Current State of Infrastructure Maintenance and Monitoring in South Korea

(ACECC TC-28, CECAR9, 22nd of Sep 2022)

KSCE – Dr. Robin Eunju Kim
Hanyang University

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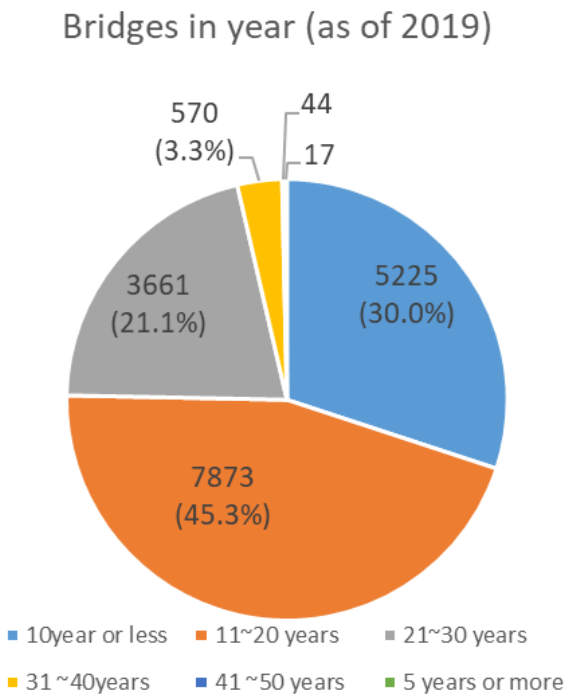
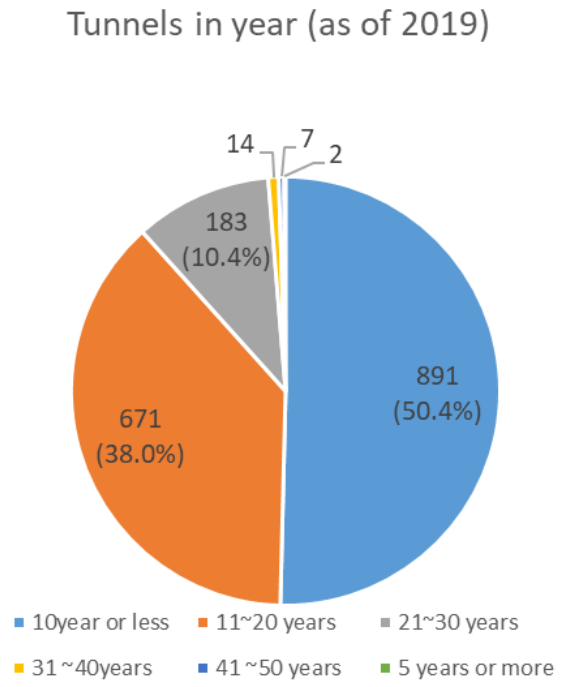
Outline

1. Deterioration of Infrastructures and Plans in South Korea
2. Monitoring Research Efforts in South Korea
3. Conclusion

1. Deterioration of Infrastructures and Plans

- **Major infrastructure was intensively built from 1970s**
  - The number of facilities over 30 years is rapidly increasing
  - The average year of major bridges is 15.2 years

