

# CHUYANG GAO

Bern, Switzerland

github:<https://github.com/jingtiangao> website:<https://jingtiangao.github.io>/

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## EDUCATION

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**Ph.D. Student in Computer Science** 2022 – 2026

University of Bern, Switzerland

Communication and Distributed Systems Group; Supervisor: Prof. Torsten Braun

**Doctoral Coursework in Mathematics (Diploma of Completion Awarded)** 2020 – 2022

Southern University of Science and Technology, Shenzhen, China

**Visiting Student** 2017 – 2018

Institute of Computing Technology, Chinese Academy of Sciences, Beijing, China

Key Laboratory of Network Data Science and Technology; Supervisor: Zhibin Zhang

**M.Sc. in Computer Science** 2016 – 2019

Beijing University of Posts and Telecommunications, Beijing, China

State Key Laboratory of Networking and Switching Technology; Supervisor Group: Academician Jun-liang Chen

*Thesis: Design and Implementation of Real-Time and Historical Multi-View Trend Display System (CN, EN)*

**B.Eng. in Communication Engineering** 2012 – 2016

Shandong University, Weihai, China

School of Airspace Science and Engineering (formerly School of Mechanical and Information Engineering)

*Thesis: Android Real-Time Data Publishing Software (CN, EN); Supervisor: Chenghui Liang*

## RESEARCH EXPERIENCE

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**Networking for Immersive Communications (NICO)** 2022–2026

*Research Assistant, Communication and Distributed Systems Group, University of Bern, Adv. Torsten Braun*

- **Low-Latency Support for Immersive Communications**

*Funded by Swiss National Science Foundation (SNSF), Project No. 204447*

**Research on Continual Learning to avoid catastrophic forgetting**

*Research assistant*

*09/2020-now*

Department of Computer Science and Engineering, Shenzhen

Advisor: Jianguo Zhang, Professor of Comouter Science at Southern University of Science and Technology, China, emeritus Reader of Visual Computation at University of Dundee, United Kingdom

- Review papers in the field of Continual learning with gradient algorithms like GEM, MER, OTH-SUBSPACE, Superposition
- Research on self supervised method, contrastive learning and medical image analysis

- Do experiments on the MNIST dataset to avoid catastrophic forgetting, and use the feature orthogonal subspace algorithm to achieve sota performance, forgetting less than 5 percent knowledge after learning 20 tasks
- Use Continual learning method to avoid catastrophic forgetting of Bayesian neural network, use uncertainty interpreting to infer Task identification and enhance the out of distribution generalization.

### **Island Reef IoT Integrated Situation Monitoring and Control System**

*Research Assistant*

*03/2017-06/2019*

State Key Laboratory of Networking and Switching Technology, Beijing

Advisor: Shuai Zhao, Associate Professor of Comouter Science, Beijing University of Posts and Telecommunications

The project aims at designing an island reef situation-based display control system for multi-dimensional target monitoring and tracking. System use IoT platform to integrate multiple sensing device data and achieve multi-device cooperation, and also more accurately display the targets situation information surrounding the island, automatic track and lock objects.

- This study is supported by National Natural Science Foundation of China (Grant No.61501048).
- The project results won the first prize of 2019 Wu Wenjun Artificial Intelligence Technology Invention.
- publish papar in IEEE ITAIC 2019. DOI: [10.1109/ITAIC.2019.8785795](https://doi.org/10.1109/ITAIC.2019.8785795)
- demo video
- For device display and control service
- Implemented device control and alarm information display and control function that shows the sensor data of AIS(Automatic Identification System), radar, ADS(Automatic Dependent Surveillance), wind energy and solar energy.
- Implemented video display and control function to show the RTSP video stream and send control commands (such as rotation or focus) to photoelectric device.
- Developed device collaboration service using IOT Middleware, which connects different devices using publish and subscribe network and achieve AIS, radar and photoelectric device cooperation.
- Redesigned and developed ship and radar track display function using Bezier curve fitting method that increase real-time rendering performance by four times, and Simultaneously display 200 AIS sensor data.
- Implemented map switching function that achieve coordinate transformation between Web Mercator projection standard EPSG 3857 and EPSG 4326
- Device display control service part
- Implemented energy information display function to display real-time sensor information such as wind energy, solar energy and weather.
- For Data service part
- Designed distributed graph database storage model that stores perception characteristics, behavior, threat analysis data.
- Implemented database read-write separation and load balance using Haproxy that increase concurrent and read-write efficiency.
- For situation fusion service part

