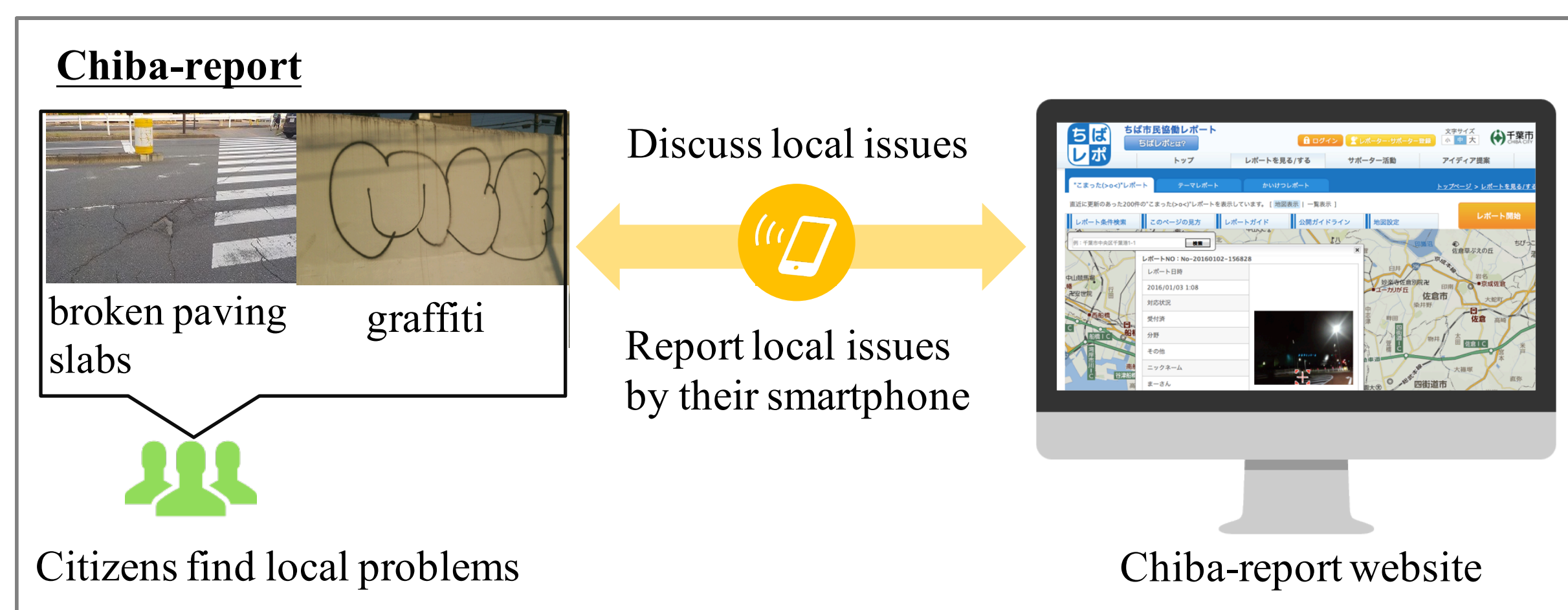


An Easy Infrastructure Management Method Using On-Board Smartphone Images and Citizen Reports by Deep Neural Network

Hiroya Maeda, Yoshihide Sekimoto, Toshikazu Seto

1. Background

Systems in which citizens report local issues to the government on websites have started to operate worldwide. (FixMyStreet, 311 Chicago, Chiba-report...)



A lot of Citizen-data will be gathered (not by experts)

