# JONG-HYUN JEONG, PH.D.

jhjeongaa@gmail.com

Palo Alto, CA

## EDUCATION

**Ph.D., Civil Engineering**                                        *Jan. 2016 - Nov. 2021*
The University of Arizona, Tucson, AZ, USA
Advisor: Dr. Hongki Jo

**M.S., Electrical & Computer Engineering**                         *Sep. 2020 - Nov. 2021*
The University of Arizona, Tucson, AZ, USA
Advisor: Dr. Gregory Ditzler

**M.S., Civil Engineering**                                         *Mar. 2013 - Feb. 2015*
Konkuk University, Seoul, Korea
Advisor: Dr. Yong-Hak Lee

**B.S., Civil Engineering**                                         *Mar. 2007 - Feb. 2013*
Konkuk University, Seoul, Korea

## PROFESSIONAL EXPERIENCE

**Structural / Analytics Engineer**, Palo Alto Research Center(PARC, a Xerox company), Palo Alto, CA
*Nov. 2021 - Current*

- Development of fiber optics sensor and Internet of Things(IoT)-based structural health monitoring system
- Decentralized & scalable large-scale dynamic streaming data processing architecture & visualization software development
- Automated statistical analysis software development for large-scale time-series streaming data
- Sensor data processing algorithm development(i.e., sensor fusion algorithm, digital filter etc.,)
- Fiber optic based sensors(i.e., strain, temperature, acceleration etc.) performance validation.
- Finite element modeling & simulation for infrastructure assets

**Graduate Student Researcher**                                     *Jan. 2016 - Oct. 2021*
*Smart Structure Systems Laboratory*
*The University of Arizona, Civil & Architectural Engineering & Mechanics*

- Faculty Advisor: Hongki Jo, Ph.D.

- **Actively Managed Battery Degradation of IoT Wireless Sensors for Group Replacement**
  (Funding: National Science Foundation, Grant # 2027425)
  - Developed a reinforcement learning agent based optimal wireless sensor scheduling environment
  - Developed reward strategy for network level optimal sensor operation for uniform battery degradation
  - Case study for full-scale cable stayed bridge wireless sensor network optimal duty cycle control (i.e., 119 nodes simultaneous control using single RL agent)

- **RL based Artificial Structural Designer Development: Reinforcement Learning based Structural Design Automation**
  - Design and implementation of a framework for agent based automated reinforced concrete beam design using reinforcement learning based on ACI-318 provision
  - Formulated the structural designing task in Markov Decision Process

- Developed design environment & reward strategy to train an RL agent to design structure in autonomous manner

- **Crowd-sourced Smartphone Sensor Data for Real-time Pavement Condition monitoring** (Funding: UA Tech Launch # UA20-237)
  - Developed a calibration-free smartphone based pavement roughness estimation strategy using deep learning method
  - Developed a convolutional neural network architecture to estimate pavement roughness independent from vehicle mechanical characteristics and driving speed
  - Collected an experimental dataset from various vehicle dynamics measurement
  - Developed a smartphone application for practical implementation
  - Developed a cloud based data management system

- **Strain-based Fatigue Crack Monitoring of Steel Bridges using Wireless Elastomeric Skin Sensors** (Funding: Transportation pooled Fund, Grant # TPF-5(328))
  - Developed a wireless high-sensitive capacitive sensing hareware system
  - Proposed a two-step shunt-calibration method for capacitive sensor calibration
  - Integrated developed sensor unit to a new high fidelity sensor platform-Xnode for I-70 bridge fatigue monitoring

- **Robust Wireless Skin Sensor Networks for Long-term Fatigue Crack Monitoring of Bridges** (Funding: Transportation pooled Fund, Grant # TPF-5(556))
  - Automated high-frequency AC bridge balancing method development
  - Developed digitally controlled capacitance shunt calibration strategy
  - Automated scheduled balancing-calibration strategy development
  - Prototype hardware & software development & lab scale validation

- **Wind-induced Vibration Investigation and Mitigation for Jojoba Substation A-frame Structure** (Funding: Salt River Project)
  - Proposed a deep learning and computer vision-based structural displacement monitoring technique considering environmental uncertainties(i.e., illumination change, fog, rain and occlusion)
  - Developed a Computer vision-based long-term structural dynamic displacement monitoring system (Hardware system & software development)
  - Low-cost micro-burst identification & monitoring IoT device development

