

# JONGSEONG CHOI (BRAD)

PhD Candidate / Graduate Research Assistant

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## RESEARCH INTERESTS

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**Visual Analytics; Engineering Mechanics; Computer Vision; Machine Learning; Sustainable Structure; Big Visual Data; Multiview Geometry; Aerial Manipulation; Nondestructive Testing; Composite Materials; Numerical Heat Transfer**

## EDUCATION

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**PhD., Mechanical Engineering, Purdue University**, West Lafayette, Indiana, United States ..... 05/2020

✚ Dissertation: *Automating Visual Data Collection and Analytics toward Lifecycle Management of Engineering Systems*

✚ Advisor: Dr. Shirley J. Dyke

**MSc., Mechanical Engineering, University of Mississippi**, Oxford, Mississippi, United States ..... 05/2014

✚ Thesis: *Parametric Scramjet Analysis*

✚ Advisor: Dr. Jeffrey A. Roux

**BSc., Mechanical Engineering, University of Mississippi**, Oxford, Mississippi, United States ..... 05/2012

## RESEARCH RECORD

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### Professional Research Projects

**Integrating Human and Machine for Post-Disaster Visual Data Analytics** ..... 01/2019 – Present

- Supported by NSF under Grant No. NSF-1835473
- Develop a visual data retrieving software to search for data based on visual similarity, using Siamese Network.
- My contribution includes developing similarity-based image classification tool such as PyTorch and Tensorflow.
- 1 journal paper accepted [J10]; 1 journal paper in preparation [J9]; 1 conference paper submitted [C6]

**STORM: Safeguarding Cultural Heritage through Organisational Resources Management** ..... 04/2017 – Present

- Collaboration with European Union Grant No. H2020 n. 700191
- Develop automated monitoring system for graffiti in a community
- My contribution includes developing a unique graffiti detector working with 3D point cloud.
- 1 conference paper published [C4]; 1 journal paper under review [J7]

**RETH: Resilience ExtraTerrestrial Habitat** ..... 08/2018 – 01/2019

- Supported by New Horizon Program at Purdue University.
- Develop the expertise needed to address the grand challenge of permanent human settlements outside Earth.
- My contribution includes creating 3D models to capture features inside lava tubes using over 10 GB visual data.
- 3D models & videos were published in numerous articles worldwide (e.g., usatoday.com, space.com, phys.org, etc.); Available in <https://phys.org/news/2019-07-humans-lava-tubes-moon.html>
- 1 conference paper published [C5]

**Active Citizen Engagement to Enable Lifecycle Management of Infrastructure Systems** ..... 05/2017 – 08/2018

- Supported by NSF under Grant No. NSF-1645047
- Develop a lifecycle structural management system using crowdsourced images.
- My role is to lead project, develop demos, collect data, and publish.
- 1 journal paper published [J6]; 1 journal paper accepted [J8]

**Image-Based Collection and Measurements for Construction Pay Items ..... 05/2015 – 08/2017**

- Supported by INDOT under Grant No. SPR-4006
- Develop a tool of graphical measurement to improve efficiency and safety at a construction site
- My contribution includes constructing model, developing tool, building a drone.
- 1 journal paper published [J4]; 1 conference paper published [C1]; 1 Technical Report published [C3]

**Soft Armor Non-Destructive Evaluation Test Method: Vibration Energy Signature Test .....9/2014 – 08/2015**

- Supported by U.S. Department of Justice under Grant No. 2014-MU-CX-K004
- Develop a non-destructive test method for soft body armor's ballistic performance.
- My role was to lead team, design systems, build experiment setup, derive model.

**High Rate Compression Performance of Smartphone Buffer Materials ..... 08/2014 – 10/2014**

- Supported by Corvid co.
- Assess the dynamic performance of various foam materials.
- My contribution includes conducting experiments, analysis material behaviors.

**Parametric Analysis of Scramjet Engine Varying Material and Fuel ..... 08/2012 – 05/2014**

- Supported graduate program by University of Mississippi.
- Analytic research of Propulsion and Heat Transfer of an engine optimization problem.
- 3 journal papers published [J1], [J2], [J3]; 1 Master thesis generated.

**Individual Non-Funded Research Projects**

**Future Lifecycle Infrastructure Management System toward Smart City and Resiliency ..... 01/2019 – Present**

- Convolution Neural Networks (CNNs) enhanced SIFT features extraction, thus to achieve a robust image orientation and pose estimation.

