Mehrdad Shafiei Dizaji, Ph.D.

Postdoctoral Research Associate

Turner Fairbank Highway Research Center,

U.S. Department of Transportation, Federal Highway Administration

(434)987-9780

RESEARCH INTERESTS

- Data-driven structural identification
- Deep learning-based intelligent visual sensing
- Automated/augmented structural inspection
- 3D Digital image correlation for full field sensing
- Engineered Artificial Neural Networks
- Adaptive Digital Twinning of Structures
- Mixed reality Using AR/VR for FEA
- Physics Informed Neural Networks
- Real-time Finite Element Integrated Analysis
- Computational Modeling and Damage Detection

ACADEMIC EXPERIENCE

Postdoctoral Research Associate, Turner Fairbank Highway Research Center, FHWA *Jun. 2023- 2025*
Advisor: *Hoda Azari*

Research Project:
- *Analyzing NDE Data Using Artificial Intelligence: An NDEChat Platform.*
- *Physics-Informed Neural Networks to Predict NDE data.*

Postdoctoral Research Associate, University of Virginia, Dept. of Eng. Sys. and Env. *Sep. 2021- Jun. 2023*
Advisor: *Devin K. Harris*

Research Project:
- *Adaptive Digital Twining: An Immersive Visualization Framework for Structural Cyber-Physical Systems*

Postdoctoral Scholar, University of Massachusetts Lowell, Dept. of Mech. Eng. *Aug. 2020-Sep. 2021*
Advisor: *Zhu Mao*

Research Project:
- *Deep Learning Architecture for Extraction of Natural Frequencies*

Research Assistant, University of Virginia, Dept. of Eng. Systems and Environment. *Aug. 2015- May. 2020*
Advisor: *Devin K. Harris*

Ph.D. Dissertation Research:
- *A Computer full-field Vision-Based Structural Health Monitoring Framework for Structural Identification*

Teaching Ass., SEAS Graduate Teaching Internship Fellow (GTI), University of Virgini *Aug 2019-Jan. 2020*
Advisor: *Jose Gomez*
- *Course name*: Advanced Topics in Structural Engineering (Co-Instructor with Dr. Jose Gomez, UVA).
- *Couse level*: Graduate (CE5340), delivered as in-person & web-based format.
- *Couse Name*: Advanced Topics in Structural engineering, Fall Semester 2019.

EDUCATION

Ph.D. in Civil Engineering, University of Virginia, Dept. of Eng. Sys. & Envi. Charlottesville, VA *2015-2020*
- Dissertation: A Computer Vision-Based Structural Health Monitoring Framework
- Advisor: Prof. Devin K. Harris

M.Sc. in Civil Engineering, Sharif University of Technology, Dept. of Civil Eng. Tehran, Iran *2005-2008*
- Thesis: Nonlinear Analysis of Concrete Gravity Dams by Artificial Neural Networks
- Advisor: Prof. Abdolreza Joghataie

B.Sc. in Civil Engineering, Tabriz University, Dept. of Civil Eng. Tabriz, Iran *2000- 2005*
- Term Project: Designing of Steel Structures Using Computer-Aided Software

HONORS AND AWARDS

19. **National Academics Fellowship**. Selected as a recipient of NRC Research Associateship Program fellowship: $73000 (~Annually for two years) *2023*

18. **Award Recipient,** SEI Presenter Scholarship Workshop on Technical Communication, Structure Congress, Structural Engineering Institute (SEI), American Society of Civil Engineers (ASCE), Amount: $1500. *2023*

17. **Award Recipient,** ASCE Young Professional Scholarship, Structural Engineering Institute (SEI), American Society of Civil Engineers (ASCE), Amount: $1500. *2021*

16. **Best Presentation Award**, selected as a recipient of "Best Presentation" fund, UVA POSTDOC RESEARCH SYMPOSIUM, 2021, Presentation title," Adaptive Digital Twinning – An Immersive Visualization Framework for Structural CPS", a 12-min talk, Nov 18th, University of Virginia, Amount: $100 *2021*

15. **Award Recipient**, selected as a recipient of "Hoos Coming Back" fund to attend the graduation ceremony, UVA Alumni, University of Virginia, Amount: $500 *2021*

14. **Best Paper Nominee**, paper title, "Multi-Level Damage Detection using Octree Partitioning Algorithm", Conference Proceedings of the Society for Experimental Mechanics Series, IMAC-XXXX: Next Frontier in Structural Dynamics, Sponsor: Polytec, Amount: $500 *2021*

13. **Best Paper Nominee**, paper title, "Detecting and Reconstructing the 3D Geometry of Internal Structural Damage Using Full-Field Sensing and Finite Element Model Updating", 2020 SPIE Smart Structures + Nondestructive Evaluation, April 27 - May 1, 2020, Amount: $1000. *2020*

12. **Award Recipient,** ASCE Student Fellowship, Structural Engineering Institute (SEI), American Society of Civil Engineers (ASCE), Amount: $1000. *2020*

11. **Award Recipient,** ASNT Research Symposium, March 23-26, graduate student travel grant, Amount: $1,000. *2020*

10. **Award Recipient,** ACI American Concrete Institute (ACI), Graduate Student Convention Travel Stipend Contest, sponsored by S805 Collegiate Concrete Council, Amount: $1,000. *2019*

9. **Award Recipient,** CEE Graduate Teaching Internship Fellowship (GTI), Fall semester 2019, UVA, Amount: $9500 *2019*

8. **Award Recipient,** IDICs Student travel Fellowship, to attend iDICs conference, Oct. 14-17, graduate student travel grant, Amount: $400. *2019*

7. **Award Recipient,** Selected as the recipient of Virginia Engineering Foundation Graduate Fellowship, 2019-2020, UVA Amount: $5,000. *2019*

6. **Award Recipient,** CEE Department Travel Award, Department of Civil Engineering, UVA, Amount $1500. *2018*