- **Flood Induced Bridge Scour Prediction Using Bio-Inspired Smart Sensor Network** (Funding: National Science Foundation, Grant # 1434923)
  - Developed an IoT edge device based scour monitoring system
  - Installed the system on La Cholla Bridge and monitored scour for 2 years
  - Developed a signal processing technique using hydrophone for scour level estimation

- **Wind-induced Structural Risk Monitoring System Development for SRP Power Substation and Transmission Structures** (Funding: Salt River Project)
  - Analyzed aerodynamic characteristics A-frame conductor beam using CFD
  - Wind-tunnel test analysis for conductor beam retrofitting

**Research Assistant**                                                                                     *3/2012 - 12/2015*
*Concrete Structure Laboratory*
*Konkuk University, Civil Engineering*

- Faculty Advisor: Yong-Hak Lee, Ph.D.

- **Development of Torsional Rotation Control Technique for Curved Prestressed Curved Concrete Girder Bridge**
(Funding: Korea Agency for Infrastructure Technology Advancement, Grant # 12CCTI-C063718-01)
  - Formulated time dependent bending/torsional creep behavior in concrete & experimental validation
  - Formulated Non-uniform bending shrinkage behavior in concrete beam & experimental validation
  - Developed tensile & torsional creep testing machines
  - Scaled two-span curved, continuous double-t post-tensioned girder bridge design/construction
  - Experimental validation of time-dependent torsion control of curved double-t girder bridge via asymmetrical tendon tensioning technique

## RESEARCH INTERESTS

Artificial intelligence, Wireless Sensor Development, Pavement Health Assessment, Mobile Crowdsourcing, Deep Reinforcement Learning, Autonomous Structural Design, Computer Vision based Structural Health Monitoring

## GRANTS, HONORS AND AWARDS

| | |
|---|---:|
| - Outstanding Graduate Students for AY 2021-22 | *2021* |
| - Graduate & Professional Student Council Travel Grant | *2021* |
| - UA Tech launch Innovation Challenge ($20,000, PI) | *2020* |
| *Convolutional Neural Networks for Pavement Roughness Assessment Using Calibration-Free Vehicle Dynamics (UA20-237)* | |
| - Lewis, Delbert R Graduate Fellowship | *2017, 2019, 2020* |
| - 3rd Place (poster), 15th Arizona Pavements/Materials conference | *2018* |
| - 1st Place (poster), Department of Civil Engineering & Engineering Mechanics Poster Contest | *2018* |
| - Travel grant, UA College of Engineering | *2018* |
| - Whitenack & Dr. Russell D. Scholarship | *2017* |
| - University designated scholarship, Konkuk University | *2010* |

## PUBLICATIONS

### Journal Publications

[J1] **Jeong J. H.**, Jo, H., Li, J., Collins, W., Laflamme, S. Automatic control of AC bridge-based capacitive strain sensor interface for wireless structural health monitoring *Measurement, (Accepted with minor revision)*

[J2] Taher, S. A., Li, J., **Jeong, J. H.**, Laflamme, S., Jo, H., . . . Downey, A.(2022) Structural Health Monitoring of Fatigue Cracks for Steel Bridges with Wireless Large-Area Strain Sensors, *Sensors*, 22(14), p.5076.(IF: 3.847) https://doi.org/10.3390/s22145076

[J3] **Jeong J. H.**, Jo, H., (2021) Real-time generic target tracking for long-term structural displacement monitoring under environmental uncertainties via deep learning *Structural control and health monitoring*, e2902 (IF: 4.819), https://doi.org/10.1002/stc.2902

[J4] **Jeong J. H.**, Jo, H., (2021) Deep reinforcement learning for automated reinforced concrete structure design, *Computer-Aided Civil and Infrastructure Engineering.1–22.*,(Top journal within Civil Engineering discipline , JCR 1/136, IF: 11.775) https://doi.org/10.1111/mice.12773

[J5] **Jeong J. H.**, Jo, H., Ditzler G. (2020) Convolutional neural networks for pavement roughness assessment using calibration-free vehicle dynamics. *Computer-Aided Civil and Infrastructure Engineering.1–21.*,(Top journal within Civil Engineering discipline , JCR 1/136, IF: 11.775) https://doi.org/10.1111/mice.12546

[J6] **Jeong, J. H.**, Xu, J., Jo, H., Li, J., Kong, X., Collins, W., ... & Laflamme, S. (2018). Development of wireless sensor node hardware for large-area capacitive strain monitoring. *Smart Materials and Structures*, 28(1), 015002., (IF: 3.585) https://doi.org/10.1088/1361-665X/aaebc6

