

# JANAKI VAMARAJU

[janaki.vamaraju@gmail.com](mailto:janaki.vamaraju@gmail.com) • Austin, Texas • 919-597-0242 • Website: [janaki.vamaraju](http://janaki.vamaraju) • LinkedIn: [vjanaki](https://www.linkedin.com/in/vjanaki)

## RESEARCH INTERESTS

Computational Science, Numerical Modeling and Analysis, Inverse Problems, High Performance Computing, Applied Machine Learning, Pattern Recognition, Applied Mathematics

## EDUCATION

### Ph.D. in Geophysics

December 2019 (Expected)

Major: Computational Geophysics

The University of Texas at Austin, Jackson School of Geosciences

Advisor: Dr. Mrinal Sen (Major GPA 3.88/4.0, CGPA 3.6/4.0)

### Master of Science in Civil Engineering

May 2016

Major: Computational Mechanics

The University of Texas at Austin, Cockrell School of Engineering (Major GPA 3.83/4.00)

### 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

### Journal Publications :

- Vamaraju, J., Sen, M., Wheeler, M.F. and De Basabe, J., 2019. A hybrid-Galerkin finite-element method for seismic wave propagation in fractured media. *Journal of Geophysical International* (Under Review)
- 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. and Sen, M.K., 2019. Unsupervised physics based neural networks for seismic migration. *Interpretation*, 7(3), pp.1-51.
- Vamaraju, J., Sen, M.K., De Basabe, J. and Wheeler, M., 2018. Enriched Galerkin finite element approximation for elastic wave propagation in fractured media. *Journal of Computational Physics*, v-372, pp.726-747.

### SEG Expanded Abstracts :

- Vamaraju, J. and Sen, M.K., 2019. Anisotropic moveout correction using a Hough transform neural network. *SEG Technical Program Expanded Abstracts 2019*.
- Vamaraju, J., Zhao, Z. and Sen, M.K., 2019. Pre-stack target-oriented least squares RTM in Image domain using Conjugate Hopfield networks and the Boltzmann machine. *SEG Technical Program Expanded Abstracts 2019*.
- Vamaraju, J. and Sen, M.K., 2018. Mean field Boltzmann machines for high resolution Kirchhoff migration. *SEG Technical Program Expanded Abstracts 2018* (pp. 2006-2010). (most downloaded expanded abstract on SEG library website, 2018-2019)
- 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., PCT/US2018/039718. Drill bit subsystem for automatically updating drill trajectory. (Patent filed at U.S Receiving office)

## WORK EXPERIENCE

### **Royal Dutch Shell (Shell Technology Centre) – Machine Learning R&D Intern; Houston, TX**

May 2019 – August 2019

- Developing unsupervised seismic imaging algorithms using machine learning tools and techniques. When compared to conventional least squares migrations, this approach is robust to imaging artifacts and is computationally efficient.

### **ExxonMobil (Upstream Research Company) – Computational Science Intern; Houston, TX**

May 2018 - August 2018

- Developed unsupervised pattern recognition workflows to automate classification of geomorphic elements from Turbulence and Sediment Transport based numerical simulations (Process Stratigraphy).  
Algorithms used: Principal Component Analysis, Restricted Boltzmann Machines, Clustering techniques
- Automated the extraction of geometrical properties from classified geomorphic elements using curve fitting techniques and Geomorphon mapping tools.
- Implemented a Spectral clustering based graph partitioning algorithm to identify avulsion events and predict stacking patterns. The Hausdorff distance measure was used for a robust clustering of channel trajectories.
- Translated outputs from above numerical models into business needed concepts and quantitative data.

### **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 Mean field Boltzmann machine (Recurrent neural network) to solve seismic migrations (Kirchhoff, Born and Reverse Time (RTM)). The algorithm was tested on the SEG/EAGE fault model and the Marmousi model. When compared to conventional least squares migrations, this approach is robust to imaging 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 poro-elastic media with fluid filled fractures.
- Modeled seismic fractures (using linear slip theory) for 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 (FWI) 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, Caffe, PyTorch), MATLAB, UNIX shell scripting
- **Programming interfaces:** MPI, OpenMP, CUDA
- **Processing and Analysis software:** Seismic Unix, Madagascar, ANSYS, Abaqus, Deal.ii, Mathcad, PETSc, METIS

### **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

### **AWARDS AND HONOURS**

- Recipient of Ewing/Worzel UTIG fellowship August, 2019
- Selected as a “Rising Star” in Computational and Data Sciences (acceptance rate < 21%), February, 2019  
Oden Institute for Computational Engineering and Sciences at the University of Texas at Austin and Sandia National Laboratories
- Recipient of CSIR-BITS Scholarship, Birla Institute of Technology and Science, Pilani June 2012, January 2013

### **REVIEWER**

- Geophysics (journal)
- Interpretation (journal)
- Advances in Civil Engineering (journal)

### **PROFESSIONAL ORGANIZATIONS**

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

### **PRESENTED TALKS/POSTERS**

- *Anisotropic moveout correction using a Hough transform neural network*  
Talk at SEG Annual Conference 2019, San Antonio, USA September, 2019  
Talk at Geophysics Research Seminar, UT Austin, USA December, 2018
- *Pre-stack target-oriented least squares RTM in Image domain using Conjugate Hopfield networks and the Boltzmann machine.*  
Talk at SEG Annual Conference 2019, San Antonio, USA September, 2019  
Talk at Geophysics Research Seminar, UT Austin, USA May, 2018
- *Numerical Simulations of Seismic Wave Propagation in Fractured Media and Fracture Parameter Estimation*  
Talk at ExxonMobil Upstream Research Company, Houston, USA June 2018  
Talk at Society of Petroleum Geophysicists, North American Chapter, Houston, USA June, 2018  
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  
Talk at SEG Annual Conference 2018, Anaheim, USA October, 2018  
Poster at Jackson School of Geosciences Annual Research Symposium 2019, Austin, USA February, 2019  
Talk at EDGER Forum Annual Meeting 2019, Austin, USA March, 2019  
Poster at the “Rising Stars” in Computational and Data Sciences workshop 2019, Austin, USA April, 2019
- *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    |
| • <i>A comparison of continuous, discontinuous, and enriched Galerkin finite-element methods for elastic wave-propagation simulation</i> |                 |
| 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 |
| • <i>A hybrid-Galerkin finite-element method for seismic wave propagation in fractured media</i>   |                 |
| Talk at SEG Annual Conference 2017, Houston, USA   | September, 2017 |

## BOOK REVIEW

Mrinal K. Sen, and Janaki Vamaraju (2018). "Reviews." The Leading Edge, 37(10), 784–785.

## RELEVANT COURSEWORK

Finite Elements, Advanced 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, Rock Physics, Multidimensional Data Analysis