5. **Best Paper Nominee**, paper title, "En "vision" ing a Novel Approach for Structural Health Monitoring–A Model for Full-Field Structural Identification using 3D-Digital Image Correlation." SHMII-I International Conference on SHM of Intelligent Infrastructure (SHMII-8). *2017*

4. **Best Paper Nominee**, paper title, Leveraging Vision for Structural Identification: A Digital Image Correlation Based Approach", iDICs, International Digital Image Correlation Society Conference, (Invited paper to publish in Experimental Mechanics Journal) *2016*

3. **Ph.D. Awarded Scholarship**, selected as a recipient of civil engineering research assistant program, Department of Engineering Systems & Environment, University of Virginia *2015*

2. **M.Sc. Awarded Scholarship**, selected as a recipient of structural engineering Master of Science program, Department of Civil Engineering, Sharif University of Technology *2005*

1. **B.Sc. Awarded Scholarship**, selected as a recipient of civil engineering Bachelor of Science program, Department of Civil Engineering, University of Tabriz *2000*

PUBLICATIONS

Journal Publications in Review

4. Dizaji, M. S., Azari, H. (2026). "An Integrated Vision-and-Language Pretraining (VLP) and Visual Question Answering (VQA) model to Automate Nondestructive Evaluation Image Analysis", (Under review). *2026*

3. Dizaji, M. S., Azari, H. (2026). "Integrated Laser Scanning and Image-Based Topology Optimization Techniques for Detection and Quantification of Visible and Subsurface Structural Defects", (*Under review*). *2026*

2. Dizaji, M. S., Azari, H. (2026). "Physics-Informed Neural Networks to Predict Subsurface Abnormalities Growth in GPR-NDE Data Using the BEAST Dataset", (*Under review*). *2026*

1. Automated Finite Element Model Updating-based Load Rating of Bridges with Incomplete As-Built Information by Integrating Numerical data with Sensor-Based measurement, (*In review*). *2026*

Peer-Reviewed Journal Publications

16. Dizaji, M. S., Mao, Z., & Haile, M. (2023). A hybrid-attention-ConvLSTM-based deep learning architecture to extract modal frequencies from limited data using transfer learning. Mechanical Systems and Signal Processing, 187, 109949. *2023*

15. Dizaji, M. S., Harris, D. K., & Alipour, M. (2022). Integrating visual sensing and structural identification using 3D-digital image correlation and topology optimization to detect and reconstruct the 3D geometry of structural damage. Structural Health Monitoring, 14759217211073505. *2022*

14. Dizaji, F. S., & Dizaji, M. S. (2022). Seismic performance assessment of steel frames upgraded with shape memory alloy re-centering dampers for passive protection of structures subjected to seismic excitations using high-performance NiTiHfPd material. Smart Materials and Structures, 31(6), 065004. *2022*

13. Dizaji, F. S., & Dizaji, M. S. (2022). Novel computational mathematical algorithms for structural optimization using graph-theoretical methods. Engineering Computations. *2022*

12. Farrokh, M., Dizaji, F. S., & Dizaji, M. S. (2022). Hysteresis Identification Using Extended Preisach Neural Network. Neural Processing Letters, 1-25. *2022*

11. Dizaji, M. S., Harris, D. K., Kassner, B., & Hill, J. C. (2021). Full-field non-destructive image-based diagnostics of a structure using 3D digital image correlation and laser scanner techniques. *Journal of Civil Structural Health Monitoring*, 1-14. *2021*

10. Dizaji, M. S., Alipour, M., & Harris, D. K. (2021). Image-Based Tomography of Structures to Detect Internal Abnormalities Using Inverse Approach. *Experimental Techniques*, 1-16. *2021*

9. Dizaji, M. S., Alipour, M., & Harris, D. K. (2021). Subsurface damage detection and structural health monitoring using digital image correlation and topology optimization. *Engineering Structures*, *230*, 111712 *2021*

8. Joghataie, A., & Dizaji, M. S. (2019). Neuro-Skins: Dynamics, Plasticity, and Effect of Neuron Type and Cell Size on Their Response. *Neural Processing Letters*, *49*(1), 19-41. *2019*

7. Dizaji, M. S., Alipour, M., & Harris, D. K. (2018). Leveraging full-field measurement from 3D digital image correlation for structural identification. *Experimental Mechanics*, *58*(7), 1049-1066 (Invited paper). *2018*

6. Farrokh, M., & Dizaji, M. S. (2016). Adaptive simulation of hysteresis using neuro-Madelung model. *Journal of Intelligent Material Systems and Structures*, *27*(13), 1713-1724. *2017*

5. Joghataie, A., & Dizaji, M. S. (2016). Neuroplasticity in dynamic neural networks comprised of neurons attached to adaptive base plate. *Neural Networks*, *75*, 77-83. *2016*

4. Farrokh, M., Dizaji, M. S., & Joghataie, A. (2015). Modeling hysteretic deteriorating behavior using generalized Prandtl neural network. *Journal of Engineering Mechanics*, *141*(8), 04015024. *2015*

3. Joghataie, A., & Dizaji, M. S. (2014). Reducing extent of cracks and increasing time to failure of concrete gravity dams by optimization of properties of layers of concrete. Scientia Iranica, 67-81. *2014*

2. Joghataie, A., & Dizaji, M. S. (2013). Designing high-precision fast nonlinear dam neuro modelers and comparison with finite-element analysis. *Journal of Engineering Mechanics*, *139*(10), 1311-1324. *2013*

1. Joghataie, A., & Dizaji, M. S. (2011). Transforming results from model to prototype of concrete gravity dams using neural networks. *Journal of engineering mechanics*, *137*(7), 484-496. *2011*

Technical Reports

3. Harris, D.K., Dizaji, M.S., (2019)" Preserving Coastal Infrastructure through the Design and Implementation of Image-Based Structural Health Monitoring (iSHM)." The National Academies of Sciences Engineering Medicine, U.S. Department of Transportation *2019*

2. Harris, D.K., Ozbulut, O., Bagheri, A., Dizaji, M.S., Ndong, A.K., Alipour, M. (2018). "Load Rating Strategies for Bridges with Limited or missing As-Built Information." Virginia Transportation Research Council (A partnership of the VDOT and the University of Virginia). *2018*