- Developed real-time monitoring services to visualize target information graph and multi-dimensional data views (including perception characteristics, behavior, threat analysis data view).
- Developed playback service (including area, alarm event and panorama mode) that achieve buffered batch data loading and speed control.
- Developed object tracking and spatial interpretation service that visualize migration situation, hotspot area and alarm data honeycomb.
- Developed object profile function to visualize the threat levels of different aspect ratio features.

### **Research on Graph Database and Deep Learning Optical Character Recognition**

*Research Assistant*

*11/2017-01/2018*

Key Laboratory of Network Data Science and Technology, Institute of Computing Technology Chinese Academy of Sciences, Beijing

Advisor: Zhibin Zhang, Associate Professor of Comouter Science, Institute of Computing Technology Chinese Academy of Sciences

Research the performance of the database model, storage engine, and iterative graph computing engine of the graph database. In future, It is used to store the threat kownledge graph after alarm data clustering, alarm data correlation analysis.

- [Source code:click here](#)
- Study multi-master distributed graph database system that have the ability of billion-level graph data storage. Verified its feasibility by storing twitter 1.4 billion relational data based on ArangoDB.
- Study the pros and cons of two storage engines of ArangoDb. Concluded that MMFiles allows for very fast concurrent reads, and RocksDB have the advantage of persistent indexes, read and write separation.
- Study query, traversal, graph computing performance of different storage engines of ArangoDb. Experimented with Breadth First Search and pagerank algorithms, and concluded that the mmfile engine has better performance.
- Study graph computing performance of different architecture of ArangoDb. Experimented with Breadth First Search and pagerank algorithms in cluster architecture and stand-alone, and concluded that cluster architecture has better performance.

Research on end-to-end image text recognition based on deep learning

- [Docker file and Source code:click here](#)
- Achieved deep learning model collaborative computing based on Nvidia-docker container. Used CPTN and CRNN model to convert unstructured image data into structured Chinese text data.
- Built a CPTN model using Caffe, which can detect Chinese text in the image.
- Built a CRNN model using pytorch, which can recognize the text in the image.

### **Research on Internet of Things Architecture and Resource Middleware**

*Research Assistant*

*11/2016-03/2017*

State Key Laboratory of Networking and Switching Technology, Beijing

Advisor: Shuai Zhao, Associate Professor of Comouter Science, Beijing University of Posts and Telecommunications

This study focuses on providing an infrastructure to open up or even break the current application

silos and facilitate the bridge from Intranet of Things to Internet of Things. It provides an infrastructure for heterogeneous resource accessing and formally describing resources and entities based on semantic model, then provides their outputs to different applications by the way of well-understood and machine-processible format. The entire platform consists of five parts: IoT resource modeling tools, IoT resource directory, IoT resource access gateways, unified messaging publish/subscribe networks, and complex event processing engines.

- This study is supported by “973” program of National Basic Research Program of China(Grant No. 2011CB302704, 2012CB315802).
- The program won the first prize of the Technical Inventions category of China Communications Association, 2018.
- Participated in the development of resource modeling tools, achieve the function of creating, organizing and maintaining resource entity model.
- Implemented semantic resource model. Extend the existing W3C SSN, OWL-S ontology, and use Linked Data technology associated with GeoName and FOAF functional ontology to achieve the function of resource templates, instance creation and persistence, which express domain knowledge.
- Developed resource entity binding service that link the underneath resource model and upper entity model.

### Prison indoor positioning platform

Research Assistant

08/2016-11/2016

State Key Laboratory of Networking and Switching Technology, Beijing

Advisor: Chuanchang Liu, Associate Professor of Computer Science, Beijing University of Posts and Telecommunications

Based on high-precision indoor positioning technology, the system accomplish functions such as prison building query, real-time monitoring of personnel, electronic fence, etc. It can query detailed trajectory data of all prison personnel and monitoring equipment in real time, realize personnel management visualization, information digitization and automatic warning.