**[J7]** **Jeong, J. H.**, Park, Y. S., & Lee, Y. H. (2015). Variation of shrinkage strain within the depth of concrete beams. *Materials*, 8(11), 7780-7794.,(IF: 3.623) https://doi.org/10.3390/ma8115421

**[J8]** Lee, T., **Jeong, J. H.**, Kim, H. J., & Lee, Y. H. (2015). Interface behavior of concrete infilled steel tube subjected to flexure. *Journal of The Korean Society of Civil Engineers*, 35(1), 9-17., (in Korean) https://doi.org/10.12652/KSCE.2015.35.1.0009

**[J9]** Lee, Y. H., Lee, T., **Jeong, J. H.**, Kim, H. J., & Park, K. T. (2014). Interface behavior of concrete infilled steel tube composite beam. *Journal of the Korea institute for structural maintenance and inspection*, 18(5), 9-18.(in Korean) https://doi.org/10.11112/jksmi.2014.18.5.009

### Journal Publications in Progress

**[P1]** **Jeong J. H.**, Jo H., A Deep Learning based Smartphone crowdsourced pavement condition assessment *(In review)*

### Invited book chapter

**[B1]** **Jeong J. H.**, Jo H., (2022). Smartphone based civil infrastructure health monitoring, In Haldar, A., Al-Hussein, A. (Ed.). Recent Developments in Structural Health Monitoring and Assessment — Opportunities and Challenges, *World Scientific*, https://doi.org/10.1142/12434

### Conference publications

**[C1]** Taher, S.A., Li, J., **Jeong, J.H.**, Laflamme, S., Jo, H., Bennett, C., Collins, W., Liu, H., Downey, A. and Shaheen, M. (2022, April). Long-term field monitoring of fatigue cracks for steel bridges with wireless large-area strain sensors In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2022* (Vol. 12046, p. 20-28). International Society for Optics and Photonics.

**[C2]** **Jeong, J. H.**, Xu, J., Jo, H., Li, J., Kong, X., Collins, W., ... & Laflamme, S. (2018, March). Capacitance-based wireless strain sensor development. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2018* (Vol. 10598, p. 105980S). International Society for Optics and Photonics.

**[C3]** Kong, X., Li, J., Collins, W., Bennett, C., Jo, H., **Jeong, J. H.**, & Laflamme, S. (2018, March). Dense capacitive sensor array for monitoring distortion-induced fatigue cracks in steel bridges. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2018* (Vol. 10598, p. 105980Q). International Society for Optics and Photonics.

**[C4]** Ahamed, T., Shim, J., **Jeong, J. H.**, Jo, H., & Duan, J. G. (2017, May). Advanced Signal Processing of Sonar Measurement for Bridge Scour Monitoring. *In World Environmental and Water Resources Congress 2017* (pp. 93-100).

**[C5]** Lee, S. W., **Jeong, J. H.**, Knez, K. P., Min, J. H., & Jo, H. (2016, April). Practical application of RINO, a smartphone-based dynamic displacement sensing application for wind tunnel tests. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2016* (Vol. 9803, p. 98032X). International Society for Optics and Photonics.

**[C6]** **Jeong, J. H.**, Park, Y. S., Lee, Y. H.,(2015, Oct.) Time-dependent experiment of two-span curved double-t beam, *KSCE 2015 CONVENTION 2015 CIVIL EXPO & CONFERENCE*, (pp. 19-20)

**[C7]** Park, Y. S., **Jeong, J. H.**, Kim, H. J., Lee, Y. H.,(2015, Oct.) Torsional Effect of Bimoment due to Prestressing Force in Double-T Beam, *KSCE 2015 CONVENTION 2015 CIVIL EXPO & CONFERENCE*, (pp. 97-98)

**[C8]** **Jeong, J. H.**, Park, Y. S., Kim, H. J., Lee, Y. H., (2015, April) Age-dependent torsional behavior of prestressed double-T beam *In 2015 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum* (pp. 431-434)

**[C9]** **Jeong, J. H.**, Park, Y. S., Kim, H. J., Lee, Y. H., (2015, April) Torsion control of prestressed curved girder with prestressing force. *In 2015 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum* (pp. 361-364)