**Optimize Maintenance Design of the Large-scale Mechanical System toward Smart Factory ..... 01/2019 – Present**

- Develop a novel monitoring system toward smart factory.

**Vision-based Visual Inspection System for A Large Number of Aerial Images ..... 01/2017 – 12/2017**

- Develop a building façade visual inspection technique using drones and orthophoto generation.
- 1 proposal generated and funded [P5], 1 journal paper published [J6]

**Sensor Integrated Autonomous Flight UAV System Development ..... 05/2016 – Present**

- Use various sensors (LIDAR, stereo camera, and IMU) to achieve autonomous flight.
- 2 proposal generated [P2], [P3]

**Automated Region-of-Interest Localization and Classification for Facility Visual Assessment ..... 05/2015 – 05/2017**

- Develop an image localization technique that can be used in structures using a large volume of images.
- 1 journal paper published [J5]; 1 conference paper published [C2]; 2 proposal generated [P1], [P4]

**Professional Talks & Presentations**

- [T3] Professional Presentation, Midwest Smart Structure Colloquium (MSSC), Midwest US ... 10/2016, 10/2017, 4/2019
- [T2] Professional Presentation, 9th European Workshop on SHM, Manchester, UK, July ..... 08/2018
- [T1] Poster Session, Herrick board meeting, West Lafayette, IN, USA ..... 11/2015, 11/2016, 11/2017, and 11/2018

**TEACHING / MENTORING RECORDS**

**Research Advising (5 undergraduate students)**

- Undergraduate Research Advisor ..... 08/2016 – current  
Yisong Yin, Undergrad Independent Research (Senior), 6 credits (Fall 2016 – Spring 2017)

Sharda Parth, Undergrad Independent Research (Senior), 3 credits (Spring 2017)  
 Gun Wook Park, Undergrad Independent Research (Senior), 6 credits (Spring – Fall 2017)  
 - 1 conference paper published [C5]  
 Jonghyun Park, Undergrad Independent Research (Senior), 6 credits (Spring 2018 – current)  
 Wookjin Chung, Undergrad Independent Research (Senior), 6 credits (Spring 2018 – current)

### **Course Teaching**

- Teaching Assistant ..... 05/2013 – 05/2014
  - ME325 Dynamics (typ. 70 students)
  - Primary responsibilities included weekly setup of equipment, presentation of pre-lab lectures, and grading.

### **STEM Curriculum Development for K-12 Students**

- TRAILS: Teachers and Researchers Advancing Integrated Lessons in STEM ..... 02/2016 – 01/2020
  - Supported by NSF under Grant No. NSF-1513248
  - Promote practices that increase students' motivations and capacities to pursue careers in STEM area.
  - My role includes analyzing video data to observe students' behavior. (08/2016 – 05/2017)
- SLED: Science Learning through Engineering Design ..... 09/2010 – 08/2019
  - Supported by NSF under Grant No. NSF-0962840
  - Collaboration between STEM disciplinary faculty and grades 3-6 teachers to develop engineering-based tasks.
  - My role includes analyzing video data to observe students' behavior (09/2015 – 08/2016)

### **Teaching and Educational Services**

- TRAILS K-12 Outreach: Collaborated Eng. Project & Activity w/ McCutcheon High School (Lafayette, IN)
- TRAILS K-12 Outreach: Collaborated Project Evaluation w/ Mishawaka High School (South Bend, IN)
- TRAILS K-12 Outreach: Collaborated Eng. Project Activity w/ Wea Ridge Middle School (Lafayette, IN)
- TRAILS K-12 Outreach: Collaborated Project Evaluation w/ Peru High School (Peru, IN)
- TRAILS K-12 Outreach: Collaborated Eng. Project Activity w/ Battle Ground Middle School (Lafayette, IN)