- Source code:<https://github.com/jingtangao/Prison-indoor-positioning-platform>
- Implemented function of real-time monitoring of location information based on Lora technology and iBeacon node. Achieved visualization of real-time location trace.
- Implemented indoor personnel management and automatic alarm function based on jQuery EasyUI and Bootstrap.

## WORK EXPERIENCE

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### Variational Network Technology Co., Ltd

Founder

03/ 2021-Now

Our mission is to provide computer network services and artificial intelligence products. Our vision is to become a company that continuously develops innovative technology

- Company's main page (Under Recording): <http://www.variationalnetwork.com:8082/>
- Unified social credit code: 91440300MA5GN6FM83
- Have become Provincial 30-certificate-in-one consignee and consignor of import and export goods
- Obtained the qualification for technology import and export license by Chinese government, Obtained Shenzhen Customs certification
- For our products and business

- Developed a new product called anti-forgetting X : <http://lifelonglearning.variationalnetwork.com:8081/>
- Partner He Ke graduated from the University of Science and Technology of China. We designed The Probability Mathematical Model of Macau Gambling Slot Machine for Shangmei Studio, and used the pattern search and Monte Carlo algorithm to adjust the parameters.
- Designed smart modem and Flink-based Weibo monitoring project for individual customers

#### Micro data information technology company

*Research&Development Intern*

07/ 2016-08/2016

ETL for the insurance and claims business data of Xinjiang People Insurance Company, calculate business indicators and use Spark framework for memory calculation acceleration.

- Source code:<https://github.com/jingtiangao/Backend-of-business-indicators-using-Spark-framework>
- Data preprocessing and ETL. Used Kettle to export datasets from the infomix database to provide raw data for data processing
- Calculated insurance business indicators (including NCD coefficients, claims ratios, etc.) based on Spark framework to meet business needs.

### PUBLICATION

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- C. Gao\* and T. Braun, “Moreau Envelope-Based Computational Acceleration for Online Dual-Engine 360° VR Video Caching.”
- C. Gao\* and T. Braun, “Game-Theoretic Incentive Mechanism Design for 360° Video Edge Caching.”
- C. Gao\* and T. Braun, “Dual-Engine Intelligent Caching: A Joint Optimization Framework for 360° Mobile VR Video Edge Caching,” *IEEE Journal on Selected Areas in Communications*, vol. 43, no. 10, pp. 3532–3547, Oct. 2025. doi:10.1109/JSAC.2025.3574596
- C. Gao\* and T. Braun, “Two-Stage Hybrid Edge Caching Framework for 360° VR Video,” in *Proc. IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, Fort Worth, TX, USA, 2025, pp. 1–10. doi:10.1109/WoWMoM65615.2025.00015 (Best Paper Award)
- Y. Yue, C. Gao, *et al.*, “Delay-Aware and Resource-Efficient VNF Placement in 6G Non-Terrestrial Networks,” in *Proc. IEEE Wireless Communications and Networking Conference (WCNC)*, Glasgow, United Kingdom, 2023, pp. 1–6. doi:10.1109/WCNC55385.2023.10118893 (Best Paper Award)
- Chuyang Gao, Shuai Zhao, Bo Cheng. Design and Implementation of Real Time and History multi-view IoT trend Display and Control System[C]//IEEE 8th Joint International Information Technology and Artificial Intelligence Conference 2019. DOI: 10.1109/ITAIC.2019.8785795
- Master’s Thesis : Design and Implementation of Real Time and History Muti-view Trend Display System([Chinese Ver.](#), [Machine Translation English Ver.](#)), Advisor:Shuai Zhao
- Bachelor’s Thesis: Design and implementation of Android real-time data publishing system ([Chinese Ver.](#), [Machine Translation English Ver.](#)), Advisor: Chenghui Liang

### SUPERVISED RESEARCH

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#### Research on game Theory

Advisor: Andy Liu, professor of Finance at the South University of Science and Technology