1. Dizaji, M.S., Alipour, M. and Harris D. (2018). "Evaluation of Mecklenburg Bridge Result Summary Following Repair using 3D Digital Image Correlation." Virginia Transportation Research Council (A partnership of the VDOT and the University of Virginia). *2018*

Conference Proceedings

42. Dizaji, M. S., Azari, H., A Visual Question Answering Model to Automate Nondestructive Evaluation Image Analysis. Structural Health Monitoring Community, 15th International Workshop on Structural Health Monitoring (IWSHM), Sep. 9-11, Stanford University, CA, USA, 2025. *2025*

41. Dizaji, M. S., Azari, H., Predicting Subsurface Abnormalities Growth using Physics-Informed Neural Networks. TRBAM-25-02241, Poster/Board: B587, Session 4033: Soil Properties and Subsurface Investigation Techniques, 104th TRB Annual Meeting (2025). *2025*

40. Dizaji, M. S., Using Advanced Artificial Intelligence (AI) to Predict Infrastructure Deterioration., Exploratory Advanced Research Program, United States. Department of Transportation. Federal Highway Administration, FHWA R&T Now. *2024*

39. Dizaji, M. S., Harris, D. K., A Generalized digital image correlation Using Attention-based Deep Learning Architecture to Extract Full-field Subpixel Displacement Measurements from Limited Data Using. ASCE Engineering Mechanics Institute 2023 Conference Atlanta, Georgia | June 6 – 9, 2023. *2023*

38. Zhiyanpour, Z., Yahia, A., Dizaji, M. S., Harris, D. K., Agile Simulation of Structural Systems within a Digital Twin Framework. ASCE Engineering Mechanics Institute 2023 Conference Atlanta, Georgia | June 6 – 9, 2023. *2023*

37. Dizaji, M. S., Zhiyanpour, Z., Yahia, A., Harris, D. K., Deep learning-based Digital Image Correlation to Extract Visual Measurement. Annual International ATEM-iDICs 23 Conference, Awara, Fukui, Japan, Oct. 9-12, 2023. *2023*

36. Dizaji, M. S. Digital Bridge Whisperer: A Cyber-Human Collaboration Framework for the Future of Bridge Inspection. Structure Congress, Structural Engineering Institute (SEI), New Orleans, Louisiana, May 3-6 American Society of Civil Engineers (ASCE) 2023. *2023*

35. Dizaji, M. S., Harris, D. K. Leveraging Mixed Reality for Augmented Structural Mechanics Education. Structure Congress, Structural Engineering Institute (SEI), New Orleans, Louisiana, May 3-6 American Society of Civil Engineers (ASCE) 2023. *2023*

34. Dizaji, M. S., Harris, D. K. A Generalized digital image correlation Using Attention-based Deep Learning Architecture to Extract Full-Field Subpixel Displacement Measurement from limited data Using Transfer Learning. Engineering Mechanics Institute Conference (EMI), Atlanta, Georgia- June 6-9, 2023. *2023*

33. Zhiyanpour, Z., Yahia, A., Dizaji, M.S., Harris, D. K., Agile Simulation of Structural Systems within a Digital Twin Framework. Engineering Mechanics Institute Conference (EMI), Atlanta, Georgia- June 6-9, 2023. *2023*

32. Dizaji, M. S., Alipour, M., Harris, D. K., & Mao, Z. (2023). Detecting and Reconstructing the 3D Geometry of Subsurface Structural Damages Using Full-Field Image-Based Sensing and Topology Optimization. In Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6 (pp. 175-180). Springer, Cham. *2023*

31. Dizaji, M. S., & Mao, Z. (2023). A Hybrid-Attention-LSTM-Based Deep Convolutional Neural Network to Extract Modal Frequencies from Limited Data Using Transfer Learning. In Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6 (pp. 167-173). Springer, Cham. *2023*

30. Dizaji, M. S., & Mao, Z. (2023). Optimal Kernel Design for the Extraction of Subtle Motions Using Convolutional Neural Network. In Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6 (pp. 181-185). Springer, Cham. *2023*

29. Dizaji, M. S., (2022). Full-Field Image-Based Sensing and Topology Optimization for Detecting and Reconstructing the 3D Geometry of Subsurface Structural Damages for Large Scale Structures. Annual International DIC Conference, iDICs conference, Boston, Nov. 7th, 2022. *2022*

28. Dizaji, M. S., & Mao, Z. (2022, April). Machine-learning to see defects: a hybrid attention-ConvLSTM-based convolutional neural network deep learning architecture for structural damage detection. In Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2022 (Vol. 12046, pp. 167-173). SPIE. *2022*

27. Yehia, A., Chao, J., Lyons, C., Dizaji, M. S., & Harris, D. (2022, August). A Case Study on Leveraging Augmented Reality for Visualization in Structural Design. In 2022 ASEE Annual Conference & Exposition. *2022*

26. Dizaji, M.S., Alipour M., Harris, D., Mao, Z., "Fusion of Computer Vision-Based Sensing and Topology Optimization Using 3D-Digital Image Correlation to Identify 3D Geometry of Structural Damage.", Full paper submitted, Photomechanics IDICS Conference Nantes-France. *2021*

25. Dizaji, M.S., Mao, Z., "Multi-Level Damage Detection using Octree Partitioning Algorithm." Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6, Conference *2021*

Proceedings of the Society for Experimental Mechanics Series, IMAC-XXXX: Next Frontier in Structural Dynamics (*Best paper*)

