Hanchun Wang

enthazy.github.io | linkedin.com/in/hanchun
hw1121@ic.ac.uk | (44) 07422428173

EDUCATION BACKGROUND

Imperial College London, MSc. **Applied Mathematics** 2021 – 2022
- Grade: **3.96/4, A+(82), Distinction**
- Main Modules: Geometric Mechanics, Scientific Computation, Data Science, Statistical Learning, Game Theory

University of Toronto, Honours BSc. **Math Physics Specialist + Computer Science Major (Adv. Triple)** 2018 – 2021
- Main Modules: Mathematics: Differential Geometry, Nonlinear PDE, Stochastic Process, Statistics
  Physics: Mathematical Physics, Quantum Mechanics, Relativity, Computational Physics
  Computing: Deep Learning, Reinforcement Learning, Software Design
  2016 Mathematical Contest in Modeling (MCM/ICM), Meritorious Winner

SKILLS

- Math Background: Differential Geometry, Hamiltonian Mechanics, Functional Analysis, Nonlinear Dynamics, Markov Process, Stochastic Differential Equations, Math Finance, Time Series Analysis, Multi-Agents System
- Programming: Python (6 y.), Mathematica (4 y.), C++ (2 y.), Java (2 y.), C, MATLAB, Lisp, Pytorch, Jekyll
- Research Toolbox: Linux, Unix, Git, LaTeX, Inkscape, Illustrator, Spring Framework, Classical Guitar (10 y.)
- Machine Learning: Neural Operators, Physics-Informed NN, Transformer, GAN, Diffusion Model, Gaussian Process

WORKING EXPERIENCES

Visit Researcher *University of Cambridge / DAMTP* 06/2023 – 09/2023
- Visit researcher at Prof. Mihaela van der Schaar's lab in Dept. of Applied Mathematics and Theoretical Physics.

Casual Research Worker *Imperial College London / Dept. Mathematics* 10/2022 –
- Study the prediction of human postures from video by using random dynamical system and diffusion model.

Head Teaching Assistant *University of Toronto* 09/2020 – 06/2021
- Taught the tutorials of calculus, linear algebra, differential equations in Department of Engineering.

Java Backend Developer *Combanc Technology Co., Ltd.* 04/2017 – 08/2017
- Designed algorithms in a web-based learning platform. Prototyped an online trading service based on Spring Boot.

PUBLICATIONS

Predicting the Light Spectrum of VR Scenarios for Non-image-Forming Visual Evaluation [Demo] 2022
IEEE VR 2023 Workshop. [DOI:10.1109/VRW58643.2023.00238]. Chromatology, Spectral Analysis, Unity
- Established an all-sided framework to evaluate the effects of VR scenes on human visual sensing. Developed a color rendering algorithm for mesh in Unity to reduce Melanopic activation level while preserving color perception.

Hydrodynamics and the Golden Ratio [Demo] 2021
THE MATHEMATICAL INTELLIGENCER, [DOI: 10.1007/s00283-021-10099-1]. Vortex Dynamics, Hamiltonian, Integrable System.
- Revealed a **new theorem** that the kink/cusp-bifurcation value in the 2 vortices system on half plane is the Golden Ratio.

ONGOING RESEARCH

Inertia Effect in Active Brownian Particles System [Demo] 2022
MSc. Thesis, Stochastic Simulation, Soft Condensed Matter, Non-Equilibrium Statistical Mechanics, C++, Numba, CuPy
- Studied the **emergence phenomena** in a large community. Researched the spontaneous macroscopic aggregation behavior of individuals through autonomous random movement in a system without any attraction mechanism.
- Designed and implemented a **CPU/GPU simulator** for Underdamped Langevin's dynamics to oversaw over **millions of particles**. By creating the topological connectivity and Voronoi Tessellation analysis methods on torus to study the impact of inertia factors.

Regret Minimization Learning in Blotto Game [Demo] 2022
Game Theory, Dynamics of Learning, Stochastic Simulation, Reinforcement Learning
- Realized a multi-player Blotto game in a **continuous action space** players with various reinforcement learning and regret minimization learning methods to study the equilibriums and convergence processes of strategies and portfolios.

Invariant Measure in Random Dynamical System [Demo] 2023
Random Dynamical System, Markov Process, Stochastic Simulation
- Provided a novel explanation for the fractal structure in nature by studying the non-zero fractal probability measure in stochastic dynamical systems. Devised methods to automatically select action combinations that yield a non-zero fractal probability measure.

Raman Spectrum Analysis on Human Organoids using Improved t-SNE 2023
Unsupervised Machine Learning, Data Science, Feature Engineering
- Improved t-SNE visualization with finer cluster structures which leads to a novel **non-prior-knowledge classification** algorithm for materials in brain organoids and artificial cartilage.

Philosophy Essay 2017 – 2021
- Philosophy of Physics: Can the Discovery of Weinberg's Final Theory be Realized?
- Philosophy of Science: Are Simulations Epistemologically Experiments?
- Philosophy of Politics: Mathematical Proof of the Inconsistence between Mill's Harm Principle and Utilitarianism