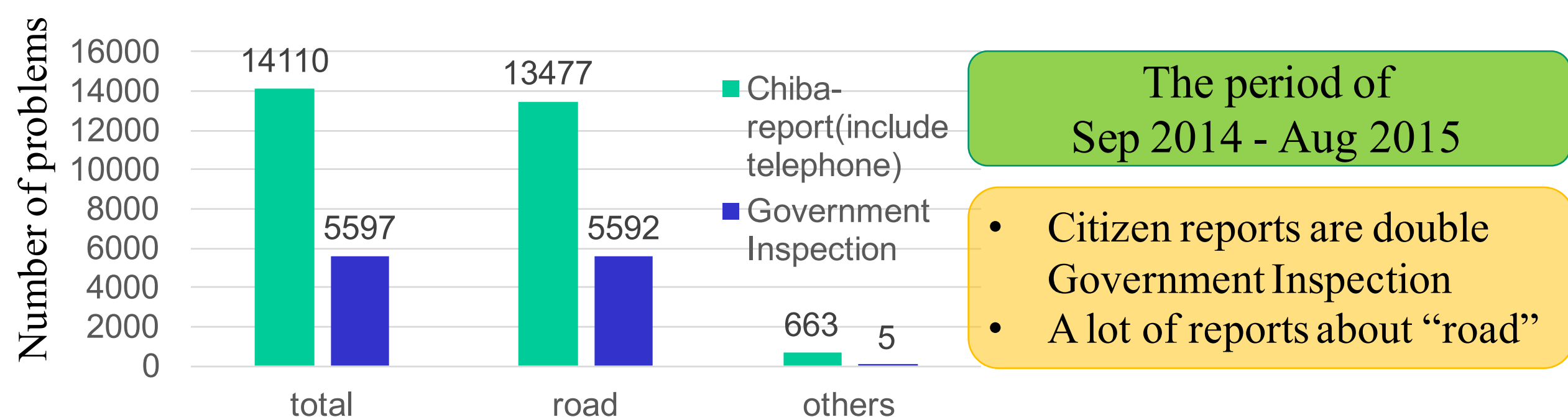
The information collected by citizens is expected to be utilized for infrastructure maintenance.

2. Objective

It may be...

Burden for local government to deal with large amount of citizen data

- Citizen data sometimes have trivial problems (Because it's not expert inspection).
- Local governments that have no expert can't judge which problems are important.