24. Dizaji, M.S., Alipour M., Harris, D., Mao, Z., "Leveraging Full-field Measurement from 3D Digital Image Correlation for Topology Optimization to Detect Internal Abnormalities.", EMI 2021/PMC 2021 conference. *2021*
23. Alipour, M., Harris D., Dizaji, M.S., Bilmen, Z., Zeng, Z., (2021). "Leveraging Mixed Reality for Augmented Structural Mechanics Education", 2021 ASEE Annual Conference, Virtual Meeting, July 26-29, 2021 *2021*
22. Dizaji, M.S., and Harris D. (2020). "Detecting and Reconstructing the 3D Geometry of Internal Structural Damage Using Full-Field Sensing and Finite Element Model Updating", SPIE Smart Structures + Nondestructive Evaluation, April 27 - May 1, 2020 (*Best paper*). *2020*
21. Dizaji, M.S., and Harris D. (2020). "Post-Repair Full-Field Non-destructive Evaluation of Mecklenburg Bridge," TRB 2020 Annual Meeting, (Abstract Accepted) *2020*
20. Dizaji, M.S., and Harris D. (2020). "Computer Vision-based Tomography of Structural Elements to Detect Internal Abnormalities: A Preliminary Feasibility Study," Structures Congress 2020, St. Louis, Missouri, April 5-8, 2020, (Abstract accepted). *2020*
19. Dizaji, M.S., and Harris D. (2019). "Mixed Finite Element-DIC Technique to Detect Unseen Abnormalities of a Structure Using an Inverse Approach," Oct. 14-17, iDICs 2019 Conference and Workshop, Portland, OR.(Paper Accepted). *2019*
18. Alipour, M., Dizaji, M.S., Li, T., and Harris D. (2019). "Pixel-Level Crack Identification and Measurement Using Deep Learning", CalTech Engineering Mechanics Institute Conference 2019 (EMI 2019), Pasadena, California, USA, June 18 – June 21 (Abstract accepted). *2019*
17. Li, T., Alipour, M., Dizaji, M.S., and Harris D. (2019). "Visual and Textual Data Mining for Automation in Bridge Inspections: A Deep Learning Approach", CalTech Engineering Mechanics Institute Conference 2019 (EMI 2019), Pasadena, California, USA, June 18 – June 21 *2019*
16. Alipour, M., Li, T., Dizaji, M.S., and Harris D. (2019). "Model-Assisted Active Learning: A Framework for Scalable Automated Infrastructure Inspection", CalTech Engineering Mechanics Institute Conference 2019 (EMI 2019), Pasadena, California, USA, June 18 – June 21 (Abstract accepted). *2019*
15. Dizaji, M. S., & Harris, D. K. (2019, April). 3D InspectionNet: a deep 3D convolutional neural networks-based approach for 3D defect detection on concrete columns. In *Non-destructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XIII* (Vol. 10971, p. 109710E). International Society for Optics and Photonics. *2019*
14. Dizaji, M.S., Yang, S. and Harris D. (2018). " Topology Optimization of Structural Systems using full-field 3D Digital Image Correlation", iDICs 2018 Conference and Workshop, October 2018, Hangzhou, China (Abstract Oral presentation in peer-reviewed conference) *2018*
13. Dizaji, M. S., Harris, D. K., Alipour, M., & Ozbulut, O. E. (2018, March). Reframing measurement for structural health monitoring: a full-field strategy for structural identification. In *Non-destructive Characterization and Monitoring of Advanced Materials, Aerospace, Civil Infrastructure, and Transportation XII* (Vol. 10599, p. 1059910). International Society for Optics and Photonics. *2018*
12. Ndong, A. K., Dizaji, M. S., Alipour, M., Ozbulut, O. E., & Harris, D. K. (2019). Load Rating of a Reinforced Concrete T-beam Bridge through Ambient Vibration Testing and Finite Element Model Updating. In *Dynamics of Civil Structures, Volume 2* (pp. 337-343). Springer, Cham. *2019*
11. Yang, S., Dizaji, M. S., & Harris, D. K. (2018, March). Integrating 3D Scanning within a simulation framework for structural mechanics. In *Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2018* (Vol. 10598, p. 1059846). International Society for Optics and Photonics. *2018*

10. Dizaji, M.S., Yang, S. and Harris D. (2018). " Vision-Based Characterization and Identification of Structural Systems", Massachusetts Institute of Technology (MIT), Boston, Massachusetts, USA, May 29 –June 1., (Abstract Oral presentation in peer-reviewed conference). *2018*

9. Dizaji, M.S., and Joghataie, A. (2018). "Deep Learning Neuro-Membrane Neural Networks: A Training Algorithm", Massachusetts Institute of Technology (MIT), Boston, Massachusetts, USA, May 29– June 1. (Abstract Oral presentation in peer-reviewed conference) *2018*

8. Dizaji, M.S., and Harris D. (2018). "Load Rating Strategies for Bridges with Limited or Missing As-Built Information ", ACI Spring Convention in Salt Lake City, 2018. (Abstract Oral presentation in peer-reviewed conference). *2018*

7. Dizaji, M.S., Alipour, M. and Harris D. (2017). "Finite Element Model Updating Using 3D digital image correlation", iDICs 2017 Conference and Workshop, Barcelona, Spain. (Abstract Oral presentation in peer-reviewed conference). *2017*

6. Dizaji, M.S., Harris, D., Alipour, M., & Ozbulut, O. (2017, December). En "vision" ing a Novel Approach for Structural Health Monitoring–A Model for Full-Field Structural Identification using 3D-Digital Image Correlation,". In *The 8th International Conference on Structural Health Monitoring of Intelligent Infrastructure, Brisbane* (*Best paper*). *2017*

5. Dizaji, M. S., Alipour, M., & Harris, D. K. (2017). Leveraging vision for structural identification: a digital image correlation-based approach. In *International digital imaging correlation society* (pp. 121-124). Springer, Cham, (*Best paper*) *2016*

4. Dizaji, M.S., and Joghataie, A. (2016). "Introducing an Algorithm for Training of Neuro-Skin Model", EMI 2016 and PMC 2016 Conference, May 22-25, Vanderbilt University, Nashville, Tennessee, U.S. (Abstract Oral presentation in peer-reviewed conference). *2016*

3. Joghataie, A., Dizaji, M. S., & Dizaji, F. S. (2012, January). Neural Network Software for Dam-Reservoir-Foundation Interaction. In *Proceedings of the International Conference on Mechanical, Automotive and Materials Engineering, Dubai, United Arab Emirates* (pp. 7-8). *2012*

