Ziming Liu

School of Physics, Peking University
No. 5 Yiheyuan Road, Beijing 100871, P. R. China
Tel: 86-15011510133   E-mail: liu_zi_ming @pku.edu.cn   Web: kindxiaoming.github.io

EDUCATION

09/2016-06/2020	**PEKING UNIVERSITY**	Beijing, China

Bachelor of Science in Physics, School of Physics

- GPA: 3.78/4.0
- Computer Skills: Python (packages: sklearn/tensorflow/pytorch), Mathematica, LaTeX, Matlab, C/C++/C#, Linux
- English: TOEFL 104, GRE 327 (157/V+170/Q+3.5/AW), GRE Physics Sub 990 (95% Below)

RESEARCH INTEREST

- Applications of machine learning to science and engineering
- Langevin dynamics and Hamiltonian dynamics for sampling & optimization
- Online and large-scale tensor decomposition methods
- Quantum computing and quantum information

RESEARCH

1) *July. 2018-March. 2019*   **Principal Component Analysis of Collective Flow in Relativistic Heavy-Ion Collisions**

Advisor: Huichao Song, Peking University

Results:

➢ Unlike traditional methods, we did not use any a priori transformation (e.g. Fourier transformation) to define observables. On the contrary, we let PCA automatically determine features in particle distribution, from which we define new observables, which show advantages over traditional ones in many aspects.

➢ ***The paper has been accepted by EPJC (first author).*** Title: Principal Component Analysis of Collective Flow in Relativistic Heavy-Ion Collisions. Authors: Ziming Liu, Wenbin Zhao, and Huichao Song.

➢ ***The research was presented by me on Initial Stages 2019 (oral, June 2019 at Columbia University in New York).*** Title: Principal Component Analysis and its Applications to Relativistic Heavy-Ion Collisions.

2) *January. 2019-March. 2019*   **The Limitations of Principal Component Analysis to Study Factorization Breaking Effects of Collective Flow**

Advisor: Jiangyong Jia, Department of Chemistry, Stony Brook University

Results:

➢ CMS collaboration had published results of leading flow and sub-leading flow in PbPb and pPb system by applying PCA to two-particle correlation. The sub-leading flow are believed to come from sub-leading eccentricity. However, we found that the sub-leading flow can also originate from non-flow effects.

➢ ***The paper is in preparation (as first author).*** Title: The Limitations of Principal Component Analysis to Study Factorization Breaking Effects of Collective Flow. Author List: Ziming Liu, Arabinda Behera, Huichao Song, and Jiangyong Jia.

3) *June. 2019- September.2019*   **Quantum-Inspired Hamiltonian Monte Carlo for Bayesian Sampling**

Advisor: Zheng Zhang, Department of Electrical and Computer Engineering, University of California, Santa Barbara

Results:

➢ Inspired by quantum mechanics, we modify Hamiltonian Monte Carlo (HMC) by introducing a time-varying

Ziming Liu

School of Physics, Peking University
No. 5 Yiheyuan Road, Beijing 100871, P. R. China
Tel: 86-15011510133   E-mail: liu_zi_ming @pku.edu.cn   Web: kindxiaoming.github.io

mass term and refer to the proposed algorithm as quantum-inspired Hamiltonian monte carlo (QHMC). In this way we can achieve much better sampling of spiky distributions than the original HMC algorithm.

➢ ***This work has been invited as a talk in SIAM 2020 data science workshop.***

➢ ***The paper is in preparation, and will be submitted to International Conference of Machine Learning (ICML) 2020.*** Title: Quantum-inspired Hamiltonian Monte Carlo. Author List: Ziming Liu, Zheng Zhang

MATHEMATICAL MODELING AND OTHER EXPERIENCES

- Led a group of eight competing for CUPT (China Undergraduate Physics Tournament) which requires us to solve real-life physical problems and won the second place in Peking University
- Used C# to develop an online Electrical Laboratory software with a group of four
- Held a seminar for hydrodynamics, participated in a seminar for numerical analysis, holding a seminar for quantum computation and quantum information.

AWARDS AND HONORS

- Peking University Merit Student Award   2019, 2018, 2017
- Scholarship of Robin Lee (5th place out of 200 students)   09/2019
- Shenzhen Finance Institute scholarship (7th place out of 200 students)   09/2018
- The Championship of 'Data Open' competition in Beijing   05/2018
- Scholarship of China National Petroleum Corporation   09/2017
- 2nd Place in Male Rope Skipping Competition in Peking University   03/2018
- 2nd Place in Latin Dance Competition in Peking University   06/2017

PUBLICATIONS AND PRESENTATIONS

- Paper (First author): Quantum-Inspired Hamiltonian Monte Carlo for Bayesian Sampling (Ziming Liu, Zheng Zhang). The paper has been submitted to arXiv and will soon be submitted to Journal of Machine Learning Research (JMLR). arXiv:1912.01937
- Paper (First author): Principal Component Analysis of Collective Flow in Relativistic Heavy-Ion Collisions (Ziming Liu, Wenbin Zhao, and Huichao Song). This paper has been accepted by European Physical Journal C. Eur. Phys. J. C (2019) 79:870.
- Paper (Co-first author): Influenza Modeling Based on Massive Feature Engineering and International Flow Deconvolution (Ziming Liu, Yixuan Wang, Zizhao Han and Dian Wu). arXiv:1912.02989
- Oral Talk (Speaker): Principal Component Analysis and its Applications to Relativistic Heavy-Ion Collisions. June 2019, Columbia University, Initial Stages 2019. Slides.
- Paper (First author): Limitations of Principal Component Analysis to Study Factorization Breaking Effects of Collective Flow (Ziming Liu, Arabinda Behera, Huichao Song, and Jiangyong Jia). The paper is in preparation and will be submitted to Physics Review C (PRC).