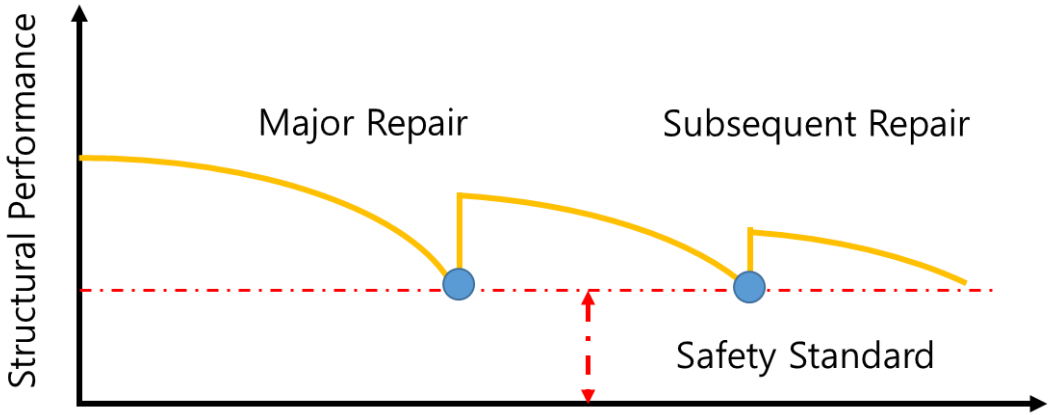


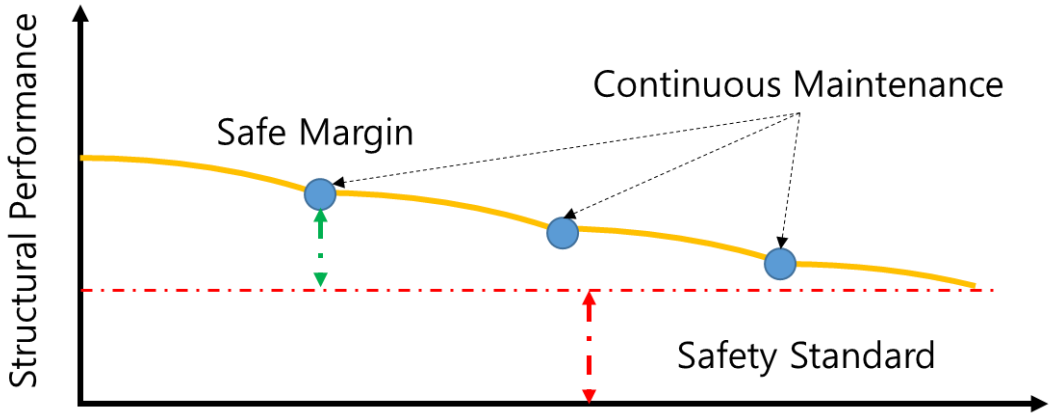


1. Deterioration of Infrastructures and Plans

- **Inspection strategies**
  - Moving toward from “Reactive Management” to “Proactive Management”

Reactive Management	Proactive Management
Performs Regular Inspection Implement annual maintenance for damaged members	**Predict Optimal Maintenance Time & Method** Perform maintenance at the early period (or even before) damage occurs





Monitoring Research Efforts in South Korea

- **Various Institutes and Universities are working on Developing Technologies for "Smart Maintenance & Construction" to realize *Proactive Maintenance***

HANYANG UNIVERSITY

CHUNG-ANG UNIVERSITY
중앙대학교

SUNG KYUN KWAN UNIVERSITY(SKKU)

CHUNGBUK NATIONAL UNIVERSITY

서울시립대학교
UNIVERSITY OF SEOUL

KICT
KOREA INSTITUTE of CIVIL ENGINEERING and BUILDING TECHNOLOGY

KAIST
Korea Advanced Institute of Science and Technology

Monitoring Research Efforts in South Korea

- **Various Institutes and Universities are working on Developing Technologies for "Smart Maintenance & Construction" to realize *Proactive Maintenance***

- **New/Rising Research Keywords**
  - **Computer Vision**
  - **Non-contact sensing**
  - **Unmanned Vehicles (UAVs and UGVs)**
  - **IoT sensors & Platforms**

Monitoring Research Efforts in South Korea

Smart Monitoring Objectives

As-Is

- Human-based inspection
  - High cost
  - Requires expert knowledge
  - Slow and subjective testing

To-Be

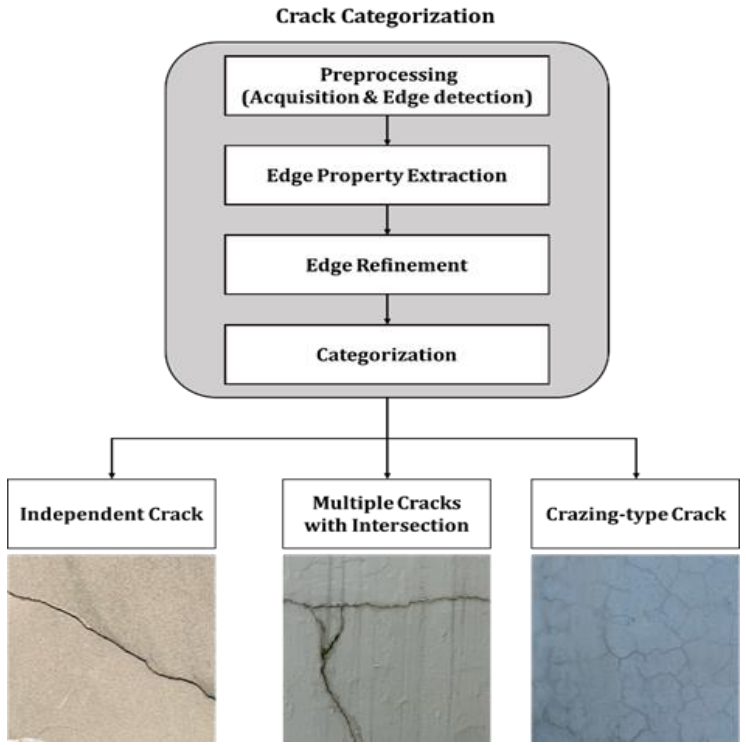
- Minimize human intervention
- AI technologies and use of database
- Automated Inspection Procedure with humane decision/classification