2. Joghataie, A., & Dizaji, M. S. Optimization of size of informions for designing nonlinear vibration Neuro-modellers of dams. *2011*

1. Joghataie, A., & Dizaji, M. S. (2009, July). Nonlinear analysis of concrete gravity dams by neural networks. In *Proceedings of the World Congress on Engineering* (Vol. 2). *2009*

SELECTED PRESENTATIONS/WORKSHOPS/INVITED TALKS

35. **IWSHM**, 2025, Society for Experimental Mechanics, "A Visual Question Answering Model to Automate Nondestructive Evaluation Image Analysis" STRUCTURAL HEALTH MONITORING 2025, 15th International Workshop on Structural Health Monitoring (IWSHM), Sep. 9-11, Stanford University, CA, USA, 2025. *2025*

34. **TRB**, 2025, TRB Annual Meeting, Predicting Subsurface Abnormalities Growth using Physics-Informed Neural Networks. TRBAM-25-02241, Poster/Board: B587, Session 4033: Soil Properties and Subsurface Investigation Techniques, 104th TRB Annual Meeting 2025. *2025*

33. **ATEM-iDICs**, 2023, Society for Experimental Mechanics, "Deep learning-based Digital Image Correlation to Extract Visual Measurement" Annual International ATEM-iDICs 23 Conference, Awara, Fukui, Japan, Oct. 9-12, 2023. *2023*

32. **Structure Congress**, 2023, Structural Engineering Institute (SEI), "Digital Bridge Whisperer: A Cyber-Human Collaboration Framework for the Future of Bridge Inspection", New Orleans, Louisiana, May 3-6 American Society of Civil Engineers (ASCE), 2023. *2023*

31. **Structure Congress**, Structural Engineering Institute (SEI), "Leveraging Mixed Reality for Augmented Structural Mechanics Education". New Orleans, Louisiana, May 3-6 American *2023*

Society of Civil Engineers (ASCE), 2023.

30. **EMI**, Engineering Mechanics Institute Conference, “A Generalized digital image correlation Using Attention-based Deep Learning Architecture to Extract Full-Field Subpixel Displacement Measurement from limited data Using Transfer Learning”, Atlanta, Georgia- June 6-9, 2023. *2023*
29. **iDICs, 2022,** Society for Experimental Mechanics, “Full-Field Image-Based Sensing and Topology Optimization for Detecting and Reconstructing the 3D Geometry of Subsurface Structural Damages for Large Scale Structures”. Annual International DIC Conference, iDICs conference, Boston, Nov. 7th, 2022. *2022*
28. **SEM IMAC, 2022,** Society for Experimental Mechanics, “Detecting and Reconstructing the 3D Geometry of Subsurface Structural Damages Using Full-Field Image-Based Sensing and Topology Optimization.” In Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6 (pp. 175-180). Springer, Cham *2022*
27. **SEM IMAC, 2022,** Society for Experimental Mechanics, A Hybrid-Attention-LSTM-Based Deep Convolutional Neural Network to Extract Modal Frequencies from Limited Data Using Transfer Learning. In Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6 (pp. 167-173). Springer, Cham. *2022*
26. **SEM IMAC,** Society for Experimental Mechanics, Optimal Kernel Design for the Extraction of Subtle Motions Using Convolutional Neural Network. In Rotating Machinery, Optical Methods & Scanning LDV Methods, Volume 6 (pp. 181-185). Springer, Cham. *2022*
25. **SPIE**, Machine-learning to see defects: a hybrid attention-ConvLSTM-based convolutional neural network deep learning architecture for structural damage detection. In Sensors and Smart Structures Technologies for Civil, Mechanical, and Aerospace Systems 2022 (Vol. 12046, pp. 167-173). SPIE. *2022*
24. **UVA POSTDOC RESEARCH SYMPOSIUM**, 2021, Research Communication, ”Adaptive Digital Twinning – An Immersive Visualization Framework for Structural CPS”, a 12-min talk, Nov 18th Postdoc Research Symposium, University of Virginia, (Oral presentation). *2021*
23. **EMI**, Engineering Mechanics Institute Conference, 2021, ”Leveraging Full-field Measurement from 3D Digital Image Correlation for Topology Optimization to Detect Internal Abnormalities.”, EMI 2021/PMC 2021 conference, (Virtual presentation). *2021*
22. **iDICs**, International Digital Image Correlation Society Conference (iDICs), Conference and Workshop, “Fusion of Computer Vision-Based Sensing and Topology Optimization Using 3D-Digital Image Correlation to Identify 3D Geometry of Structural Damage.”, Full paper submitted, Photomechanics IDICS Conference, (Virtual presentation). *2021*
21. **IMAC-IXXX**, “Multi-Level Damage Detection using Octree Partitioning Algorithm”, Optical Methods & Scanning LDV Methods, Proceedings of the Society for Experimental Mechanics Series, IMAC-XXXX: Next Frontier in Structural Dynamics, (Virtual presentation). *2021*
20. **ASNT**, American Society for Nondestructive Testing, ”Full-Field Non-destructive Evaluation of Mecklenburg Bridge Using Computer Vision-Based Techniques”, ASNT Research Symposium in Williamsburg, VA, April23-26, 2020, (Oral presentation) *2020*
19. **SEI**, American Society of Civil Engineers, ”Computer Vision-based Tomography of Structural Elements to Detect Internal Abnormalities: A Preliminary Feasibility Study”, SEI Structure Congress in St. Louis, Missouri, April5-8, 2020, (Oral presentation). *2020*
18. **ACI**, American Concrete Institute, ”Load Rating Strategies for Bridges with Limited or Missing As-Built Information”, ACI Spring Convention in Chicago, 2020, (Oral presentation). *2020*
17. **ACI**, American Concrete Institute, ”Subsurface Condition Assessment and Structural Health Monitoring of Concrete Structures Using Digital Image Correlation and Topology Optimization”, *2019*

ACI Fall Convention in Cincinnati, Ohio, 2019, (Oral presentation in 444 committee meeting, CRC proposal endorsement).

