DANH-TAI HOANG, PhD

National Institutes of Health, Bethesda, MD 20892
https://github.com/danhtaihoang danhtai.hoang@gmail.com

QUALIFICATIONS

Biomedical Data Scientist with over 6 years of experience in Data Analysis, Statistical Modeling, Mechanistic Modeling, Machine Learning.

- Multi-disciplinary background in solving complex real-world problems.
- Leading and managing high-level research projects.
- Published 19 papers in high-profile journals including 12 as the first author.

TECHNICAL SKILLS & TOOLS

- Python, NumPy, SciPy, Scikit-learn, Pandas, Jupyter Notebook
- Linux, Command Line, Bash Scripting, Git/GitHub
- Data Analysis, Data Cleaning, Data Mining and Manipulation, Data Visualization, Big Data
- Machine Learning, Predictive Models, Classification, Regression, Forecasting, Model Selection
- Logistic Regression, Random Forests, Linear Regression, Decision Trees, k-NN, Naive Bayes, SVM, Gradient Boosting, PCA, t-SNE, K-Means
- Bayesian Statistics, Markov chain Monte Carlo, Dynamics, Stochastics, Time-series Analysis

SOFTWARE DEVELOPMENT

- Model selection with hidden variables: https://danhtaihoang.github.io/hidden-variable/
- Network inference in stochastic systems: https://danhtaihoang.github.io/network-inference
- Expectation Reflection for classification: GitHub/danhtaihoang/expectation-reflection
- Protein structure prediction: GitHub/danhtaihoang/protein-structure-inference

Other programming codes: GitHub/danhtaihoang

PROFESSIONAL EXPERIENCE

- **April 2016-Present: Postdoctoral Researcher in Data Science and Machine Learning, National Institutes of Health (NIH), Bethesda, Maryland, USA.**

- Developed a new machine learning algorithm, Expectation Reflection (ER), for network inference in stochastic systems that outperforms the current state-of-the-art methods, especially in small sample sizes (but many variables).

- Implemented Python packages based on the ER method for medical diagnosis and classification of 11 biomedical datasets: kidney disease (accuracy ~ 84%), diabetes (79%), heart disease (85%), breast cancer (97%), diabetic retinopathy (74%), cardiotocography (84%), protein expression (99%), gene sequence (96%), drug effect (70%), breast tissue (90%), orthopedics (87%).

- Applied the Expectation Reflection method to predict tertiary structures of protein from multiple sequence alignments. The method provided a good inference accuracy (AUC ~ 0.84) for many protein domains.

- Conducted a new data-driven method, combining the Expectation Reflection and the Expectation-Maximization, to identify hidden nodes in networks that can significantly improve the predictive performance in partially observed systems.

- Originated an algorithm for clustering, applied to classify image data successfully, and systematically found an optimal number of clusters.

- Inferred a real neural network from a multichannel recording of neuron activities. Predicted activities of neurons from activities of input neurons with an accuracy of 80%.

• **January 2013-March 2016: Postdoctoral Researcher in Computational Biology,**
Asia Pacific Center for Theoretical Physics (APCTP), POSTECH, South Korea.

- Analyzed the perturbation of controllable synchronization under human diabetes, suggested a new method for diabetes diagnosis based on measuring the synchronization between hormone pulses.

- Studied the mechanism of organizations and paracrine interactions of islet cells, suggested new perspectives for the therapy of diabetes with an optimal structure of artificial islets made by stem cells.

- Examined the effect of re-organization of islet cells where the death beta cells are removed and replaced by other cells. Found that the cellular re-organization could actively contribute to recovery under diabetic conditions.

- Investigated the role of pancreatic delta cells that delta cells enhanced the incoherent state at euglycemia.

- Inferred the relative attractions between the pancreatic cells from their 3D coordinates and found that the attractions between homotypic cells are slightly, but significantly, stronger than the attractions between heterotypic cells.

EDUCATION

• Ph.D. (with the highest honor) in Theoretical Physics (2013), University of Cergy-Pontoise, France.
• M.S. (2007) and B.S. (2004) in Physics, Vinh University, Vietnam.