**[C10]** **Jeong, J. H.**, Kim, H. J., Lee, Y. H., (2014, April) Torsional behavior of curved PSC girder. *In 2014 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum* (pp. 495-498)

**[C11]** Park, Y. S., Shin, D. H., **Jeong, J. H.**, Kim, H. J., Lee, Y. H.,(2013, Oct.) Shrinkage and creep under flexure in concrete beam., *KSCE 2013 CONVENTION*, (pp. 1462-1465)

**[C12]** Park, Y. S., Shin, D. H., **Jeong, J. H.**, Kim, H. J., Lee, Y. H.,(2013, Oct.) Single curve formulation of creep under time-varying stress history., *KSCE 2013 CONVENTION*, (pp. 1257-1261)

### Technical Reports

- Lee, Y.H., Park, Y.S., **Jeong, J. H.**, Kim, H.J., Kim, S.G., Park. S.H. (2015, Dec.), Development of Torsional Rotation Control Technique for Curved Prestressed Curved Concrete Girder Bridge: Final Project Report, Korea Agency for Infrastructure Technology Advancement

## PRESENTATIONS

### Conference Presentations Accepted by Abstract

**[T1]** **Jeong, J. H.**, Jo, H., (2021, May). A Deep-Learning Based Smartphone Application for Real-Time Pavement Roughness Assessment and Experimental Validation *Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference 2021*

**[T2]** **Jeong, J. H.**, Jo, H., (2021, May). Deep Reinforcement Learning for Automated Reinforced Concrete Structural Design *Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference 2021*

**[T3]** **Jeong, J. H.**, Jo, H., Li, J., Laflamme, S., Bennett, C., Downey, A., Collins, W., (2021, May). Fully Automated Wireless Capacitive Strain Sensing Node Development for High-Sensitive, Large Area Strain Monitoring *Engineering Mechanics Institute Conference and Probabilistic Mechanics & Reliability Conference 2021*

**[T4]** **Jeong, J. H.**, Jo, H., (2021, March). Mobile crowdsourced pavement condition estimation *Conference on Artificial Intelligence in Smart Cities – KOCSEA 2021*

**[T5]** **Jeong, J. H.**, Xu, J., Jo, H., Li, J., Kong, X., Collins, W., ... & Laflamme, S. (2018, March). Capacitance-based wireless strain sensor development. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2018*

**[T6]** Lee, S. W., **Jeong, J. H.**, Knez, K. P., Min, J. H., & Jo, H. (2016, April). Practical application of RINO, a smartphone-based dynamic displacement sensing application for wind tunnel tests. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2016*

**[T7]** **Jeong, J. H.**, Park, Y. S., Lee, Y. H.,(2015, Oct.) Time-dependent experiment of two-span curved double-t beam, *KSCE 2015 CONVENTION 2015 CIVIL EXPO & CONFERENCE*

**[T8]** **Jeong, J. H.**, Park, Y. S., Kim, H. J., Lee, Y. H., (2015, April) Age-dependent torsional behavior of prestressed double-T beam *In 2015 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum*

**[T9]** **Jeong, J. H.**, Park, Y. S., Kim, H. J., Lee, Y. H., (2015, April) Torsion control of prestressed curved girder with prestressing force. *In 2015 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum*

**[T10]** **Jeong, J. H.**, Kim, H. J., Lee, Y. H., (2014, April) Torsional behavior of curved PSC girder. *In 2014 The Korea Institute for Structural Maintenance and Inspection Spring Conference & Forum*

## PROPOSAL WRITING EXPERIENCES

### Korea Railroad Research Institute *April 2021*
<u>Title</u>: Intelligent maintenance technology development for rail infrastructures
<u>Role</u>: Co-authored on behalf of Dr. Hongki Jo *(Not Funded)*

- Proposed train & rail interaction based rail track health monitoring strategy using smartphone IMU measurement

**UA Tech Launch** *June 2020*

<u>Title</u>: Convolutional Neural Networks for Pavement Roughness Assessment Using Calibration-Free Vehicle Dynamics

<u>Role</u>: Principle Investigator *(Funded)*

- Entire proposal writing including technical opportunity, research plan, intellectual merit and budget plan

**National Science Foundation: FW-HTF-RM** *March 2019*

<u>Title</u>: Collaborative Research: WAKE: Boosting construction workplace safety and efficiency through a fatigue prediction and intervention system

<u>Role</u>: Co-authored on behalf of Dr. Hongki Jo *(Not funded)*

- Proposed experimental design & deep learning based EEG signal processing algorithm