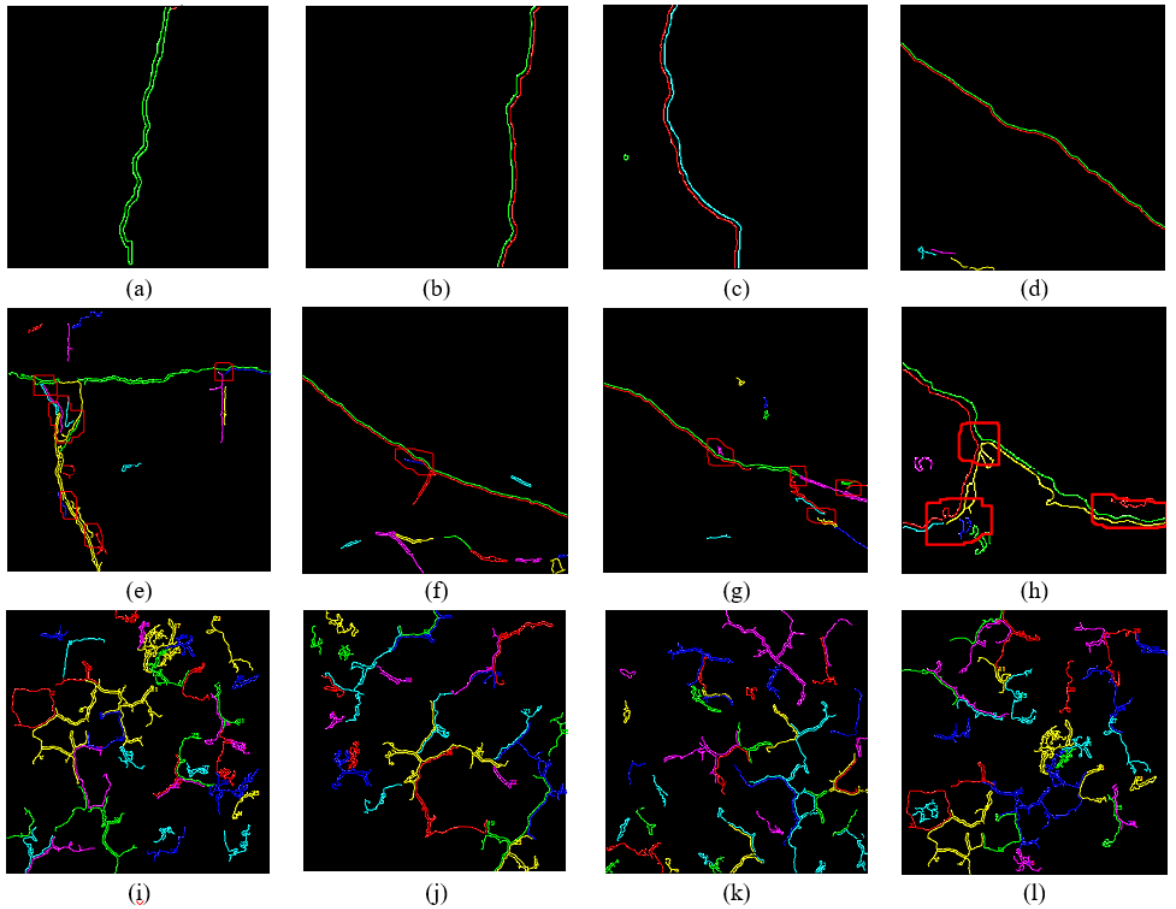
https://www.big-meter.com/opensource/en/5fca07e06e7df17ef052c7d3.html

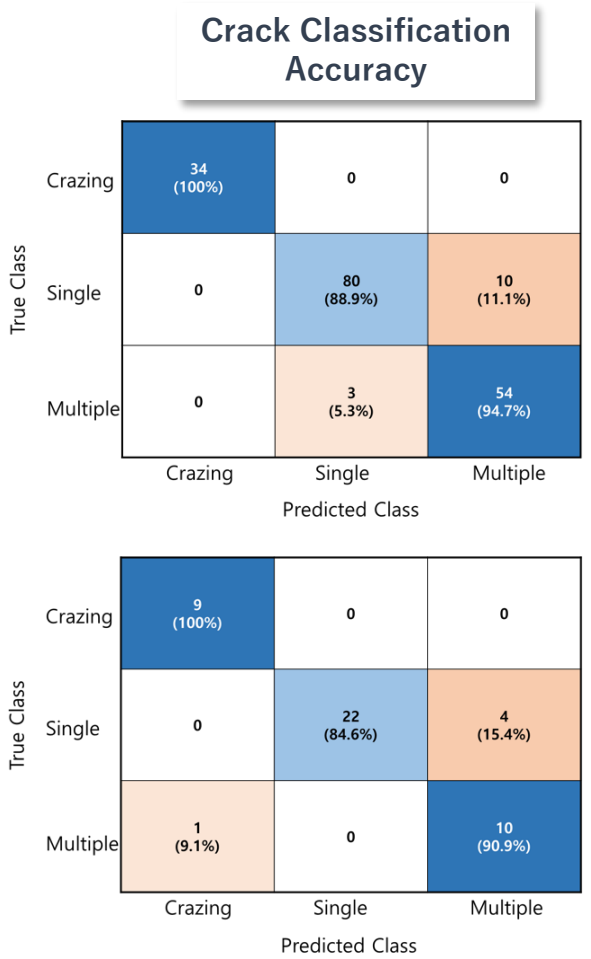
Monitoring Research Efforts in South Korea

