

JANAKI VAMARAJU

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RESEARCH INTERESTS

Seismogram Synthesis, Seismic Fracture Characterization, Inverse Problems, High Performance Computing, Applied Machine Learning

EDUCATION

Ph.D. in Geophysics

May 2020 (Expected)

Major: Computational Geophysics

The University of Texas at Austin, Jackson School of Geosciences

Advisor: Dr. Mrinal Sen

Master of Science in Civil Engineering

May 2016

Major: Computational Mechanics

The University of Texas at Austin, Cockrell School of Engineering

Master of Science in Mathematics (Honors)

May 2013

Birla Institute of Technology and Science, Pilani, India

Bachelor of Engineering in Civil Engineering (Honors)

May 2013

Birla Institute of Technology and Science, Pilani, India

PUBLICATIONS

- Vamaraju, J. and Sen, M., 2018. Mean field Boltzmann machines for Kirchhoff migration. *SEG Technical Program Expanded Abstracts 2018*. (abstract submitted)
- Vamaraju, J., Brumbaugh, G., Huang, Y., Winston, J., Taylor, A. and Wesley, A. Decreasing downhole uncertainties and improving safety using machine learning networks. (under preparation)
- Vamaraju, J., Sen, M., De Basabe, J. and Wheeler, M., 2017. A comparison of continuous, discontinuous, and enriched Galerkin finite-element methods for elastic wave-propagation simulation. (submitted to Journal of Computational Physics)
- Vamaraju, J., Sen, M., Wheeler, M.F. and De Basabe, J., 2017. A hybrid-Galerkin finite-element method for seismic wave propagation in fractured media. (under preparation)
- Vamaraju, J., Sen, M., De Basabe, J. and Wheeler, M., 2017. A comparison of continuous, discontinuous, and enriched Galerkin finite-element methods for elastic wave-propagation simulation. *SEG Technical Program Expanded Abstracts 2017*, pp.4063-4067.
- Vamaraju, J., Sen, M., Wheeler, M.F. and De Basabe, J., 2017. A hybrid-Galerkin finite-element method for seismic wave propagation in fractured media. *SEG Technical Program Expanded Abstracts 2017*, pp.4074-4079.

PATENTS

- Brumbaugh, G., Huang, Y., Vamaraju, J., Taylor, A., Winston, J and Wesley, A., 2017-IPM-101596. Automated lithology detections w/ formation interpretations. (Pending)
- Brumbaugh, G., Huang, Y., Vamaraju, J., Taylor, A., Winston, J and Wesley, A., 2017-IPM-101594. Smart Bit. (Pending)

WORK EXPERIENCE

Halliburton (Landmark Solutions) - Data Scientist R&D Intern; Houston, TX

May 2017- August 2017

- Built novel deep learning models to automate lithology detection from surface/drilling data. These models can be generalized over multiple wells.
Algorithms used – Random Forests, Gradient Boosted Trees, Convolutional Neural Networks, Long Short Term Memory neural networks, Deep Neural Networks based stacked generalization
- Patents filed - Automated Lithology Detection w/ formation interpretation (2017-IPM-101596) and Smart Bit (2017-IPM-101594)

The University of Texas at Austin - Graduate Research Assistant; Austin, TX

May 2015 – Present

- Developed a Meanfield Boltzmann machine (Recurrent neural network) to solve Kirchhoff seismic migration. The algorithm was tested on the SEG/EAGE fault model and the Marmousi model. When compared to conventional and conventional least squared Kirchhoff migrations, this approach is robust to migration artifacts and is computationally fast.
- Developing finite difference (staggered grid) and finite element models (spectral elements and discontinuous Galerkin) to simulate seismic wave propagation in porous media with fluid filled fractures.
- Modeled seismic fractures (using linear slip theory) in elastic wave propagation using Discontinuous, Enriched and Hybrid Galerkin finite element schemes. Enriched and Hybrid Galerkin methods were designed to make existing finite element schemes computationally more efficient.
- Developed 2D and 3D parallel finite difference and finite element elastic seismic wave propagation models.
- Implemented Full Waveform Inversion algorithm using nonlinear conjugate gradient and Hamiltonian Monte Carlo schemes.