- Learned the basic method in Matching theory include Gale-Shapley Algorithm and Stable matching
- Learned the basic content of Static game and Nash Equilibrium including spernner lemma, Brouwer fixed point theorem, Proof of the existence of mixed strategy Nash equilibrium.
- learned the basic method of Correlated equilibrium and incomplete or complete information dynamic extension form game including Back track Algorithm, subgame perfect equilibrium and Application in Texas Hold'em
- Learned the basic method of Repeated game including Tit for tat strategy and Nash equilibrium for repeated Prisoner's dilemma
- Learned the basic method of epistemic game including Common knowledge, knowledge function and its application in the stock market
- Learned the basic content about Cooperative game (core and shapley value)
- Learned Auction theory and mechanism design including Second price sealed auction and Vickery's theorem
- For Application part
- [source code](#)
- Programed algorithm in Python to fictitious play for two-player games
- Programed an algorithm to compute correlated equilibria for a finite game
- Reinforcement Learning Application for Football game, my work is Research on the detail of PPO and A3C and DQN algorithm, here is [Paper recurrence](#)

### Research on Financial Econometrics

Advisor: Ti Zhou, Assistant professor of Finance at the South University of Science and Technology

- learned the basic concept of probability, statistics, and econometric tools including Moments, Kurtosis, Jensen's inequality, Moment generating function, Cauchy-Schwarz Inequality, Chi-squared, t, and F Distribution, Law of Large Numbers, Convergence in probability, Markov and Cheby-shev's inequality, Continuous Mapping Theorem, Uniform Law of Large Numbers, Almost Sure Convergence and the Strong Law, Converge in distribution
- learned central limit theorem and Delta Method (extended continuous mapping theorem, Slutsky's theorem)
- learned the basic method of Modelling techniques in asset pricing (lug-in method, Generalized method of moments and its applications Maximum Likelihood Estimation, Score, Hessian, and fisher Information )
- learned the method of Ordinary Least Squares including finite-sample and large-sample statistical properties of the OLS estimator, Geometry way to interpret OLS,nonlinear and linear hypotheses test
- For Application part
- [source code](#)

- Using time-series regression to achieve DATA analysis of market excess return and portfolio excess return, Data from WRDS (Wharton research data services) using CRSP, individual stocks fama bond portfolios, market portfolio(S&P 500), Calculated estimated coefficients as well as regression R2
- Paper recurrence of M&A goodwill, investor overreaction and stock price bubbles and collapses. (pdf)

### **Research on Bayesian Statistics Theory**

Advisor: JingHeng Cai, Associate Professor, School of Mathematics, Sun Yat-sen University, China

03/2021-06/2021

- Learned basic concepts of Single-parameter models (highest posterior density region, Estimating a Normal Mean with Known Variance, oninformative Prior Distributions, informative Prior Distributions ,conjugate, Noninformative Prior Distributions, Jeffreys' invariance principle, Posterior predictive distribution)
- Learned basic method of multiparameter models (Normal Data with a Conjugate Prior Distribution or Noninformative Prior Distribution, Multinomial Model for Categorical Data or with Known Variance or with Unknown Mean and Variance)
- Learned basic method of Hierarchical models (Fully Bayesian Analysis of Conjugate Hierarchical Models, Estimating Exchangeable Parameters From a Normal Model)
- Learned basic method of Model check (Posterior Predictive p value)
- Learned method of Evaluating Models (Information Criteria and Cross-Validation, Out-of-sample predictive accuracy expected log posterior predictive density, Akaike information criterion, Bayesian information criterion, Deviance information criterion)
- Learned the basic algorithm of Bayesian Computation (Distributional Approximations, Simulating from predictive distributions Rejection sampling, Importance Sampling)
- Basics of Markov chain simulation (Gibbs sampler, Metropolis and Metropolis-Hastings algorithms, Inference and assessing convergence)

### **Research on non-smooth optimization theory**

Advisor: Jin Zhang, Tenure-track assistant professor, Department of Mathematics, Southern University of Science and Technology, China

09/2020-01/2021

- Learned basic concepts about Affine Sets and Convex Sets, Dual Space, Extended Real-Valued Functions (Closedness versus Continuity, Convex Functions and Support Functions, quivalence of closedness, lower semicontinuity, and closedness of level sets )
- Learned basic concepts about Subgradients (supporting hyperplane theorem, Directional Derivatives, The Max Formula brige between the Subgradients Directional Derivatives, sum rule of subdifferential calculus, Value Function, Lipschitz Continuity and Boundedness of Subgradients )
- Learned Optimality Conditions (Fermat's optimality condition, Convex Constrained Optimization, Nonconvex Composite Model, KKT Conditions, Fritz-John necessary optimality conditions, Constrained qualification like MFCQ, slater condition )
- learned basic theory about Conjugate Functions (Biconjugate, conjugate of indicator functions, Conjugate Calculus Rules,Infimal Convolution and Conjugacy, Subdifferentials of Conjugate Functions, Fenchel's Duality Theorem, conjugate subgradient theorem)