16. **iDICs**, International Digital Image Correlation Society Conference (iDICs), Conference and Workshop, "Mixed Finite Element-DIC Technique to Detect Unseen Abnormalities of a Structure Using an Inverse Approach", SEM Fall Conference, October 14-17, Portland, Oregon, 2019, (Oral presentation). *2019*

15. **SPIE**, Smart Structures + Nondestructive Evaluation, "3D InspectionNet: a deep 3D convolutional neural networks-based approach for 3D crack detection on concrete columns", Denver, Colorado, USA, 3-7 March 2019, (Oral presentation). *2019*

14. **ACI**, American Concrete Institute, "Finite Element Model Updating for Structural Evaluation of Bridges with Limited Information", ACI Fall Convention in Las Vegas, 2018, (Oral presentation). *2018*

13. **EMI**, Engineering Mechanics Institute Conference, 2018 "Vision-Based Characterization and Identification of Structural Systems", MIT, Boston, Massachusetts, USA, May 29 – June 1, 2018, (Oral presentation). *2018*

12. **EMI**, Engineering Mechanics Institute Conference, 2018 "Deep Learning Neuro-Membrane Neural Networks: A Training Algorithm", MIT, Boston, Massachusetts, USA, May 29 – June 1, 2018, (Oral presentation). *2018*

11. **SPIE**, Smart Structures + Nondestructive Evaluation, "Integrating 3D Scanning within a Simulation Framework for Structural Mechanics", Denver, Colorado, USA, 4-8 March, 2018, (Oral presentation). *2018*

10. **SPIE**, Smart Structures + Nondestructive Evaluation, "Reframing Measurement for Structural Health Monitoring: A Full-Field Strategy for Structural Identification", Denver, Colorado, USA, 4-8 March 2018 (Oral presentation). *2018*

9. **ACI**, American Concrete Institute, "Load Rating Strategies for Bridges with Limited or Missing As-Built Information", ACI Spring Convention in Salt Lake City, 2018, (Oral presentation). *2018*

8. **SHMII8**, Structural Health Monitoring of Intelligent Infrastructure Conference, "En-vision-ing a Novel Approach for Structural Health Monitoring – A Model for Full-Field Structural Identification using 3D-Digital Image Correlation", December 5-8, Brisbane, Australia, 2017 (Oral presentation). *2017*

7. **Civil Engineering Department**, Flash Talks, Seminar Series, "Leveraging Vision for Structural Identification: A Digital Image Correlation Based Approach" University of Virginia, Virginia, September 25, 2017, (Oral presentation). *2017*

6. **Electrical Engineering and Computer Science Department**, Image Processing Seminar Series, "Integrating Imaging into a Framework for Civil Infrastructure Assessment" University of Virginia, Virginia, November 16, 2017, (Oral presentation). *2017*

5. **Graduate Research Symposium**, "Full-field Structural Identification Using 3D Digital Image Correlation (DIC)", Civil Engineering Department, University of Virginia, Charlottesville, VA, U.S., 2017 (Poster presentation). *2017*

4. **iDICs**, International Digital Image Correlation Society Conference (iDICs), Conference and Workshop, "Finite Element Model Updating Using 3D digital image correlation", SEM Fall Conference, November 6-9, Barcelona, Spain, 2017 (Oral presentation). *2017*

3. **iDICs**, International Digital Image Correlation Society Conference (iDICs), "Leveraging Vision for Structural Identification – A Digital Image Correlation Based Approach," SEM Fall Conference, November 8-11, Philadelphia, PA, U.S., 2016 (Oral presentation). *2016*

2. **Master of Science Thesis**, "Simulating Nonlinear behavior of Concrete Gravity dams crest under earthquakes by Neural Networks", Sharif University of Technology, (Supervisor: Dr. Abdolreza Joghataie, Examination Committee: Dr. Ali Kaveh, Dr. Estekanchi and Dr. Ghaemian), Tehran, *2008*

Iran (Oral presentation).

1. **Master of Science Seminar**, "Nonlinear Models for Simulating of Deteriorating Hysteresis Behavior of Concrete", Sharif University of Technology, (Supervisor: Dr. Borghei), Tehran, Iran (Oral presentation) *2007*

RESEARCH PROPOSALS

- Data Fusion Using Multi-Model Deep Learning Strategy to Predict the Spatial-temporal implications of damage on the life cycle of Structural Systems
  - Awarded $73,000 (annually) from NRC Research Associateship Program (Role: PI). 2023
- Engaging the Two-Way Interaction for a Digital Twin for Large Scale Infrastructure
  - Awarded $30,000 from CCI-Smart Cities Program, UVA (Role: partially assistant). 2022
- Digital Twin Framework of Cyber-Physical Structural Systems *2021*
  - Awarded $300,000 from NSF EAGER (Role: partially assistant).
- Deep Learning-Based Automated 3D Crack Detection for Post-Disaster Building Assessment *2019*
  - In partial fulfillment of the qualifying examination for the Ph.D. program (Role: PI).
- Image-based Tomography for Bridge Damage Identification *2019*
  - Submitted to BRAC (Role: Co-PI)

RESEARCH EXPERIENCE

- Physics Informed Neural Networks (PINN): A PINN to predict GPR data *June 2023-2024*
  - Develop a Physics-Informed Neural Networks (PINNs) to incorporate electromagnetic wave propagation into the NN training to enhance the learning task.
  - By harnessing the synergy between deep learning algorithms and the physical laws governing subsurface structures—or in medical terms, human tissues—the model effectively embeds the physics of electromagnetic wave propagation into its architecture

Contributions *– One poster paper and one journal paper submitted* ***Sponsor****: FHWA*

- Analyzing NDE Data Using Artificial Intelligence: An NDEChat Plateform *June 2024-2025*
  - Develop a Visual Question Answering Model (VQA) to Automate Nondestructive Evaluation Image Analysis.
  - Leveraging deep learning and natural language processing, the developed system integrates image feature extraction (via a ResNet-50 model) and language generation capabilities (via GPT-2) to provide accurate, informative feedback.