## **PROFESSIONAL SERVICE & OTHER QUALIFICATIONS**

### **Awards & Scholarships**

- **Honorable Mentions** from 3<sup>rd</sup> Midwest Smart Structure Colloquium, University of Illinois (UIUC) ..... 10/2017
- **Travel Award & Workshop Invitation** from NHERI RAPID Experimental Facility, NSF..... 07/2019  
 This award selects 20 attendees who has professional research background for the RAPID 4 days Equipment Training Workshop at the University of Washington, Seattle, as well as support up to \$1,500 Travel Fund.
- **Travel Award for Conference** from College of Engineering, Purdue University..... 05/2018  
 This award recognizes excellence PhD candidates supporting up to \$1,000 for 2019 EWSHM conference at Hilton Hotel, Manchester, UK  
 This award recognizes excellence in research presentation.
- **Resident Assistant Scholarship** from University of Mississippi ..... 08/2012 – 08/2013
- **Honor Program Scholarship** from University of Mississippi ..... 01/2011  
 This scholarship is awarded to prominent undergraduate students in the School of Engineering.

### **Professional Affiliation**

- President of Siloam Purdue Presbyterian church, Purdue University ..... 01/2018 – 01/2019
- President of Korean Student Association (Olemiss KSA), University of Mississippi ..... 05/2014 – 08/2014
- American Society of Engineering Education (ASEE) ..... since 08/2017
- American Society of Mechanical Engineering (ASME) ..... since 04/2011

### **PROFESSIONAL LEADERSHIP EXPERIENCE**

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**IT Manager** ..... 03/2016 – Present

- IISL Laboratory, Purdue University, West Lafayette, IN, USA
- Responsibility: manage website and update.

**Workshop director** ..... 04/2019

- 4<sup>th</sup> Midwest Smart Structure Colloquium from Apr 12014, 2019 at Purdue University West Lafayette, IN, USA.

**K-12 Video Data Collector & Analyzer** ..... 09/2015 – 05/2017

- TRIALS & SLED research groups (NSF-1513248 & NSF-0962840), Purdue University, West Lafayette, IN, USA
- Responsibility: analyze the video data to observe K-12 student behavior in scientific & communicate with teachers and students to proceed a newly developed curriculum from our engineering education team.

**Volunteer Staff Caregiver** ..... 09/2009 – 10/2010

- ReVitalise, Southport, Merseyside, UK
- Responsibility: operate and maintain medical devices; train weekly volunteers for the devices.

### **PROPOSAL DEVELOPMENT**

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**[P6] Active Citizen Engagement to Enable Lifecycle Management of Infrastructure Systems** ..... 07/2016

- **(Funded** under Grant No. **CMMI-1645047**) Co-authored successful proposal on behalf of Prof. Shirley J. Dyke with funded \$100,000 from National Science Foundation (NSF).

**[P5] Automating Damage Quantification, Localization and BIM Updating Using Voluminous Optical Data**..... 02/2020

- **(Submitted** to NSF HDBE program) Co-authored successful proposal on behalf of Prof. Shirley J. Dyke and requested \$400,000 to National Science Foundation (NSF).

**[P4] HDBE (E-Defense): Enabling Building Damage Assessment by Engaging Remote Experts** ..... 01/2018

- Co-authored on behalf of Prof. Shirley J. Dyke and requested \$700,000 to National Science Foundation (NSF).

**[P3] S&SA: Autonomous Infrastructure Inspection and Condition-Based Maintenance** ..... 05/2017

- Co-authored proposal on behalf of Prof. David. Cappelleri and requested to National Science Foundation (NSF).

**[P2] S&SA: Reconfigurable Aerial Robots for Intelligent Assessment to Industrial Disasters** .....11/2016

- Co-authored proposal on behalf of Prof. Xinyan Deng and requested to National Science Foundation (NSF).

**[P1] Automated Vision-based Welding Inspection Methods on a Large-scale Structures** ..... 10/2015

- Co-authored proposal on behalf of Prof. Shirley J. Dyke and requested to INDOT.

### **PEER-REVIEWED JOURNAL PAPERS**

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**[J11]** Xiaoyu Liu, Shirley J. Dyke, Chul Min Yeum, Ilias Bilonis, Ali Lenjani, & **Jongseong Choi** (2020), Automated Indoor Image Localization to Support Post-Event Building Assessment. *Sensors*, accepted

**[J10]** **Jongseong Choi**, Chul Min Yeum, Ali Lenjani, & Shirley J. Dyke, A Novel Building Searching & Identification Method for A Large Volume of Reconnaissance Images, in preparation - exp. submission in March 2020