- learned basic theory of Smoothness and Strong Convexity (Descent Lemma, Characterizations of L-Smooth Functions, The Conjugate Correspondence Theorem, Bridge between L-smooth, sigma-strongly)
- learned basic method of Proximal Operator (The First Projection Theorem, First proxTheorem, Prox Calculus Rules, Moreau Decomposition, The Moreau Envelope, smoothness and Prox of the Moreau Envelope)

### **Application of Scientific Computing and Numerical Algebra**

Advisor: Alexander Kurganov, Chair Professor in Department of Mathematics, Southern University of Science and Technology, China, emeritus Professor in Mathematics Department, Tulane University, USA

09/2020-01/2021

- Course learning part
- Learn basic concepts including Well-posedness and Condition Number of a Problem, Approximation of Eigenvalues (Power Method)
- Learn basic method including Direct for the Solution of Linear Systems (Triangular matrix, Gaussian Elimination Method and LU Factorization, Cholesky Factorization, QR Factorization, Pivoting, Block LU Factorization)
- Learn basic method including Iterative Methods for the Solution of Linear Systems (Linear Iterative Methods, Jacobi, Gauss-Seidel and Relaxation Methods, Stationary Iterative Methods, Gradient Method, Conjugate Gradient Method) ,
- Learn basic method of Rootfinding for Nonlinear Equations (Bisection Method, Methods of Chord, Secant and Regula Falsi and Newton's Method,Zeros of Algebraic Equations,The Newton-jacobian Method, The Newton-Horner Method,The Muller Method, Stopping Criteria, Aitken's Acceleration)
- Learn basic method of Rootfinding for Nonlinear Systems (Newton's Method and Its Variants,Secant-like Methods, Fixed-point Methods)
- Learn basic theory of Polynomial Interpolation (Lagrange Interpolation, Runge's phenomenon, Newton Form of the Interpolating Polynomial)
- Learn basic theory of Numerical Integration (Midpoint or Rectangle Formula, Trapezoidal Formula, Simpson Formula, Composite formula, Newton-Cotes Formulae, Stable Romberg Integration, Richardson Extrapolation, Singular Integrals, Multidimensional Numerical Integration)
- Learn basic theory of Orthogonal Polynomials in Approximation Theory (Chebyshev Polynomials Legendre Polynomials, Discrete Least-Squares Approximation, Fourier Trigonometric Polynomials, Approximation of Function Derivatives, Classical Finite Difference Methods, Compact Finite Differences, Pseudo-Spectral Derivative), Approximation of Function Derivatives
- Application part
- all codes in [Source code:<https://github.com/jingtiangao/-Application-of-Scientific-Computing-and-Numerical-Algebra>](https://github.com/jingtiangao/-Application-of-Scientific-Computing-and-Numerical-Algebra)
- Use Newton's method to solve the roots of the equation and calculate its error and convergence
  - 1. Use quadratic Lagrangian interpolation for exponential functions, compare their concavity and convexity, and calculate the error

- 2. Write code to observe the run phenomenon, perform high-order polynomial interpolation for  $f = 1/(1 + x^2)$ , and calculate the error in a specific interval
- Numerical integration part
  - 3. Apply the midpoint, trapezoidal, and Simpson's composite rules to approximate the integral of exponential function discuss their convergence (both theoretically predicted and practically achieved) as a function of the size h of the subintervals.
  - 4. Estimate the minimum number m of subintervals that is needed for computing exponential integral up to an absolute error using the composite trapezoidal and Simpson's rules, Evaluate in both cases the absolute error.
  - 5. Using the trapezoidal rule with 9 different subdivisions, determine empirically its rate of convergence for the evaluation of the integral of  $\int_0^1 x^\alpha \ln x$  for different alpha.
- Curve Fitting part
  - 6. Write a program to interpolate the hat function by trigonometric polynomials Measure maximum absolute error on the mesh and experimental rate of Convergence.
- Numerical differentiation part
  - 7. Using Taylor's expansions derive a sixth order method for approximating the second derivative of a given smooth function, approximate the second derivative of exponential function multiplied by trigonometric function, verifying its order by different mesh