Contributions *– One conference paper and one journal paper under preparation* ***Sponsor****: FHWA*

- Adaptive Digital Twining: An Immersive Visualization Framework for Structural CPS *2021-2023*
  - Understand to what extent can artificial intelligence-formulated models effectively emulate the complex mechanical behaviors of simulation and experimentation of large-scale structural systems.
  - Evaluate to what extent the development of artificial intelligence-formulated models enables the real-time, bi-directional interaction between simulation and experimentation required of a digital twin.
  - Characterize how the deployment of artificial intelligence-formulated models within an immersive environment allows end users to observe and characterize the operational states of an in-service structural

system.

Contributions *– One journal paper under review, One conference paper presented in EMI 2022,* ***Sponsor****: NSF*

- A Hybrid Convolutional Deep Learning for Extraction of Natural Frequencies *2020-2021*
  - Proposed A novel hybrid CNN–ConvLSTM attention-based deep learning architecture for resonance frequency extraction.
  - Compared with the state of the art, the newly proposed method is more autonomous and accurate in generalizing the model to the new limited unseen dataset.
  - Adopted A Spatial-Feature Channel Attention blocks to optimize the filter design corresponding to spatial channels, focusing on important features for frequency extraction.
  - Integrated A Temporal-Feature Frame attention mechanism into the ConvLSTM network to weight keyframes in the corresponding videos.

Contributions *– One published paper and three conference papers* ***Sponsor****: US Army Research Laboratory*

- Leveraging Mixed Reality for Augmented Structural Mechanics Education" *2020-2022*
  - Conducted a real-time simulation of structural elements and effective visualization of their response.
  - Deployed a mobile augmented reality application accessible through smartphones for broad accessibility.
  - Developed a server-client architecture, where user-defined loading is applied to a finite element model.

Contributions *– Two published paper in ASEE conference,* ***Sponsor****: ESE*

- A Computer Vision-based Structural Health Monitoring (SHM) Framework. *2017-2020*
  - Constructed Image-Based Tomography of Structures to Detect Internal Abnormalities.
  - Formed a Vision-based structural health monitoring using 3D-DIC and topology optimization.
  - Leveraged full-field measurement from 3D digital image correlation for structural identification (St-ID).

Contributions *– Ph.D. dissertation, three published papers, and one under review,* ***Ph.D. program***

- Enhancing Civil Engineering Curriculum with Virtual and Augmented Reality. *2017-2018*
  - Integrated virtual and augmented reality technologies into the civil engineering curriculum.
  - Visualized the interactions of various components of large-scale infrastructure systems.

Contributions *– One published report.* ***Sponsor****: ESE*

- Vision-Based Strategy SHM for Structural Identification (St-ID). *2016-2017*
  - Developed an Image-based Structural Health Monitoring Characterization Technique.
  - Utilized high-resolution 3D laser scanning (HR3DLS) to measure the geometry of surface defects.
  - Applied the full-field measurements derived from 3D-DIC for St-ID.

Contributions *– One published report.* ***Sponsor****: MATS*

- Load Rating Strategies for Bridges with Missing or As-Built Information. *2015-2018*
  - Developed a 3D Finite Element Model-driven methodology for load rating of bridges with missing plans.
  - Designed instrumentation and full-scale load testing of 4 highway bridges.
  - Analyzed field testing data from attached physical sensors.
  - Collaborated significantly in writing of final report for VDOT.

Contributions *– One published report, two under review papers in prestigious journals.* ***Sponsor****: VDOT*

- Evaluation of Mecklenburg Bridge Result Summary Following Repair using 3D-DIC. *2018-2019*
  - Conducted Vision-based Assessment of the bridge structure.
  - Incorporated the proposed hybrid computer vision-based approach for holistic structural damage detection.
  - Applied the full-field measurements derived from 3D digital image correlation (3D-DIC) for St-ID.

Contributions *– One published paper and one published report.* ***Sponsor****: VTRC*

TEACHING EXPERIENCE

Teaching

- Graduate Teaching Internship (GTI) Fellow, Advanced Topics in Struc. Eng., (CE5340) UVA. *Fall 2019*
  - Arranged the syllabus and course project
  - Delivered lectures on numerical analysis, and finite element concept of structural components
  - Designed and developed new course modules on advanced topics in structural engineering

- Teaching Fellow, Introduction to Design of Structural Systems, (CE3330) UVA. *Spring 2019,2020*
  - Co-designed the syllabus and course project
  - Organized and delivered modules on training computer vision models for structural analysis
  - Planned course projects and student progress

- Laboratory Instructor, Introduction to Design of Structural Systems, (CE3330) UVA. *Spring 2019,2020*
  - Coordinated the laboratory experiments and course project
  - Executed laboratory tests using MTS machine, 3D printing, Digital cameras, DIC modules, etc.
  - Instructed and monitored problem-solving sessions, quizzes, and exercises

- Teaching Assistant, Introduction to Structural Optimization, Sharif Uni. Of Tech. *Fall 2008*
  - Co-designed and informed the syllabus and course project

  - Engineered and delivered modules on training computer codes using MATLAB
  - Taught and guided problem-solving sessions, quizzes, and exercises

Mentorship and Supervised Students

- Samuel J. Colvin, an undergraduate student in computer science at UVA *2021-2022*
  Project: *Mixed Reality for Augmented Structural Mechanics Education*
- Marcus J. Dupart, an undergraduate student in civil engineering at UVA *2021-2022*
  Project: *Adaptive Digital Twinning*
- Aya Yehia, Ph.D. student in Engineering Systems at UVA *2021-2023*
  Project: *Adaptive Digital Twinning (current ongoing NSF Mixed AR/VR project)*
- Zahra Zhiyanpour, Ph.D. student in Engineering Systems at UVA *2021-2023*
  Project: *Adaptive Digital Twinning (current ongoing NSF project)*
- Conner Louis Lyons, an undergraduate student in civil engineering at UVA *2021-2022*
  Project: *Mixed Reality for Augmented Structural Mechanics Education*
- Jacqueline Chao, an undergraduate student in computer science at UVA *2021-2022*
  Project: *Mixed Reality for Augmented Structural Mechanics Education*