- [J9] **Jongseong Choi** & Shirley J. Dyke (2020), CrowdLIM: Crowdsourcing to Enable Lifecycle Infrastructure Management. *Computers in Industry*, 115, 103185.
- [J8] Ali Lenjani, Shirley J. Dyke, Ilias Bilonis, Chul Min Yeum, Kenzo Kamiya, **Jongseong Choi**, Xiaoyu Liu, & Arindam G. Chowdhury (2020), Towards fully automated post-event data collection and analysis: pre-event and post-event information fusion. *Engineering Structure*, 109884.
- [J7] **Jongseong Choi**, Patrikakis Charalampos, Chul Min Yeum, & Shirley J. Dyke, Robust Graffiti Detection Approach in European Historical Monuments, *Sensors*, under review
- [J6] Chul Min Yeum, **Jongseong Choi**, & Shirley J. Dyke. (2019), Automated region-of-interest localization and classification for vision-based visual assessment of civil infrastructure. *Structural Health Monitoring*, 1475921718765419.
- [J5] **Jongseong Choi**, Chul Min Yeum, Shirley J. Dyke, & Mohammad J. Jahanshahi (2018), Computer-aided approach for rapid post-event visual evaluation of a building façade. *Sensors*, 18(9), 3017.
- [J4] Chul Min Yeum, **Jongseong Choi**, & Shirley J. Dyke (2017), Autonomous image localization for visual inspection of civil infrastructure. *Smart Materials and Structures*, 26(3), 035051.
- [J3] Jeffrey A. Roux, **Jongseong Choi**, & Neerad Shakya (2014), Parametric scramjet cycle analysis for nonideal mass flow rate. *Journal of Thermophysics and Heat Transfer*, 28(1), 166-171.
- [J2] Jeffrey A. Roux, Neerad Shakya, & **Jongseong Choi** (2013), Scramjet: minimum thrust-specific fuel consumption with material limit. *Journal of Thermophysics and Heat Transfer*, 27(2), 367-368.
- [J1] Jeffrey A. Roux, Neerad Shakya, & **Jongseong Choi** (2012), Revised parametric ideal scramjet cycle analysis. *Journal of Thermophysics and Heat Transfer*, 27(1), 178-183.

## CONFERENCE PROCEEDINGS & OTHER ARTICLES

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- [C6] Shirley J. Dyke, Xiaoyu Liu, **Jongseong Choi**, Chul Min Yeum, Juan Park, Ali Lenjani, Julio A. Ramirez, & Randall Poston (2020), "Learning from Earthquakes Using the Automatic Reconnaissance Image Organizer," Proceedings of 17<sup>th</sup> World Conference on Earthquake Engineering, Sendai, Japan, Sep 13-18, 2020, accepted
- [C5] Audai Theinat, Anahita Modiriasari, Antonio Bobet, Jay Melosh, Shirley J. Dyke, Julio A. Ramirez, **Jongseong Choi**, Amin Maghareh, & Daniel Gomez (2019, March), "Geology Explorations of Lava Tubes in the National Beds Lava Monuments," In Lunar and Planetary Science Conference (Vol. 50).
- [C4] **Jongseong Choi**, Chul Min Yeum, Shirley J. Dyke, Mohammad R. Jahanshahi, & Gun Wook Park (2018), "Rapid Vision-Based Inspection of Nonstructural Components in Buildings," Proceedings of the 9th European Workshop on Structural Health Monitoring, Manchester, UK, July 10-13, 2018.
- [C3] Chul Min Yeum, Anup Mohan, Shirley J. Dyke, Mohammad R. Jahanshahi, **Jongseong Choi**, Ziyi Zhao, & Julio A. Ramirez (2017), "Image-Based Collection and Measurements for Construction Pay Items," Purdue University e-publication.
- [C2] Chul Min Yeum, **Jongseong Choi**, & Shirley J. Dyke (2017), "Automated Region-of-Interest Localization and Classification for Visual Assessment on Civil Infrastructure," Proceedings of the 11th International Workshop on Structural Health Monitoring, Stanford, CA, September 12-14, 2017.
- [C1] Chul Min Yeum, **Jongseong Choi**, & Shirley J. Dyke (2017), "Image Localization for Computer-enhanced Visual Inspection of Civil Infrastructure," Proceedings of Engineering Mechanics Institute Conference, San Diego, CA, United States, June 4-7, 2017.