HANYANG UNIVERSITY

1. Computer Vision Technologies for Concrete Crack Classification







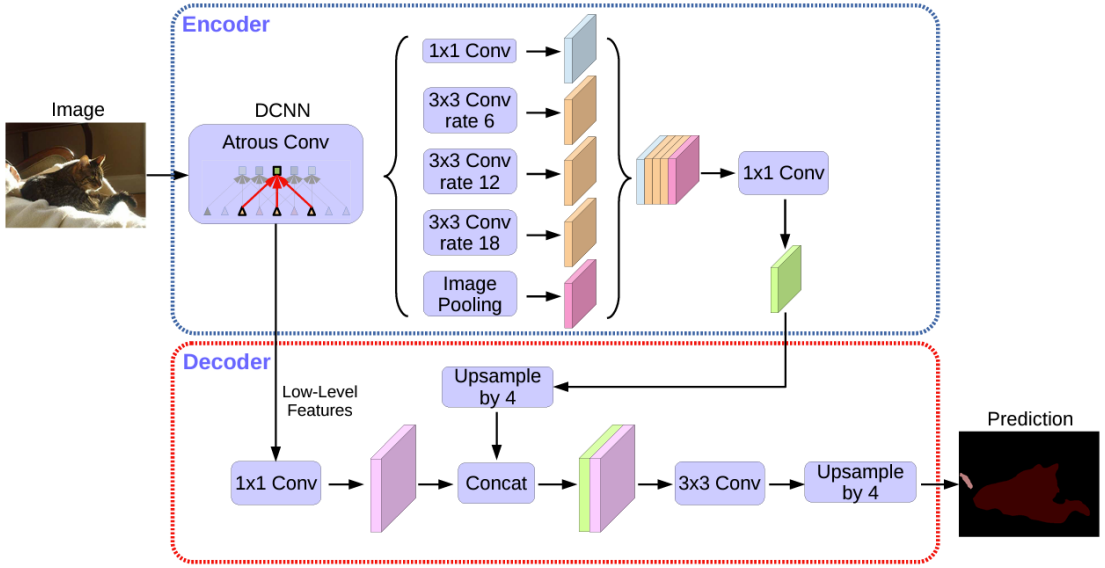
Monitoring Research Efforts in South Korea

SUNG KYUN KWAN UNIVERSITY(SKKU)

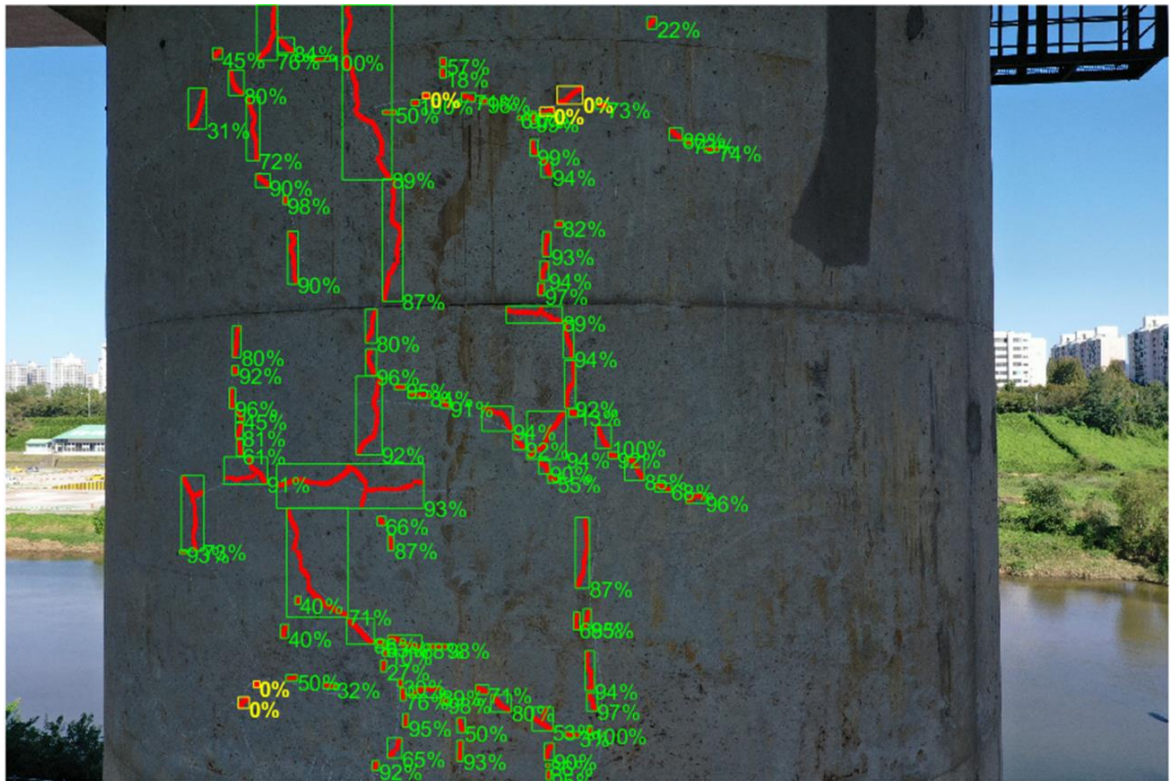
1. Computer Vision Technologies for Concrete Crack Classification

