

# CURRICULUM VITAE

## PERSONAL INFORMATION

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**Name:** Chen Song  
**Email:** scott.songch@gmail.com

## EDUCATION

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**Temple University, Philadelphia, Pennsylvania, USA** **2021.9 - 2024.3**  
Graduate Student  
**Major:** Computer and Information Science **GPA:** 3.77/4.00

**South China University of Technology (Top 1% in China), Guangzhou, China** **2017.9 - 2020.6**  
**Degree:** Master of Engineering  
**Major:** Control Engineering **GPA:** 87.48/100  
**Thesis:** Identification and Rapid Recognition of Spiral Tip via Deterministic Learning Theory

**South China University of Technology(Top 1% in China), Guangzhou, China** **2013.9 - 2017.6**  
**Degree:** Bachelor  
**Major:** Automation **GPA:** 3.19/4.00

## PUBLICATIONS

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- 1 Chen Song, Yuzhou Chen, Huanmei Wu, Xinghua Shi. GenoDiffusion: Conditional Denoising Diffusion Model for Genomic Data Augmentation. The 12th International Conference on Computational Advances in Bio and Medical Sciences, 2023
- 2 Chen Song, Wenkang Zhan, Yuzhou Chen, Xinghua Shi. Topo-Diffusion: Topological Diffusion Generative Models. In process.
- 3 Chen Song, Wenkang Zhan, Xinghua Shi. SparseHE: an efficient privacy-preserving biomedical prediction approach using sparse homomorphic encryption. IEEE International Conference on Healthcare Informatics (ICHI) 2024.
- 4 Junjie Chen, Jiahao Li, Chen Song, Bin Li, Qingcai Chen, Hongchang Gao, Wendy Hui Wang, Zenglin Xu, Xinghua Shi. Discriminative Forests Improve Generative Diversity for Generative Adversarial Networks. The Thirty-Eighth AAAI Conference on Artificial Intelligence (AAAI-24)
- 5 Wenkang Zhan, Chen Song, Yang Zhao, Yuzhou Chen, Xinghua Shi. SAT-Diffusion: A Self-Adaptive Topological Diffusion Model Improves Generative Tasks. In process
- 6 Wenkang Zhan, Chen Song, Yang Zhao, Bin Li, Yuzhou Chen, Hongchang Gao, Wendy Hui Wang, Xinghua Shi. Defend against Membership Inference Attack When Topological Data Analysis Meets Generative Models. In process
- 7 Chen Song, Wenkang Zhan, Yang Zhao, Bin Li, Yuzhou Chen, Xinghua Shi. TIDM: A Topological Inverse Diffusion Model for Image Restoration. In process.
- 8 Wenkang Zhan, Chen Song, Supratim Das, Timothy R. Rebbeck, and Xinghua Shi. E2EGraph: An End-to-end Graph Learning Model for Interpretable Prediction of Pathological Stages in Prostate Cancer. bioRxiv (2023): 2023-03.
- 9 Chen Song, Xinghua Shi. ReActHE: A homomorphic encryption friendly deep neural network for privacy-preserving biomedical prediction. Smart Health.

- 10 Chen Song, Hongchang Gao, Chang Su, Bari J Dzomba, Huanmei Wu, Xinghua Shi. Semi-supervised Deep Non-negative Matrix Factorization of Gene Expression Profiles for Alzheimer's Disease Prediction, In Process.
- 11 Xunde Dong, Chen Song, Cong Wang. Spiral Tip Identification via Deterministic Learning. International Journal of Bifurcation and Chaos, 2019, 29(3):1950040.
- 12 Chen Song, Xunde Dong, Cong Wang. Spiral Tip Recognition via Deterministic Learning. International Journal of Bifurcation and Chaos, 2020, 30(6):2050093.
- 13 Chen Song, Xunde Dong, Cong Wang. A Frequency-Speed Subsystem of the Barkley Model for Spiral Tip Identification via Deterministic Learning, 2019 Chinese Control And Decision Conference (CCDC). 2019.

## RESEARCH TOPICS

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### **Trustworthy, privacy-preserving machine learning (ML) on healthcare data including records, genotype, sequence data**

- Developed a privacy-preserving homomorphic encryption (HE) based ML algorithm to defend against membership inference attacks (MIA) on the model sparsity by tightening generalization gap on phenotype prediction with genotype and on relative detection in Forensic database [3].
- Developed a deep learning friendly HE model, ReActHE network, for precise secure multi-label tumor classification on genetic variant and for viral strain classification on genome [9].
- Integrated high-level invariant features obtained by topology data analysis (TDA) into generative models, including denoising diffusion probabilistic model (DDPM), generative adversarial network (GAN), etc., to defend against MIA on data augmentation tasks [6].
- Developed a conditional DDPM algorithm to alleviate the data scarcity of genomics from minority populations in databases, and protect genetic privacy on genotype data augmentation [1].
- Developed a graph neural network (GNN) to model co-effects in prostate gene expression for pathological stage classification; employed post-hoc interpretable ML strategies and biological interpretation to explain decision-making of the proposed GNN [8].
- Developed a non-negative matrix factorization based semi-supervised algorithm to predict Alzheimer's disease from gene expression profiles[10].

### **Deep learning algorithms on data generation and augmentation**

- Enhanced image generation by improving likelihood estimation and accelerating convergence via modeling TDA feature into DDPM [2].
- Developed a dynamic self-adaptive network to compensate for TDA estimation error during deep model training [5].
- Developed a TDA stochastic inverse model with pretrained DDPM generative model on imputing missing image [7].
- Developed a forest GAN model to improve generative diversity on data augmentation [4].

### **Master thesis: Identification and rapid recognition of spiral tip via deterministic learning theory**

- Used radial basis function (RBF) network to identify the dynamic of spiral tip from Barkley model [11].
- Developed rapid recognition of spiral tip from the dynamic which is stored in RBF weights [12].

- Built a frequency-speed system from partial differential Barkley model of spiral tip for rapid identification [13].

## TEACHING EXPERIENCE

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Lab of **CIS 1068 Program Design and Abstraction**

**Fall 2023, Fall 2022**

## WORKING EXPERIENCE

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Research Assistance at Temple University

**2020.7 - 2021.5**

## PRESENTATION EXPERIENCE

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**International Conference on Intelligent Biology and Medicine**

2022, Philadelphia, USA

**The 9th Annual MidAtlantic Bioinformatics Conference**

2022, Philadelphia, USA

**The 10th Annual MidAtlantic Bioinformatics Conference**

2023, Philadelphia, USA

**The 12th International Conference on Computational Advances in Bio and Medical Sciences**

2023, Oklahoma, USA

## PROGRAM TECHNIQUES

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Python; Matlab; Java; C ++; R language; Pytorch; Tensowflow; High Performance Computing; Container (Docker,Singularity)

## RELATED COURSES

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**CIS 5526** Machine Learning

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**CIS 5590** Optimization of Machine Learning

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**CIS 5523** Knowledge Discovery & Data Mining

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**CIS 5590** Machine Learning for Bioinformatics and Biomedical Data

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**CIS 5525** Neural Computation

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**CIS 5603** Artificial Intelligence

A-

**CIS 5543** Computer Vision

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## LANGUAGES

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English: proficiency

Chinese: native speaker

## AWARDS

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**Undergraduate:**

Award for Study Progress in University (2016)

**Graduate:**

Third-class Scholarship in University (2017)

First-class Scholarship in University (2018)

First-class Scholarship in University (2019)