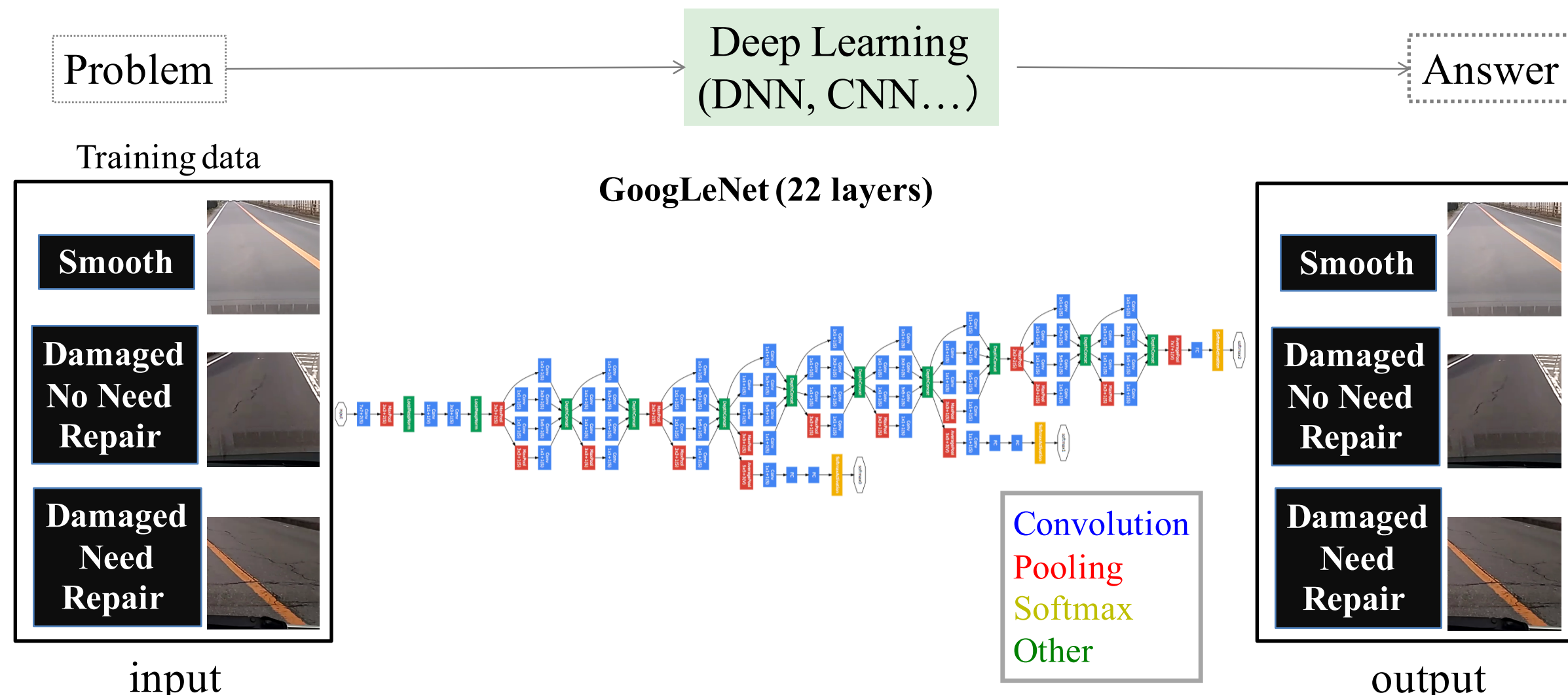


3. Method

Developing a crack detection model with Deep Learning



Deep Learning

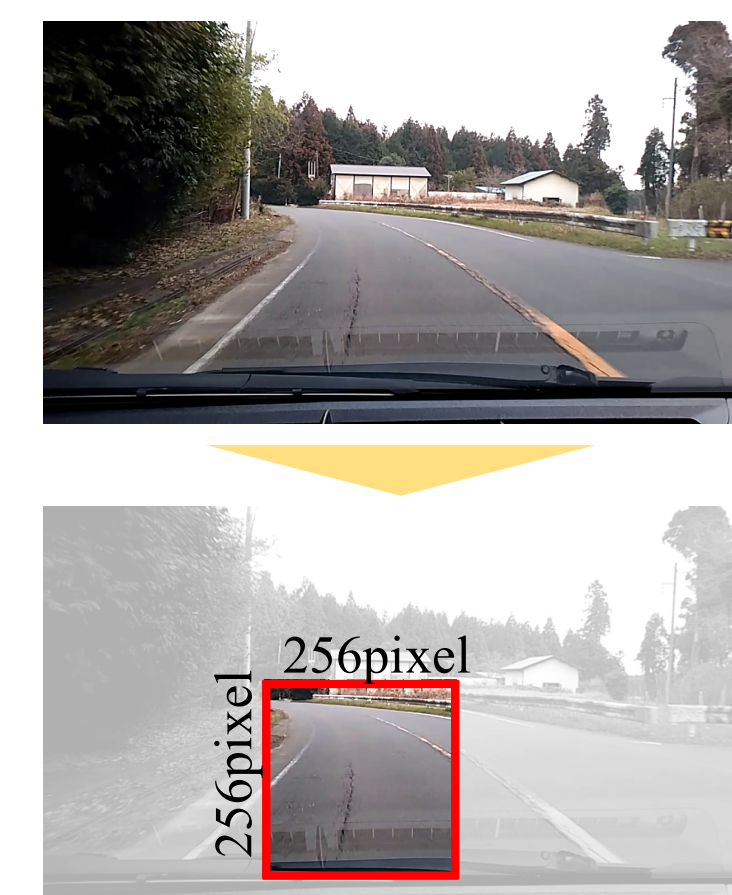
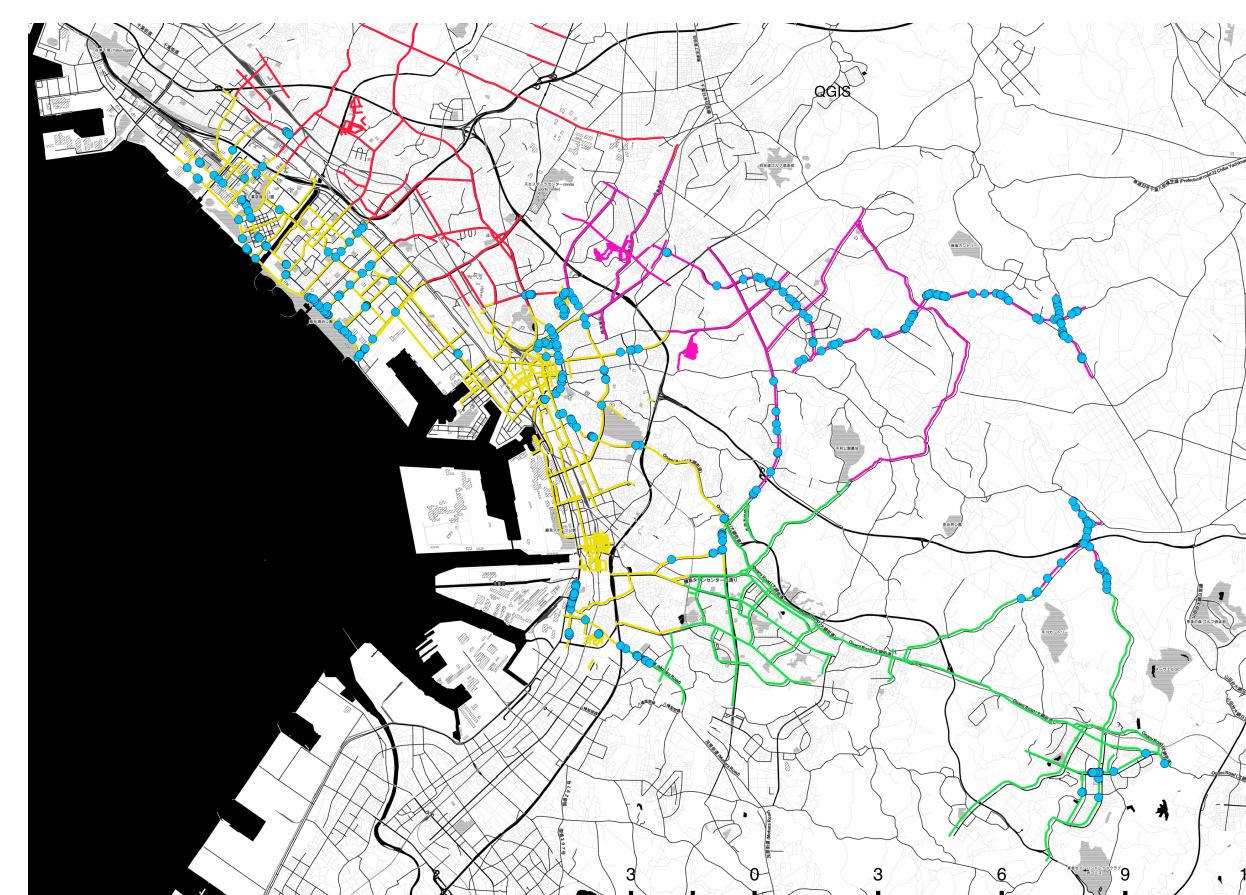


