CHENYING LIU

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EDUCATION

Georgia Institute of Technology, USA *Aug 2019 - Present*
Doctor of Philosophy GPA: 4.00/4.00
Major: Geosystem Engineering
Minor: Computational Science and Engineering
Department of Civil and Environmental Engineering

Georgia Institute of Technology, USA *Aug 2019 - Present*
Master of Science GPA: 4.00/4.00
Department of Computational Science and Engineering

Stanford University, USA *Sep 2017 - Mar 2019*
Master of Science GPA: 4.00/4.00
Department of Civil and Environmental Engineering

University of California, Los Angles, USA *June 2015 - Aug 2015*
Summer School

Nanyang Technological University, Singapore *Aug 2013 - May 2017*
Bachelor of Engineering GPA: 4.64/5.00
Department of Civil Engineering

PROJECT

Non-ergodic Ground Motion Models for Ridgecrest Jan 2020 - Present
Graduate Research

- Develop non-ergodic GMMs for Ridgecrest earthquake sequence using Bayesian hierarchical modeling.
- The repeatable source, site, and path effects are modeled as Gaussian Random Fields.
- The non-ergodic GMMs show better prediction accuracy and lower standard deviations than the ergodic counterparts.

Feature Selection and Regression Models for the Prediction of Moment Resisting Frames Drift May 2020 - present
Graduate Research

- Perform feature selection for intensity measures and structure properties to be used in the prediction model of drift of MRF, using LASSO, Forward Stepwise Selection, and Random Forest.
- Build regression models for drift prediction using Bayesian regression.

Ground Motion Models for CAV, PGV, and CAVdp Sep 2019 - current
Graduate Research

- Developed a suite of conditional, non-conditional, and scenario-based ground motion model for CAV, PGV, and CAVdp for probabilistic seismic hazard analysis.
- Bayesian hierarchical models are used to capture the epistemic uncertainties of model coefficients using Hamiltonian Monte Carlo.

Machine Learning Models for Seismically-induced Slope Displacement Sep 2019 - May 2021
Graduate Research

- Develop 19 regression models for slope displacement induced by earthquakes using parametric and non-parametric machine learning algorithms.
- The best 4 models are selected and show overall better prediction performance than currently available traditional models.

Correlation of Ground Motion Intensity Measures for Subduction Zone Earthquakes Jan 2020 - Dec 2020
Graduate Research

- Estimate the Pearson's correlation coefficients for residuals of PSA, CAV, PGV, etc. using the NGA-Sub ground motion database.
- The correlation coefficients show consistency with the results obtained for shallow crustal earthquakes

Minimum Vertex Cover Problem Aug 2020 - Dec 2020
Graduate Project

- develop 4 algorithms to solve the well-known NP-hard minimum vertex cover problem.
- The developed algorithms include branch and bound algorithm which finds the exact solution, the 2-approximate algorithm, and two local search algorithms with hill climbing.
- The 2-approximate algorithm shows the best trade-off between time complexity and solution quality.

Fast Approximate Eigen Decomposition Jan 2020 - May 2020
Graduate Project

- Develop a series of efficient algorithms to perform eigen value decomposition of high-dimensional dense matrices.
- The following algorithms are developed and compared: 1. QR decomposition using tri-diagonalizing of input matrix, Given's Rotation, and symmetric QR 2. Symmetric Schur and cyclic Jacobi algorithm 3. Adaptive randomized range finder 4. Randomized power iteration and subspace iteration 5. Randomized Nystrom Method
- The randomized algorithms are better in terms of time complexity than other methods and suitable for machine learning methods such as PCA and spectral clustering for large data sets.

Deep Learning Classification for Earthquake P Wave Arrival First-Motion Polarities and Earthquake Focal Mechanism Jan 2020 - May 2020
Graduate project

- Develop a CNN, LSTM and a combination of both to classify the first-motion polarity of the ground motion.
- Develop CNNs and fully-connected NNs for classification of focal mechanisms and regression of dip angles of the earthquakes.
- CNNs are designed in a style like the VGG model.
- Grad-CAM is used to visualize and highlight the contributing features to polarities.
- the models for polarities and focal mechanism have a best accuracy of 97% and 63.3% on the test set, respectively.

Characterization of soil particle shape using imaging processing Aug 2019 - Dec 2019
Graduate Project

- Capture images of soil particle shapes using microscope
- Process images and calculate particle shape parameters (e.g., aspect ratio, etc.) using MATLAB image processing toolbox.
- Provide the correction and corroboration to traditional sieve analysis

Effect of rooftop solar panels on disaster resilience of communities Jan 2018 - 2019
Graduate Research

- Optimized solar energy sharing within communities to improve resilience against power outage
- Processed building inventory data for San Carlos City in California
- Simulated a 1906 San Francisco Earthquake through OpenSHA to determine building damage state.
- Computed risk of power outage through an empirical probabilistic model
- Utilized a convolutional neural network to identify solar panels from satellite images.
- Examined effect of solar panel adoption and distribution on the risk of power outage and visualized power risk map through ArcGIS

Assess surface seals of soils on slopes by permeability analysis Aug 2016 - May 2017
Undergraduate Thesis

- Ascertained the existence of soil crusts on the surface of slope by analyzing experiment data
- Used Van Genuchten model to fit SWCC curve for the determination of unsaturated permeability
- Conducted infiltrometer and hydrometer experiments and data analysis to compare the permeability of soils at different depth to determine the location of soil surface seal.