- **Full-scale Pier Crack Detection using Drone Images**

Semantic Segmentation using DeepLabv3+



Full-Scale Crack Identification



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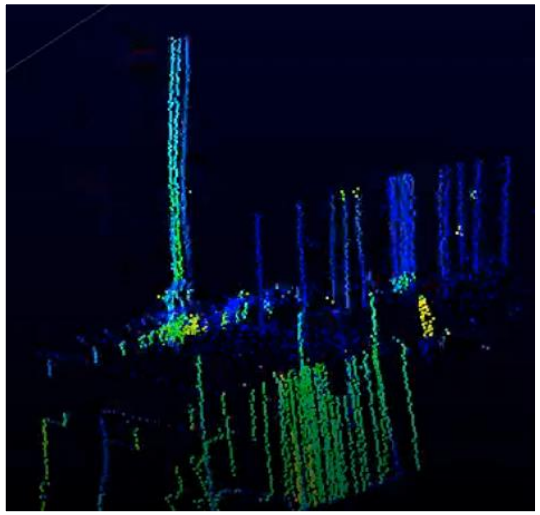
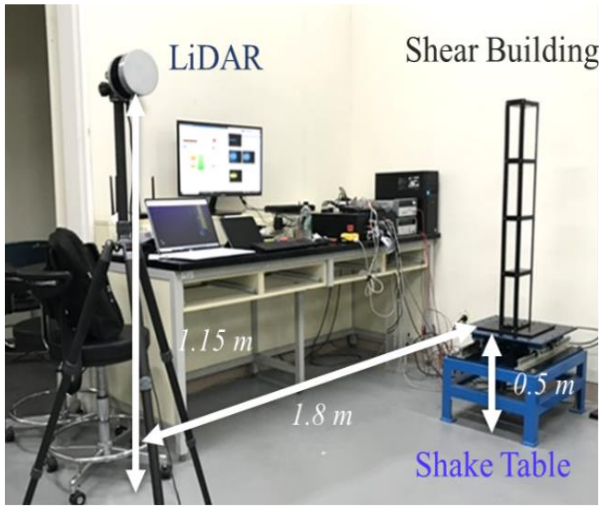
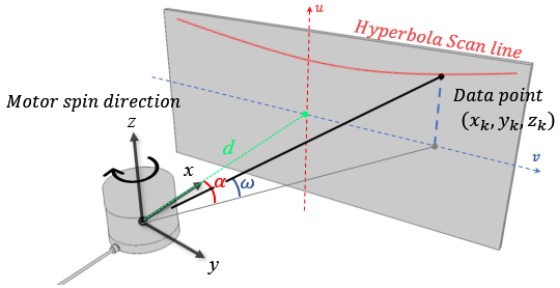
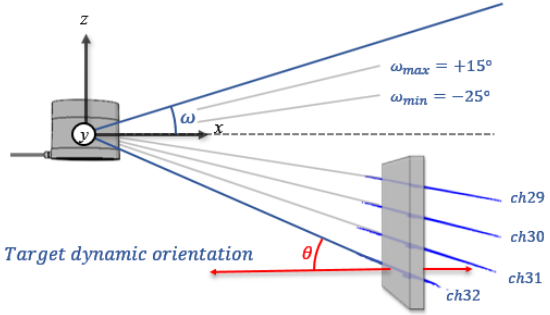
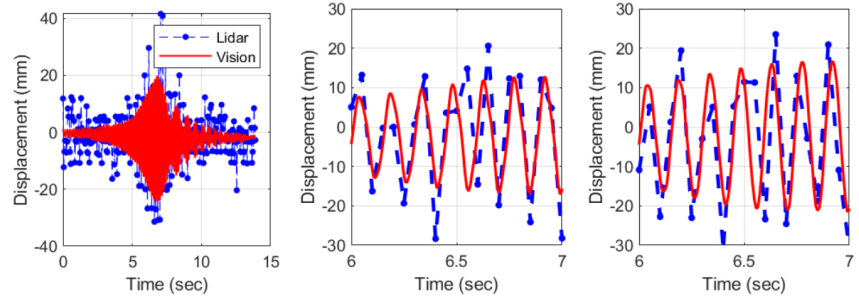
2. Non-contact sensing for Structural System Identification and Prediction







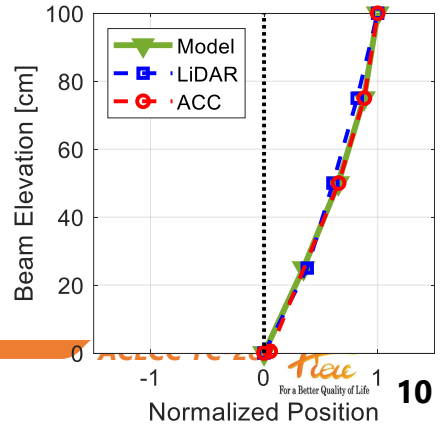




Lidar advantages

- less vulnerable to background noises and light conditions
- simpler calibration process and less sensitive to distortion
- insusceptible to texture (or tracker) of the object surface
- simpler tracking algorithm.

