



### Deep learning vision-based inspection for concrete bridge deficiencies

MBDH Student Presentation

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### <sup>1</sup>Ji Young Lee, <sup>2</sup>Brendan Barnes, <sup>2</sup>Dr. Chungwook Sim, and <sup>1</sup>Dr. Carrick Detweiler

<sup>1</sup>Department of Computer Science and Engineering, School of Computing, University of Nebraska - Lincoln <sup>2</sup>Civil Engineering department, College of Engineering, University of Nebraska - Lincoln

## **Project Overview**

SMart Big Data Pipeline for Aging Rural bridge Transportation Infrastructure





- Data acquisition
- Image stitching
- Crack detection
- Mapping and measurement

# Data Acquisition



# Image Stitching using Pix4D







### Generated bridge map

## **Crack Detection**

- Data preparation for the deep learning model
  - Labeled UAV images (before stitched) for transverse cracks
  - Cracks that run perpendicular to the direction of traffic



- Original image (3000x4000)
- Extracted patches (256x256)

### **Crack Detection**

- Data preparation for the deep learning model (Cont.)
  - Pre-process data for patch extraction
  - Each dataset have almost identical number of images

Dataset		# of labeled images	Image width	Image height	Train	Valid	Test	# of patches
CRACK500		3,364	640	360	2,152	539	673	3,364
SDNET2018		808	256	256	2,052	514	642	3,208
UAV DATASET	10-25-19	13	3,000	4,000	2,154	539	674	3,367
	11-15-19	9	3,000	4,000	2,153	539	674	3,366
	РКІ	291	500	333	1,766	442	553	2,761
Dr.Won's Dataset		260	525	319	1,988	498	622	3,108
Totai		1,381			12,265	3,071	3,838	19,174

#### Data information used for the training

# **Training and Prediction**



#### Step 1: Pre-training w/ larger data

- Pre-train the model to train small dataset later
- ImageNet (natural image dataset) > 1M data
- CRACK500 (public crack dataset) > 5,000 images
- Train the whole network to increase the ability for extracting general image features

#### Step 2: Fine-tuning w/ our collected data



- After step 1 training
- Learn the features from the cracks
- Data augmentation
- Train only partial layers

# **Training and Prediction**

#### Step 3: Prediction on bridge testbed

Split bridge map





Generate JSON file for each cell

Include information for each polygon's contour line 

### Predicted crack map

## **Crack Width Measurement**

- Based on the generated JSON for points at the boundary of the objects
- Measure the maximum perpendicular distance from the centerline of each crack to its contour line



# Thank you!









Pix4D**mapper** 