- Zijia Zeng, Zack Bilmen, B.Sc. in computer science at UVA *2020-2021*
  Project: *Mixed Reality environments for engineering education*
  Created a mixed reality mobile application for structural analysis visualization
  Published one conference paper in ASEE conference
- Shijie Gao, Ph.D. student, computer science at UVA *2019-2020*
  Partially collaborated: *Camera Installation structural frame design for robotic car*
- Shitong Hou, Visiting scholar from China at UVA *2019-2020*
  Project: *3D DIC for Structural Identification of Reinforced Concrete Beams*
- Ke Chen, Visiting scholar from China at UVA *2018-2019*
  Project: *Refined Methods of Analysis for Load Rating of Highway Bridges*
- Abdou K Ndong, Ph.D. in civil engineering at UVA *2017-2018*
  Project: *Load Rating Strategies for Bridges with Missing or As-Built information*
  Collaborated in writing of the final report, weekly meetings, and software training
  Published one technical report for VDOT and one conference paper in IMAC conference
- Shuzhen Yang, Visiting Ph.D. student in civil engineering from China at UVA *2017-2018*
  Project: *Integrating 3D Scanning within a Simulation Framework for Structural and Mechanics*
  Published two conference papers in SPIE-2018
- Dan Golczewsk, B.Sc. in civil engineering at UVA *2017- 2018*
  Project: 3*D Laser Scanning to create a 3D model of the structural elements*
  Published a 3D Laser Scanning User Guide for undergraduate students

Pedagogical and Career Training

- Fellow, Graduate Teaching Internship program (GTI), UVA *Summer 2019*
  - How to prepare and deliver lectures in the in-person / web-based classes
  - How to design new course modules
  - How to handle students at different levels
- Fellow, Tomorrow's Professor Today (TPT) Program, UVA *2019-2020*
  - Designed to facilitate the transition from student to academic professional
  - Developed to enhance the teaching abilities and credentials
  - Provided active Learning Techniques for a More Engaged Engineering Class Workshop
- Teaching fellow, training for Structural Laboratory Instructor (~CE3330), UVA *Spring 2019*
  - How to design and assemble laboratory experiments
  - How to teach students safety instructions
- Participating in teaching training classes, Center for Teaching Excellence, UVA *Spring 2019*
  - Workshop on Strategic Career Design for the Peak Performing Professor
  - Workshop on Active Learning Techniques for a more engaged Engineering Class
- Attending in PhDPlus program for a future career, UVA *Spring 2019*
  - Shaping the future of graduate education at the University of Virginia
  - Startup: Commercialization, situation, and stakeholders
- Involving in Graduate Writing Lab *Spring 2018*
  - Engineers Writing for Public Audiences
  - English Language Graduate Writing Camp

Teaching Interests

- Smart Structures and vibration analysis
- Advanced finite element modeling
- Advanced topics in structural engineering
- Introduction to Design of Structural Systems
- Steel and Concrete Design
- Strength of Materials
- Structural health monitoring
- Non-destructive evaluation
- Introduction to digital image correlation
- Structural optimization
- Statics and Dynamics
- Earthquake Engineering

SERVICE AND ACTIVITIES

Academic and Diversity:

- President, American Concrete Institute Student Chapter at the University of Virginia, 2018-2020
  - Counsel as a liaison between the ACI and students at the UVA to get them ready for job market
  - Manage All the budget meetings for possible funding from SAF for extra academic activities
  - Attend at National Conventions and prepare selected students to involve in student competitions
  - Educate undergraduate students for concrete-related industry tasks upon graduation

Journal and Conference Review:

- Journal of Engineering Mechanics (ASCE)
- Journal of Civil Structural Health Monitoring (Springer)
- iDICs conferences, International Digital Image Correlation Society (SEM)
- EMI conferences, Engineering Mechanics Institute Conferences (ASCE)
- Experimental Technique Journal (Springer)
- Experimental Mechanics Journal (Springer)
- Neural Networks Journal (Elsevier)

Professional Affiliation:

- International Digital Image Correlation Society (SEM, iDICs)
- American Society of Civil Engineers (ASCE)
- American Society of Nondestructive Testing (ASNT)
- American Concrete Institute (ACI)
- Engineering Mechanics Institute (EMI, ASCE)
- Society For Experimental Mechanics (SEM IMAC-XL)

SELECTED COURSES DURING DOCTORAL RESEARCH PROGRAM

- Finite Element Analysis (Mech. Eng. Dep.)
- Smart Structures and Vibration Sys. (Civil Eng. Dep.)
- Non-Destructive Evaluation (Civil Eng. Dep.)
- Mechanics of Composite Materials (Civil Eng. Dep.)
- Computational Visual Recognition (C.S. Dep.)
- Digital Image Correlation (Drexel University)
- Machine Learning (C.S. Dep.)
- Continuum Mechanics (Mech. Eng. Dep.)

COMPUTER SKILLS

- MATLAB
- TensorFlow
- ABAQUS
- Python
- PyTorch
- SAP2000
- ANSYS
- ARTeMIS
- Scikit-learn

REFERENCES

- Dr. Devin Harris
  Engineering Systems and Environment
  University of Virginia
  dharris@virginia.edu
  Phone: (434) 249-7710

- Dr. Jose Gomez
  Engineering Systems and Environment
  University of Virginia
  jpg4k@virginia.edu
  Phone: (434) 982-2764

- Dr. Zhu Mao
  Mechanical Engineering
  Worcester Polytechnic Institute
  zmao2@wpi.edu
  Phone: (508) 831-4845

- Dr. Marek-Jerzy Pindera
  Engineering Systems and Environment
  University of Virginia
  mp3g@virginia.edu
  Phone: (434) 924-1040