Shear Building Frequency & Mode Identification



Monitoring Research Efforts in South Korea

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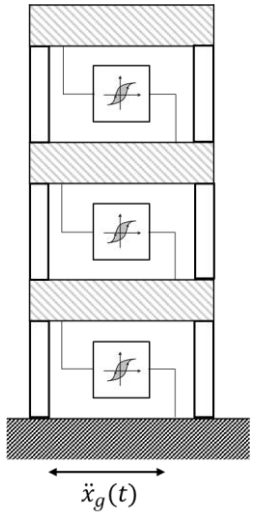
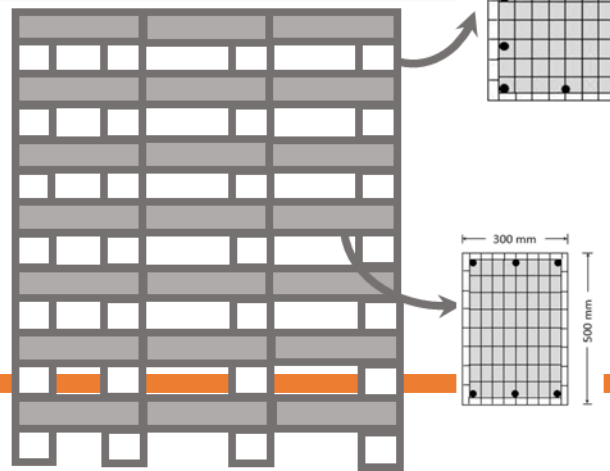
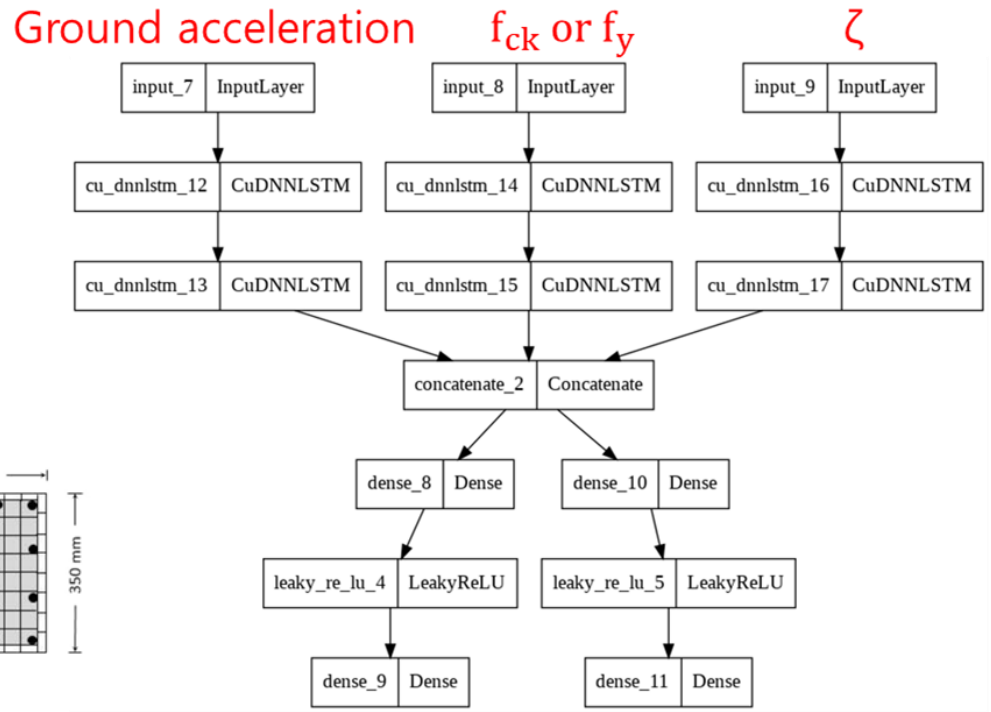
2. Non-contact sensing for Structural System Identification and Prediction

