Haoran Chen

Contact Information

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Research Interests

Unravel the mechanisms underlying complex genetic diseases and explore novel and customized clinical treatments

- Computational Modeling
- Artificial and Biological Intelligence
- Cancer Systems Biology
- Machine Learning

Education

Master of Science in Electrical Engineering **08/2018**

Texas A&M University, College Station, Texas USA

- Thesis: Improving Molecular-level Protein Docking and Interpreting System-level Cancer Mechanisms through Machine Learning
- Advisor: Prof. Yang Shen, Nicholas Duffield, Aniruddha Datta, Sing-Hoi Sze

Bachelor of Engineering in Electrical Engineering and Automation **06/2015**

South China University of Technology, Guangzhou, Guangdong China

Research Experience

Graduate Research Assistant **06/2016 - 08/2017, 01/2018 - 05/2018**

TAMU, Department of Electrical and Computer Engineering

Project: Quantify, predict, and understand mutational effects (leader)

- Designed a machine learning framework to predict cancer driver genes based on functional circuits in Protein-Protein Interaction (PPI) network
- Extracted and integrated cancer mechanisms of the propagation of mutational effects in PPI network
- Techniques: Random Forest, Sparse Group LASSO, Association Rule Learning

Project: Prediction of protein complex conformation change (leader)

- Proposed an entropy-inspired machine learning algorithm to predict the extent of protein complex conformational change between unbound / homology and bound structures
- Developed a proof-by-contradiction pipeline based on protein energy calculation and protein interface displacement for fast assessing rigidity assumption of protein complex docking
- Built a web server providing protein structures change prediction, rigidity assumption assessment and protein normal mode visualization
- Techniques: Normal Mode Analysis, Kernel Ridge Regression, CHARMM

Project: Pan-Cancer Atlas - Genomic and molecular landscape of DNA Damage Repair (DDR) deficiency

- Utilized the STRING and UniProt databases to locate the binding partners and their structures of three tumor suppressor genes, BRCA1, BRCA2 and RAD50
- Calculated the change of protein folding energy to identify mutations which potentially have a functional impact
- Techniques: CHARMM

Project: CAGI 5 - Variants of BRCA1 and BRCA2: predict which variants are associated with increased risk of breast cancer by ENIGMA

- Designed objective function and features of ordinal regression for predicting categorical clinical outcomes of BRCA1, BRCA2 and CHEK2 mutations
- Techniques: Ordinal Regression, feature engineering

Project: DREAM Challenge - AstraZeneca-Sanger Drug Combination Prediction

- Developed DNA methylation and drug-cell line kernel features for predicting the effects of drug synergy
- Techniques: Kernel Support Vector Machine, feature engineering

Undergraduate Research Assistant **09/2013 - 01/2015**

SCUT, Department of Electrical Engineering

Project: Monitoring and predicting the safe working condition of 10kV three-core cable

- Designed and executed a field experiment with state-of-the-art accuracy for a thermal rising test of 10kV three-core cables
- Designed an ANSYS finite element analysis to model the thermal resistivity of 10kV three-core cable in terms of various impacts from materials, temperature and conditions
- Techniques: ANSYS, MATLAB

Publications

Chen, H., Sun, Y., & Shen, Y. (2017). Predicting protein conformational changes for unbound and homology docking: learning from intrinsic and induced flexibility. *Proteins: Structure, Function, and Bioinformatics*, 85(3), 544-556.

Knijnenburg, T. A., Wang, L., Zimmermann, M. T., Chambwe, N., Gao, G. F., Cherniack, A. D., Fan, H., Shen, H., Way, G. P., Greene, C. S., Liu, Y., Akbani, R., Feng, B., Donehower, L. A., Miller, C., Shen, Y., Karimi, M., **Chen, H.**, Kim, P., Jia, P., Shinbrot, E., Zhang, S., Liu, J., Hui, H., Bailey, M. H., Yau, C., Wolf, D., Zhao, Z., Weinstein, J., Li, L., Ding, L., Mills, G. B., Laird, P. W., Wheeler, D. A., Shmulevich, I., The Cancer Genome Atlas Research Network, Monnat, R. J., Jr., Xiao & Y., Wang, C. (2018). Genomic and molecular landscape of DNA damage repair deficiency across The Cancer Genome Atlas. *Cell Reports*, 23(1), 239.

Menden, M. P., Wang, D., Guan, Y., Mason, M., Szalai, B., Bulusu, K. C., Yu, T., Kang, J., Jeon, M., Wolfinger, R., Nguyen, T., Zaslavskiy, M., **AstraZeneca-Sanger Drug Combination DREAM Consorti**, Jang, I. S., Ghazoui, Z., Ahsen, M. E., Vogel, R., Neto, E. C., Norman, T., Tang, E. KY., Garnett, M. J., Di Veroli, G., Fawell, S., Stolovitzky, G., Guinney, J., Dry & J. R., Saez-Rodriguez, J. (2018). A cancer pharmacogenomic screen powering crowd-sourced advancement of drug combination prediction. *bioRxiv*, 200451.

Chen, H., Hu, Q. (2014) Impact of thermal resistivity value of materials on calculation for conductor temperature of 10 kV three-core cable. *Guangdong Electric Power*, 27(4) 86-90.

Papers in Preparation

Karimi, M., Sun, Y., Cao, Y., **Chen, H.**, Moronfoye, O., & Shen, Y. (2018). Predicting missense mutational effects on protein functions and cancer pathogenicity. *Submitted*

Sun, Y., **Chen, H.**, & Shen Y. (2018) PredPro: Predicting Protein conformational change and assessing rigidity assumption. *Manuscript in preparation.*

Chen, H., Shen Y. (2018). Interpreting system-level cancer mechanisms through machine learning. *Manuscript in preparation.*

Teaching Experience

Teaching Assistant, Electrical Circuit Theory **09/2017 - 12/2017**

TAMU, Department of Electrical and Computer Engineering

- Selected as a teaching assistant for Electrical Circuit Theory, one of the core courses for electrical engineering
- Led 10-hour weekly lab sections and discussion sections for a group of 80 students
- Designed course materials including study problems and lab exams

Grader, Algorithms in Structural Bioinformatics **01/2016 - 05/2016**

TAMU, Department of Electrical and Computer Engineering

- Graded weekly assignments and exams

Honors and Awards

- Academic Performance Scholarship **10/2014**
- Academic Improvement Scholarship **10/2013**
- Social Activities Award **02/2013 & 09/2013**
- Outstanding Cadres of Student Association Award **05/2013**

Databases

- Cancer: TCGA, Xena, COSMIC, ClinVar
- Pathway: PathwayCommons, KEGG
- Protein structure and interaction: PDB, UniProt, STRING

Algorithms

- Machine Learning: Ridge, LASSO, SVM, Random Forest, Gradient Boosting, AdaBoost
- Deep Learning: CNN, RNN, LSTM, GAN, VAE
- Probabilistic Graphical Models: Bayesian Network, Dynamic Bayesian Network, Hidden Markov Model, Conditional Random Field
- Data Mining: Association Rule Learning, DBSCAN, Kernal Density Estimation, PCA, LDA, K-mean, Hierarchical Clustering
- Protein Modeling: Normal Mode Analysis

Computer Skills

- Languages: Python, R, Shell, LaTeX, MATLAB, Pascal, VB
- Software: Pymol, CHARMM, ANSYS