The University of Texas at Austin – Graduate Teaching Assistant; Austin, TX

August 2013 – May 2015

- Teaching Assistant for courses in Advanced Calculus, Properties and behavior of Engineering Materials, Masonry Engineering.
- Prepared syllabi, tests and quizzes for each course. Managed class and lab sessions for over 200 undergraduate students spanning 4 semesters. Also, graded students based on their performance and mentored them in understanding required concepts.
- Achieved a satisfaction rate of over 90% through the instructor surveys for my interest and knowledge in the subjects.

CSIR, Structural Engineering Research Centre – Research Assistant; Chennai, India

June 2012 – June 2013

- Implemented a cointegration technique for structural health monitoring and checked against benchmark systems. This technique removes the influence of changing environmental and operational conditions when inferring structural conditions from monitoring data.
- Performed operational modal analysis of multi degree freedom vibration systems based on smooth orthogonal decomposition and principal component analysis.
- Conducted a study on nonlinear system identification techniques using Hilbert Huang Transform and principal orthogonal decomposition. Applied a denoising algorithm based on wavelet transform and tested for various real noise containing responses.

Larsen and Toubro Construction – Summer Intern; Hyderabad, India

May 2012 – June 2012

- Engineered the structural design for a typical entry/exit arm for a station in the 2.2 billion dollar Hyderabad Metro Rail Project.

SKILLS

- **Languages:** C, C++, Python (numpy, Pandas, scikit-learn, TensorFlow, Keras, Theano), MATLAB, Shell scripting
- **Programming interfaces:** CUDA, MPI, OpenMP
- **Processing and Analysis software:** Seismic Unix, Madagascar, ANSYS, Abaqus, Deal.ii, Mathcad

PARTICIPATED PROJECT

BIGDATA: Collaborative Research: IA: F: Fractured Subsurface Characterization using High Performance Computing and Guided by Big Data, NSF Award #1546553, PI: Dr. Mary F. Wheeler, Co-PI: Dr. Mrinal Sen

AWARD

Recipient of CSIR-BITS Scholarship, Birla Institute of Technology and Science, Pilani

June 2012, January 2013

PROFESSIONAL ORGANIZATIONS

- Society of Exploration Geophysicists
- American Geophysical Union
- Society for Industrial and Applied Mathematics
- Society of Petroleum Engineers

PRESENTED TALKS/POSTERS

- *Numerical Simulations of Seismic Wave Propagation in Fractured Media and Fracture Parameter Estimation*

Talk at National Geophysical Research Institute, Hyderabad, India

April, 2018

- Poster at Jackson School of Geosciences Annual Research Symposium 2018, Austin, USA February, 2018
- *Mean Field Boltzmann Machines for Kirchhoff Migration*
Talk at Geophysics Research Seminar, UT Austin, USA March, 2018
- *Generalization of machine learning models to predict lithology over multiple wells*
Talk at Geophysics Research Seminar, UT Austin, USA October, 2017
Talk at Landmark, Halliburton, Houston, USA August, 2017
- *A comparison of continuous, discontinuous, and enriched Galerkin finite-element methods for elastic wave-propagation simulation*
Talk at SEG Annual Conference 2017, Houston, USA September, 2017
Talk at EDGER Forum Annual Meeting 2017, Austin, USA March, 2017
Talk at Geophysics Research Seminar, UT Austin, USA January, 2017
Poster at CSM Annual Meeting, 2016, Austin, USA September, 2016
- *A hybrid-Galerkin finite-element method for seismic wave propagation in fractured media*
Talk at SEG Annual Conference 2017, Houston, USA September, 2017

RELEVANT COURSEWORK

Finite Elements, Seismic Imaging, Seismic Reflection Processing, Inverse Theory, Seismology 1, Seismology 2, Seismology 3, Physics of the Earth, Quantitative Seismic Interpretation, Structural Dynamics, Digital Signal Processing, Computer Methods in Structural Analysis, Numerical Analysis: Linear Algebra, Boundary Element Methods, Parallel Computing, Solid Mechanics 2, Tools and Techniques in Computational Sciences