TEACHING

VIP-6600 Vertically Integrated Project Jan 2021 - May 2021
Teacher

- Supervise 10 undergraduate and graduate students and coordinate with 3 TAs on three different research projects related to application of machine learning methods in extreme engineering.

JOURNAL ARTICLES

Liu, C., Macedo, J., and Kottke, A. (2021). Evaluating the Performance of Nonergodic Ground Motion Models in the Ridgecrest Area. *Bulletin of Earthquake Engineering*. In review.

Liu, C. and Macedo, J. (2021). Spatial Correlation of Systematic Effects of Nonergodic Ground Motion Models in the Ridgecrest Area. *Bulletin of Earthquake Engineering*. In review.

Liu, C. and Macedo, J. (2021). New Conditional, Scenario-based, and Non-conditional Cumulative Absolute Velocity Models Using the NGA-Sub Database. *Earthquake Spectra*. In review.

Liu, C. and Macedo, J. (2021). New Conditional and Scenario-based Cumulative Absolute Velocity Models for Different Tectonic Settings for Damage Assessment. *Soil Dynamics and Earthquake Engineering*. In review.

Macedo, J. and **Liu, C.** (2021). New Conditional, Scenario-based, and Non-conditional Peak Ground Velocity Models Using the NGA-Sub Database. *Earthquake Spectra*. In review.

Malaga-Chuquitaype, C., Macedo, J., **Liu, C.**, and Reale, D. (2021). Hazard-consistent Seismic Drift Demands in Steel Moment Frames. *Bulletin of Earthquake Engineering*. In review.

Macedo, J. and **Liu, C.** (2021). New Procedure to Estimate Ground Motion Intensity Measure Correlations. *Soil Dynamics and Earthquake Engineering*. In review.

Macedo, J., **Liu, C.**, and Candia, G. (2021). Performance-based Probabilistic Assessment of Liquefaction-induced Building Settlements. *Soil Dynamics and Earthquake Engineering*. In review.

Macedo, J., Candia, G., Lacour, M., and **Liu, C.** (2021). New Developments for the Performance-based Assessment of Seismically-induced Slope Displacements. *Engineering Geology*, 277, 105786.

Macedo, J. and **Liu, C.** (2021). Ground-Motion Intensity Measure Correlations on Interface and Intraslab Subduction Zone Earthquakes Using the NGA-Sub Database. *Bulletin of the Seismological Society of America*.

Patel, S., Ceferino, L., **Liu, C.**, Kiremidjian, A.S., and Rajagopal R. (2021). The Disaster Resilience Value of Rooftop Solar in Residential Communities. Accepted in *Earthquake Spectra*.

Macedo, J., Abrahamson, N.A., and **Liu, C.** (2020). New Scenario-Based Cumulative Absolute Velocity Models for Shallow Crustal Tectonic Settings. *Bulletin of the Seismological Society of America* 111 (1), 157-172

Macedo, J., Farahnaz, S., and **Liu, C.** (2021). Machine-learning-based Predictive Models for Estimating Seismically-induced Slope Displacements. Accepted in *Soil Dynamics and Earthquake Engineering*.

CONFERENCE PROCEEDINGS

Zahra, F., Malaga-Chuquitaype, C., Macedo, J., and **Liu, C.** (2021). Hazard-consistent Residual Drift in Steel Moment Resisting Frames. *17th World Conference on Earthquake Engineering*.

Junda, E., Malaga-Chuquitaype, C., Macedo, J., and **Liu, C.** (2021). Efficient Predictors for Estimating the Seismic Response of Cross-laminated Timber Buildings. *17th World Conference on Earthquake Engineering*.

ACADEMIC ACHIEVEMENTS

Best Student Award for Fundamental Research Nov 2019

· Second Runner-up for student poster session in Gerogia Power

EAB Fellow Aug 2019

· Gatech CEE External Advisory Board one-year fellowship

Academic Excellence Award Sep 2016

· Signed by school chair and dean of college of engineering in NTU

Overseas Study Travel Grant Sep 2015

· $1000 from Academic Excellence Award from NTU

Placed on Dean's List May 2015

· Top 5% in the CEE department of NTU

Ministry of Education (MOE in Singapore) full scholarship Aug 2013

· Around: $600 per months

NTU Tuition Grant: Aug 2013

· Around $150000 for 4-year tuition fee

TECHNICAL STRENGTHS

Programming Languages	Python, R, MATLAB, C/C++, Java, Bash, OpenMPI, Tensorflow-Probability/Stan/Numpyro/Pymc3
Software & Tools	ArcGIS, QGIS, ETABS, AutoCAD, ANSYS MASTAN2, STRATA

WORKING EXPERIENCE

Teambuild construction & engineering PTE LTD, Singapore May 2016 - Aug 2016

- Worked as an assistant project engineer in execution of duties on site
- Conducted a project, named Dawson Contract 3, was an apartment complexes, which contained totally 8 blocks with 1217 dwelling units. This project was now on foundation stage and would last for 5 years.
- Particularly enhanced my realization of the construction of pile foundation

RELEVANT COURSES

Core Courses

Probabilistic Models in Civil Engineering
Structural Dynamics
Geotechnical Earthquake Engineering
Random Vibration
Machine Learning
Introduction to Algorithm
Numerical Linear Algebra
Performance Based Earthquake Engineering
Critical State Soil Mechanics
Soil Behavior
Linear and Nonlinear Optimization
Deep Learning
High Performance Computing

Other Courses

Probability and Statistics
Principles of Economy
Introduction to Stochastic Process
Sustainable Built Environment
Engineering Economy and Finance