Zonghao Chen

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Education

Department of Electronic Engineering, Tsinghua University **Sep. 2018 – Present**

- Bachelor of Engineering
- GPA: 3.86/4.0 Ranking: 10/253
- **Top scholarship finalist** (Highest honor awarded to 15 undergraduates every year)

Worcester College, Oxford University **Oct. 2019 – Jun. 2020**

- Visiting student at the Department of Computer Science, achieving 4 A and 4 A^+ in all 8 courses
- Fully funded by the Yinghua scholarship of Tsinghua University

Xinya College **Sep. 2017 – Jun. 2018**

- Liberal arts education
- Ranking: 1/73

Research Interests

I am generally interested in statistical machine learning. More specifically, I am currently working on approximate inference, kernel methods, graphical models, etc.

Publications and Preprints

Rethinking Function-Space Variational Inference in Bayesian Neural Networks

Tim G. J. Rudner*, **Zonghao Chen***, Yee Whye Teh, Yarin Gal

- **AABI '21** Symposium on Advances in Approximate Bayesian Inference
- **ICML '21** Workshop on Uncertainty and Robustness in Deep Learning

Efficient Neural Network Training via Forward and Backward Propagation Sparsification

Xiao Zhou*, Weizhong Zhang*, **Zonghao Chen**, Shizhe Diao, Tong Zhang

- **NeurIPS '21** Conference on Neural Information Processing Systems

A Neural Tangent Kernel Perspective on Function-Space Regularization in Neural Networks

Zonghao Chen*, Xupeng Shi*, Tim G. J. Rudner, Qixuan Feng, Weizhong Zhang, Tong Zhang

- **AISTATS '22** International Conference on Artificial Intelligence and Statistics
- Submission under review

Research Experience

Function-Space Variational Inference in Bayesian Networks **Apr 2020 – May 2021**

Advisor: Yarin Gal *Oxford Applied and Theoretical Machine Learning*

- Proposed to use linearization which simplifies the Bayesian neural network's predictive distribution as a Gaussian process, and employed inducing set techniques (Titsias et al.) to enhance scalability.
- Achieved state-of-the-art performance on various uncertainty quantification tasks including out-of-distribution detection, in-distribution calibration, robustness under covariance shift (Ovadia et al.).
- Completed the paper manuscript as co-first author here.

Sparse Neural Network Training **Apr 2021 – Jun 2021**

Advisor: Tong Zhang *Hong Kong University of Science and Technology*

- Formulated sparse neural network training from the perspective of graphical models, where sparsity is modeled as latent Bernoulli variables (Yuan et al.).
- Proposed a better gradient estimator to estimate the gradient with respect to Bernoulli parameters, which enabled completely sparse forward and backward passes. The estimator also proved unbiased with bounded variance.
- Accelerated the training speed markedly (even up to an order of magnitude) with comparable accuracy.
- Completed the paper manuscript as third author here.

Fisher Control Variate Gradient Estimators **Feb 2021 – Jul 2021**

Advisor: Michalis Titsias *Remote with Google Brain Research Scientist*

- Introduced Fisher information term (second moment) in addition to mean (first moment) in order to cancel out more variances (Saliman et al.), as an improvement to the REINFORCE type policy gradient estimator.
- Explored that the usefulness of the method was limited to small scale experiments, such as binary VAE.

Function-Space Regularization in Neural Networks **Jul 2021 – Oct 2021**

Advisor: Tong Zhang *Hong Kong University of Science and Technology*

- Proposed to explicitly regularize the neural networks in the space of functions rather than the space of parameters.
- Computed the norm of functions in the reproducing kernel Hilbert space associated with the Neural Tangent Kernel and used it as the function-space regularizer.
- Verified empirically that our regularization technique results in improved generalization performance.
- Extended our approach to continual learning and achieved state-of-the-art performance.
- Completed the paper manuscript as first author here.

Semantically Meaningful Attacks in Disentangled Latent Space **Jul 2021 – Present**

Advisor: Tong Zhang *Hong Kong University of Science and Technology*

- Based on the recent achievement of disentangled representation learning (Shen et al.), proposed to add perturbations in disentangled latent space to generate semantically meaningful adversarial images (Sven et al.), in contrast to traditional l-p norm bounded perturbations which cannot preserve plausible image semantics.
- Verified empirically that robust training in the latent space also proves robust to l-p attacks.

Awards and Honors

Top scholarship finalist (highest honor awarded to 15 undergraduates every year)	**2021**
Finalist award (Top 1%) in the America Mathematical Contest in Modeling (MCM)	**2020**
Yinghua scholarship in Tsinghua University (10/3300)	**2019**
Siyuan program in Tsinghua University (30/3300)	**2018**
Tsinghua '12-9' scholarship (highest award for juniors, more selective than National Fellowship)	**2018**
Mingwei Zhang Fellowship in Tsinghua University	**2019**
Ronghua Zhang Fellowship in Tsinghua University	**2020**
Outstanding grades in Tsinghua University	**2018 - 2020**
Outstanding scientific research in Tsinghua University	**2020**
Outstanding graduates of Shanghai High School	**2017**

Leadership / Extracurricular

Student Union **Spring 2018 – Spring 2019**

Vice President *Tsinghua University*

Skills and Qualifications

- Strong background in mathematics, signal processing, machine learning.
- Proficiency in English:
  - TOEFL score 112 (Reading: 27, Writing: 30, Listening: 30, Speaking: 25).
  - GRE score 331+5.5 (Verbal: 161, Quantitative: 170, Analytical Writing: 5.5).