3story Steel Structure

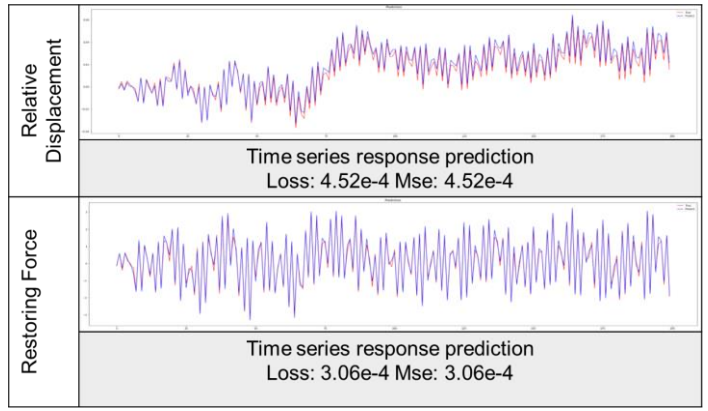


7story Rc Structure



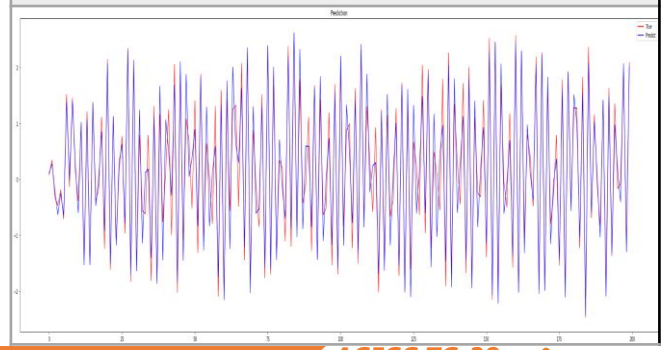


- Proposed MIMO model



Train Loss: 1.4e-6
Train Restoring force mse: 8.2e-7

Training Time : 0.64 h



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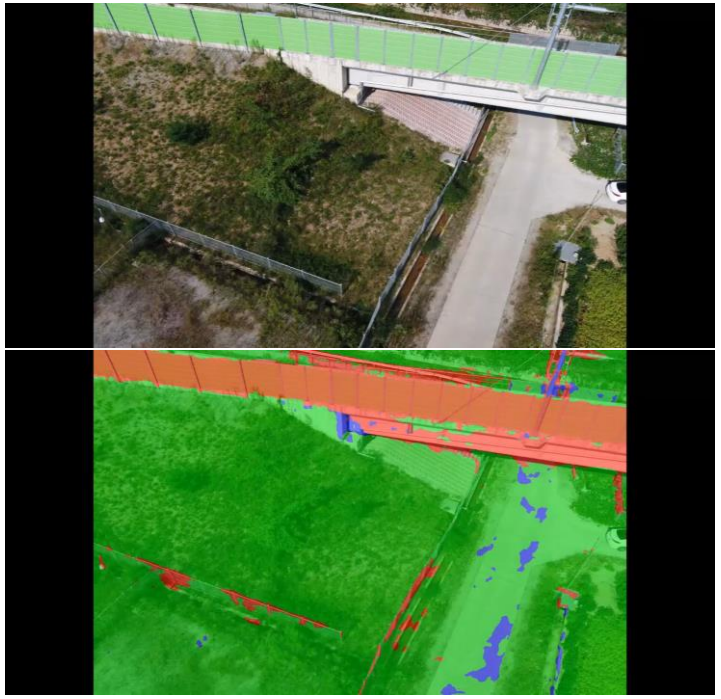
3. Unmanned Vehicles for Reconstructing BIM

- Images

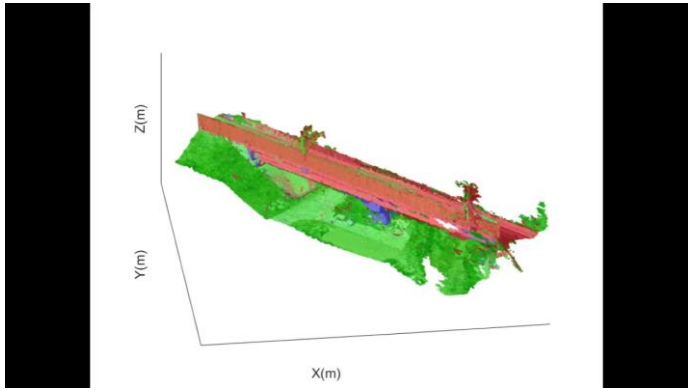
Semantic Segmentation

- Images w/ semantic information

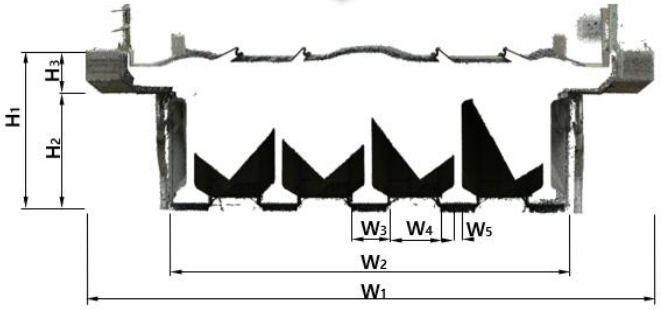


SfM

- 3D Point Cloud



Parameter Extraction



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4. IoT Sensors & Platforms for Concrete Crack Classification

Preventive maintenance plan	Short-term bridge management action plan	Bridge maintenance history information	Mid/long-term bridge asset management	3D Autonomous Routing Visualization
Deterioration environment Analysis	Reliable bridge deterioration evaluation	Image data labeling for damage classification	Bridge maintenance method/cost calculation	Scalable bridge deterioration model