SELECTED PUBLICATIONS (ISI JOURNALS)

22. Junghyo, Danh-Tai Hoang, and Vipul Periwal, Model inference from high-temperature re-weighting of observations, in preparation.
(https://github.com/danhtaihoang/e-machine)

21. Danh-Tai Hoang and Vipul Periwal, *Classification with Expectation Reflection*, in preparation.
(https://github.com/danhtaihoang/expectation-reflection)

20. Danh-Tai Hoang, Joseph McKenna, Chris Yang, and Vipul Periwal, *Data-driven approach for protein structure prediction*, in preparation.
(https://github.com/danhtaihoang/protein-structure-inference)

19. Danh-Tai Hoang, Junghyo Jo, and Vipul Periwal, *Data-driven inference of hidden nodes in networks*, Physical Review E, 99, 042114 (2019) **(Editors' Suggestion).**

18. Danh-Tai Hoang, Juyong Song, Vipul Periwal, and Junghyo Jo, *Network inference in stochastic systems from neurons to currencies: Improved performance at small sample size*, Physical Review E, 99, 023311 (2019).

17. Dong-Ho Park, Taegeun Song, Danh-Tai Hoang, Jin Xu, and Junghyo Jo, *A Local Counter-regulatory motif modulates the global phase of hormonal oscillations*, Nature-Scientific Reports, 7, 1602 (2017).

16. Danh-Tai Hoang, Manami Hara, Junghyo Jo, *Design principles of pancreatic islets: Glucose-dependent coordination of hormone pulses*, PLOS ONE, 11(4): e0152446 (2016).

15. Danh-Tai Hoang, B. Prasanna Venkatesh, Seungju Han, Junghyo Jo, Gentaro Watanabe, Mahn-Soo Choi, *Scaling law for irreversible entropy production in critical systems*, Nature-Scientific Reports, 6, 27603 (2016).

14. Marissa Pastor, Juyong Song, Danh-Tai Hoang, Junghyo Jo, *Minimal Perceptrons for Memorizing Binary Patterns*, Physica A, 462, 31-37 (2016).

13. Danh-Tai Hoang, Junghyo Jo, Hyunsuk Hong, *Traveling wave in a three-dimensional array of conformist and contrarian oscillators*, Physical Review E, 91, 032135 (2015).

12. Danh-Tai Hoang, Hitomi Matsunari, Masaki Nagaya, Hiroshi Nagashima, J. Michael Millis, Piotr Witkowski, Vipul Periwal, Manami Hara, Junghyo Jo, *A Conserved Rule for Pancreatic Islet Organization*, PLOS ONE, 9, 10, e110384 (2014).

11. Juyong Song, Danh-Tai Hoang, Jongwook Kim, and Junghyo Jo, *Population balancing with species switching*, J. Korean Phys. Soc., 61, 1, 111-116 (2014).

10. Danh-Tai Hoang and H. T. Diep, *Phase transition in dimer liquids*, J. Phys.: Condens. Matter., 26, 035103 (2014).

9. H. T. Diep, Virgile Bocchetti, Danh-Tai Hoang, and V. T. Ngo, *Theory and simulation of magnetic material: Physics at phase frontiers*, J. Phys.: Conference Series, 537, 01200 (2014).

8. Danh-Tai Hoang, Juyong Song, and Junghyo Jo, *Partial mixing phase of binary cells in finite systems*, Physical Review E. 88, 062725 (2013).

7. Maciej Kasperski, Henryk Puszkarsi, Danh-Tai Hoang, and H. T. Diep, *Magnetic properties of two-dimensional nanodots: Ground state and phase transition*, AIP Advances, 3, 122121 (2013).

6. Danh-Tai Hoang, Maciej Kasperski, Henryk Puszkarsi, and H. T. Diep, *Re-orientation transition in molecular thin films: Potts model with dipolar interaction*, J. Phys.: Condens. Matter., 25, 056006 (2013).

5. Danh-Tai Hoang and H. T. Diep, *Effect of dipolar interaction in molecular crystals*, J. Phys.: Condens. Matter., 24, 415402 (2012).

4. Danh-Tai Hoang and H. T. Diep, *Hexagonal-close-packed lattice: Ground state and phase transition*, Physical Review E, 85, 041107 (2012).

3. H. T. Diep, Yann Magnin, and Danh-Tai Hoang, *Spin resistivity in magnetic materials*, Acta. Phys. Pol. A, 121, 985-991 (2012).

2. Danh-Tai Hoang, Yann Magnin, and H. T. Diep, *Spin resistivity in the frustrated J_1-J_2 model*, Mod. Phys. Lett. B, 25, 937-945 (2011).

1. Yann Magnin, Danh-Tai Hoang, and H. T. Diep, *Spin transport in magnetically ordered systems: Effect of the lattice relaxation time*, Mod. Phys. Lett. B, 25, 1029-1040 (2011).