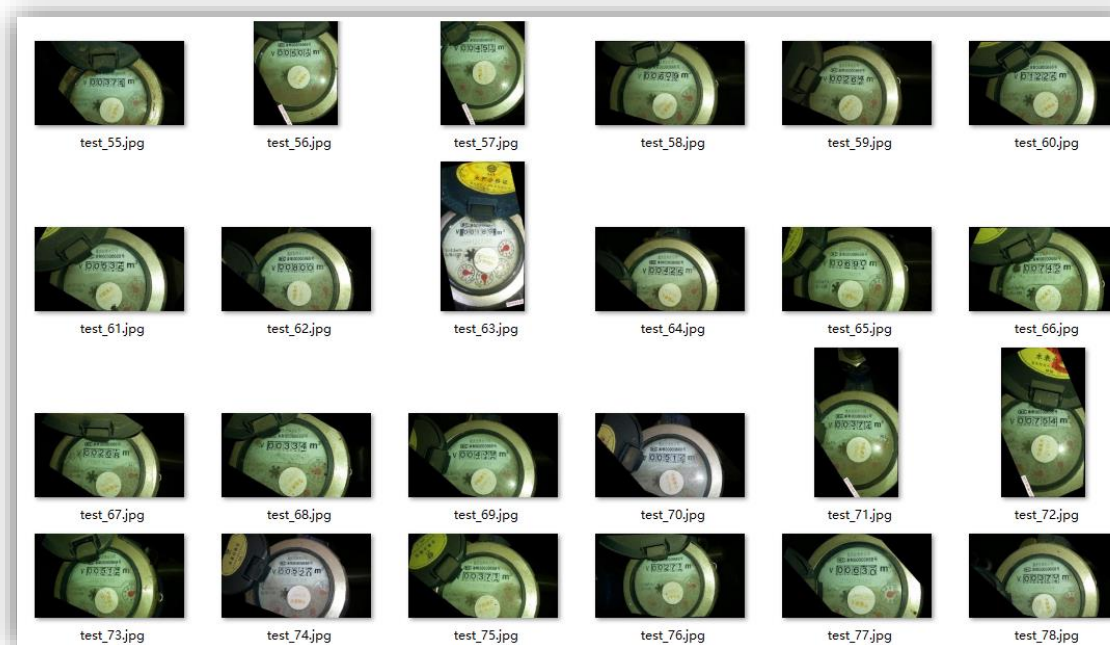


Performance Evaluation

I. Rotation Regression Network Evaluation



Before processing



After processing

Metrics:

Train Set:

Deviation angle $\leq 5^\circ$ 95.5%+

Deviation angle $\leq 10^\circ$ 99.0%+

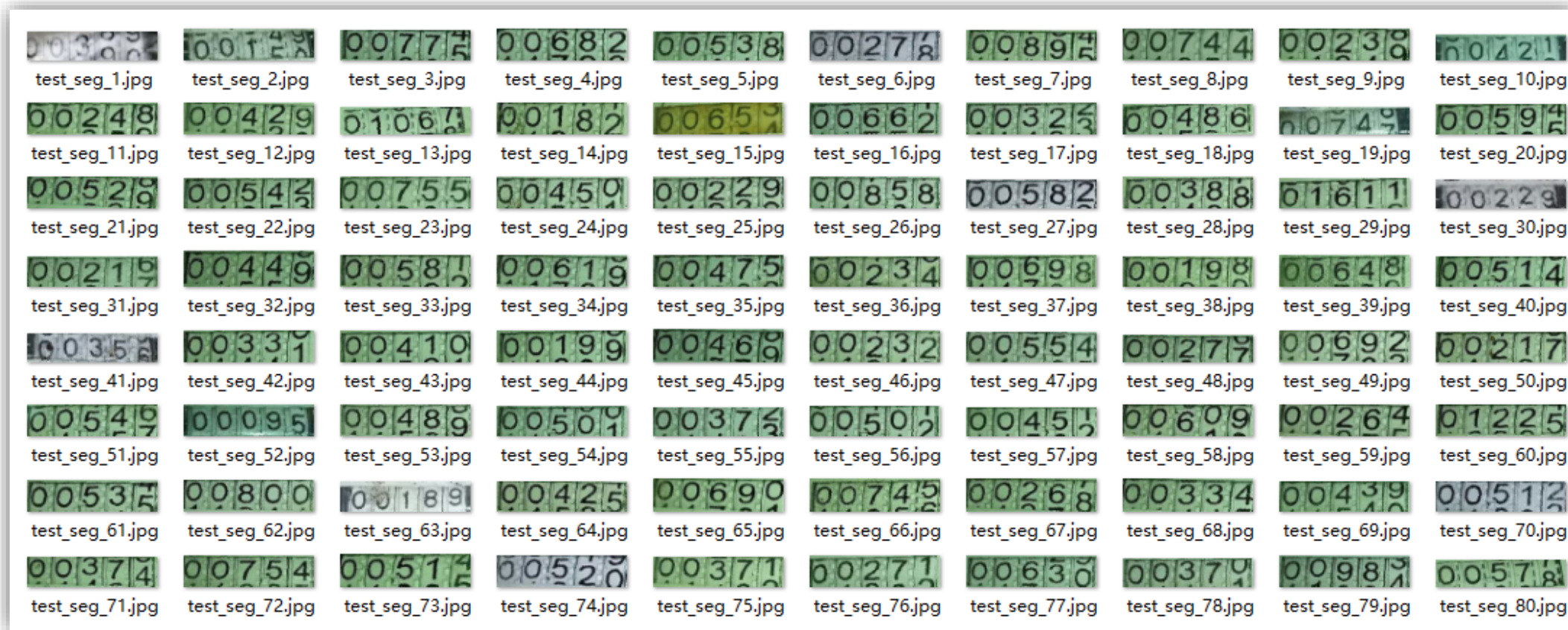
Valid Set:

Deviation angle $\leq 5^\circ$ 93.5%+

Deviation angle $\leq 10^\circ$ 98.5%+

Performance Evaluation

II. Object Detection Network Evaluation



Metrics:

mAP = 0.85

mAP(IoU > 0.5) = 0.99

mAP(IoU > 0.75) = 0.97

Performance Evaluation

III. Digits Recognition Network Evaluation

Rule	Download & Evaluation	Rank	Team	Submit	Discussion	FAQ	Signed Ahead
Second Schedule							
More Rank							
Ranking	Change	Team	Valid Submit Count	Max Score Submitted At	Max Score		
41	↑ 17	default13196184	2	2022-04-21 23:10	0.85800000		
42	-	default13189207	8	2021-12-16 23:57	0.84400000		
43	↑ 3	Learning Machine	9	2023-05-26 18:09	0.81800000		
44	↑ 1	啊对对队	10	2021-12-18 23:35	0.80600000		
45	↑ 9						
46	-						
47	-						
48	↑ 1	水表小组	5	2022-04-18 10:09	0.73600000		
49	↓ 2	白兰地队	5	2022-04-22 12:32	0.73000000		
50	-	default7686426	3	2021-01-26 09:40	0.72600000		

43	↑ 3	Learning Machine	9	2023-05-26 18:09	0.81800000
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Bottleneck: **Digits Recognition**, overfitting problem

But it surely can be improved and get a point of 0.9 or so, easily, I think.

Here are some facts and recommendations:

1. In this project, I just employed some basic models, tricks and didn't modify those hyper-parameters cautiously. You can improve it.
2. By checking ./ProcessedData in WaterMeterDataset, you can find that rotation regression and object detection parts of the job were done well. Actually, the bottleneck was right the digits recognition part.
3. Slightly expand and segment the region detected in origin image may help. We would rather take in more noise than lose vital information.

But it surely can be improved and get a point of 0.9 or so, easily, I think.

Here are some facts and recommendations:

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47	-	光之使者-小野羊	4	2020-12-09 15:11	0.74000000
48	T 1	水票小姐	5	2022-04-18 10:09	0.73600000

Thank you!