**Salt River Project** *May 2018*

<u>Title</u>: Wind-induced Vibration Investigation and Mitigation for Jojoba Substation A-frame Structure

<u>Role</u>: Co-authored on behalf of Dr. Hongki Jo *(Funded)*

- Proposed deep learning based long-term vision based displacement sensing strategy
- Proposed 24/7 vision based structure displace monitoring system development
- Proposed low-cost microburst IoT device development

**Department of Energy** *June 2018*

<u>Title</u>: Using crowdsourced smartphone data to improve pavement management and energy efficiency of vehicles

<u>Role</u>: Co-authored on behalf of Dr. Hongki Jo *(Not funded)*

- Proposed smartphone crowdsourced pavement roughness estimation strategy

**The Nature Conservancy** *May 2018*

<u>Title</u>: Real-time tree diameter measurement using 3D point-cloud sensor

<u>Role</u>: Co-authored on behalf of Dr. Hongki Jo *(Not Funded)*

- Proposed LIDAR based signal processing algorithm

**Salt River Project** *Oct. 2017*

<u>Title</u>: Wind-induced Vibration Investigation and Mitigation for Jojoba Substation A-frame Structure

<u>Role</u>: Co-authored on behalf of Dr. Hongki Jo *(Funded)*

- Authored CFD analysis section

## PATENT

- Jo, H., **Jeong, J. H.**, Ditzler, G., Convolutional neural networks for pavement roughness assessment using calibration-free vehicle dynamics *(US patent pending)*

## TEACHING EXPERIENCE

**Instructor of Record**

*The University of Arizona, Civil & Architectural Engineering & Mechanics*

- CE 389: Material Testing Laboratory *Fall 2019, Spring 2020*
  - Instructed lecture & lab session of about 40 students each semester
  - Created homeworks, exams, and evaluated student's works
  - Updated class contents: "Fundamental of Sensing in Civil Engineering"

**Teaching Assistant**

*The University of Arizona, Civil & Architectural Engineering & Mechanics*

- CE 214: Statics (Discussion session) *Fall 2018*
  - Instructed three discussion sessions per week

- CE 435/535: Prestressed concrete structures *Spring 2021*
  - Guest lecture - Prestressed concrete girder design using Leap concrete bridge (Bentely)
  - Made solutions and graded all homeworks

*Konkuk University, Civil Engineering*

- Concrete as Material Engineering *Fall 2013, Fall 2014*
  - Instructed lab session of about 40 students each semester

## STUDENT MENTORING

- Tahsin Afroz, Nishat, PhD student in Civil Engineering, UA
  - Topic: Fully-automated capacitive strain sensing hardware development
  - Deep reinforcement learning based sensor network control

- Chelsey Bergmann, Undergraduate in Computer Science, UA (Current position: Software engineer, UnitedHealth Group)
  - Topic: Real-time pavement roughness monitoring cloud platform development using smartphone crowedsourced data
  - Deep learning based iOS app development for crowdsourced pavement roughness monitoring
  - Cloud platform development using firebase for crowdsourced data management

- Jongkwang Park, Undergraduate in Mechanical Engineering, UA (Current position: Mechanical Engineer, Qualcomm)
  - Topic: Single camera based 6-DOF displacement monitoring technique development
  - Single camera based 3D displacement measurement technique using planar homography, depth calibration, and optimization techniques

## SERVICE ACTIVITIES

Summer Engineering Camp Assistant *2016-2021*

- Introductory lecture of structural engineering & bridge competition
- Updated lecture with new topics (Structural dynamics and sensors)
- Designed new competition content (Building competition under earthquake excitation)

## AFFILIATION

Data Science Institute Member, *The University of Arizona* *2020-2021*

## TECHNICAL SKILLS

**Engineering tools**
*ANSYS, Fluent, Midas Civil, SAP2000, Bentely Leap Concrete, ArcGIS*

**Programming Languages**

*Python, MATLAB, Simulink, Stateflow, C, FORTRAN, Mathematica, Swift*

**Library & API**
*Tensorflow, Pytorch, Keras, Scikit-learn, Scipy, Pandas, Singularity, Amazon web service, Dash, OpenAI-Gym, Stable-baseline*

## PROFESSIONAL LICENSES

Civil Engineer License, South Korea, 2013

## LANGUAGE PROFICIENCY

Fluent in *English*, Native in *Korean*