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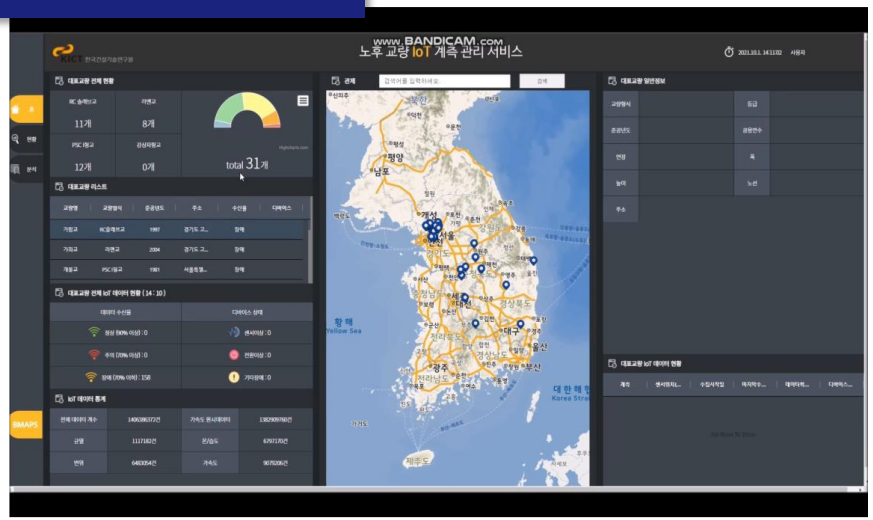
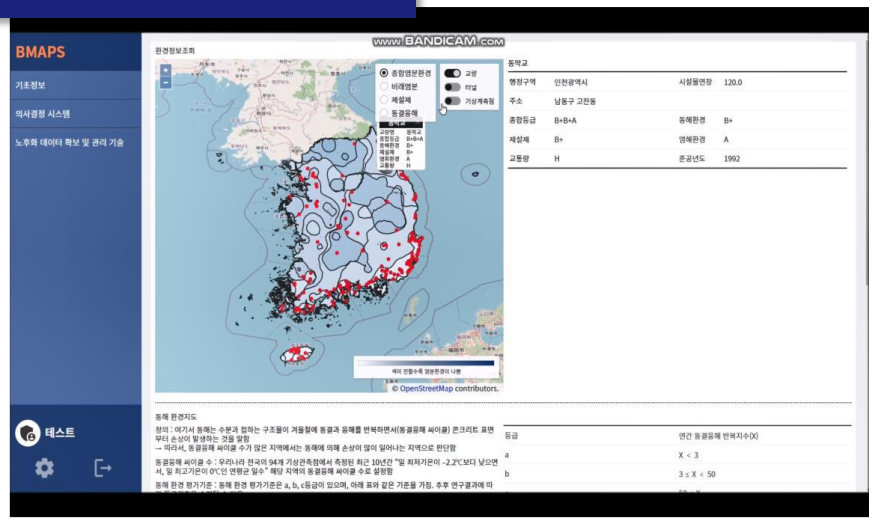
4. IoT Sensors & Platforms for Concrete Crack Classification

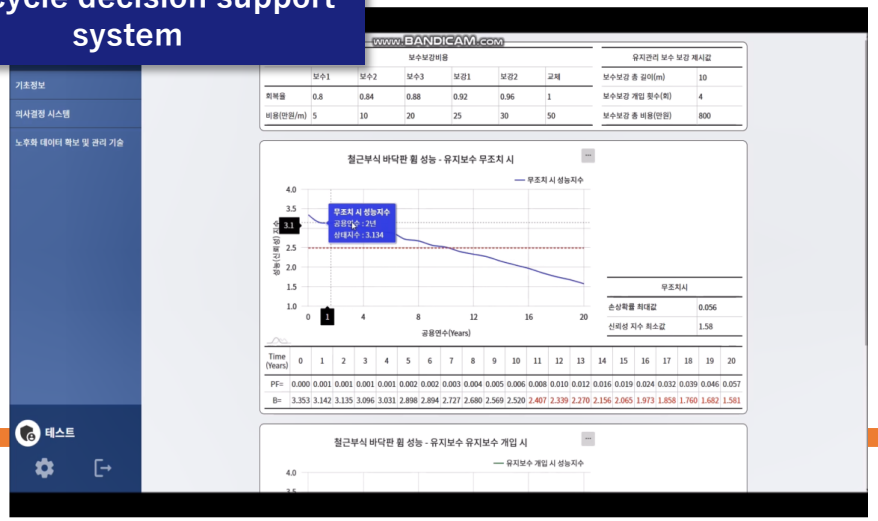
IoT Measured Data



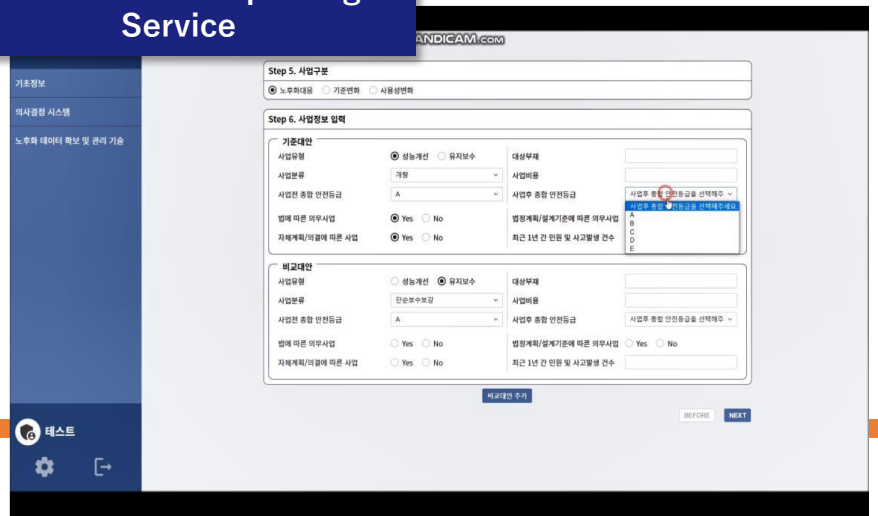
National deterioration data



Life cycle decision support system



Performance Improving Service



Conclusion

- **The government's direction for monitoring major civil infrastructure is toward proactive maintenance**
  - **Primary objective is to provide early decisions on gradual degradations of structures**

- **Current efforts on developing technologies for smart monitoring & maintenance:**
  - **Computer Vision**
  - **Non-contact sensing**
  - **Unmanned Vehicles (UAVs and UGVs)**
  - **IoT sensors & Platforms**

- **With the new trend of research, technological innovation and the realization of proactive maintenance are expected**

Thank You

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