- No Need to figure out the features ahead of time
- Use same neural net approach for many different problems
 - Easy to apply other infrastructure

4. Experiment

We focus on "road" that has the most number of citizen reports

- ① Traveled 500 km in Chiba City and captured video of the road surface. And trimmed the 256 × 256 region.



- ② Chiba-city officials determined visually whether there was damage or not.

Smooth	Damaged	
	No Need for Repair	Needs Repair
500 images	396 images	107 images

We use only Smartphone

We got labelled data from road manager

- ③ Adopted GoogLeNet and input labelled images by the expert for 10000 iters.

Result 1

- ④ Experiment whether the model can classify Chiba-report images from citizen into 3 categories.

Result 2

5. Result

Result 1

		True			Precision
		Smooth	No Need for Repair	Needs Repair	
Prediction	Smooth	480	11	1	97.5%
	Damaged	No Need for Repair	15	441	25
Needs Repair		5	48	474	89.9%
Recall		96.0%	88.2%	94.8%	Accuracy =93.0%

➤ The accuracy at 10000 iterations was 93% for GoogLeNet (We can say the model is a expert road manager!)

Result 2

		Smooth road images		Damaged road images	
		Smooth	No Need for Repair	Needs Repair	Other
Prediction	Smooth	28	0	0	9
	Damaged	No Need for Repair	0	0	0
Needs Repair		0	0	0	84

By using the model created in this study, it is possible to automatically detect the level of defects (and the need for repairs) reported by citizens.