## **Data Stream Processing System**

*03/2021-06/2021*

- Source code:<https://github.com/jingtiangao/Data-Stream-Processing-System-based-on-Flink-and-kafka>
- Design and implement a weibo data stream processing system based on Flink and kafka, use containerized technology to deploy the system, and use WebSocket to push information
- Perform performance evaluation of the system in terms of throughput, latency, scalability, etc.

## **Epsilon Transformation file execution code tracking**

*03/2021-06/2021*

- Source code:<https://github.com/jingtiangao/ETL-file-execution-code-tracking>
- Obtain executed lines by judging the running code line by viewing the activation status of the abstract syntax tree

## **Predicting Loan Credit Risk using Apache Spark Machine Learning Random Forests**

Advisor: Junping Du, Associate Professor of Computer Science, Beijing University of Posts and Telecommunications

*03/2017-03/2018*

- Source code:<https://github.com/jingtiangao/Predicting-Loan-Credit-Risk-using-Apache-Spark-Machine-Learning-Random-Forests>
- Built a random forest of decision trees model using German Credit Data Set, which can risks of bank credit loans.
- Used Area Under an ROC Curve to evaluate the predictions.
- Tuned Model parameter, adjusted the depth of the decision tree and the number of decision trees to improve generalization ability.

## **Deep Learning End to End Digital Modulation Classification and Demodulation System**

*03/2017-06/2017*

- Source code:<https://github.com/jingtiangao/Deep-Learning-End-to-End-Digital-Modulation-Classification-and-Demodulation-System>
- Conducted data processing using MATLAB signal toolbox, which calculate cumulants and generate labeled QPSK, 8PSK, 16QAM train and test dataset (including different signal-to-noise ratio)
- Built modulation recognition model using Multilayer Perceptron, for data with SNR above 15db, the accuracy rate is close to 100%.
- Built demodulation model using Convolutional Neural Network and generated confusion matrix, for data with SNR above 20db, the accuracy rate is close to 100%.
- Parameter tuning, using relu activation function, softmax crossentropy loss function, adam optimization algorithm and adjusting learning rate, which increase the convergence speed and improve classification accuracy.
- Cascaded two models to achieve end-to-end modulation and demodulation

## **Predicting House Prices on Kaggle**

*03/2017-06/2017*

- Source code:<https://github.com/jingtiangao/Predicting-House-Prices-on-Kaggle>
- Built Multilayer Perceptron model and used squared loss function using Mxnet, which predict house prices and got top 10% ranking (375th of 4422).
- Conducted data processing using Python Pandas, which standardize the continuous numerical values and convert discrete values into indicative features.
- Tuned Parameters, use dropout, weight decay, adam optimization algorithm,k-fold cross-validation to reduce overfitting and average test error and increase prediction accuracy.

## **Image Classification (CIFAR-10) on Kaggle**

*03/2017-06/2017*

- Source code:<https://github.com/jingtiangao/Image-Classification-CIFAR-10-on-Kaggle>
- Built Wide ResNet model to achieve image classification and get score 0.95 which is top 10 % ranking.
- Used Tesla K80 GPU to increase computing performance.
- Conducted image augmentation, performed normalization for the three RGB channels which ensure the certainty of the output.
- Tuned Parameters, use Nesterov momentum, weight decay and batchnorm layer to increase the convergence speed, reduce overfitting and prevent gradient explosion.

## **Dog Breed Identification (ImageNet Dogs) on Kaggle**

*03/2017-06/2017*

- Source code:<https://github.com/jingtiangao/Dog-Breed-Identification-ImageNet-Dogs-on-Kaggle>

- Built neural network model which combined ResNet-152v1 model and inceptionv3 model to achieve image classification and get Top 10 % ranking on Kaggle competition.
- Used fine-tuning for transfer learning, use pre-trained ResNet152v1 and inceptionv3 neural network model on the ImageNet dataset as the source model and fine-tune the remaining layer parameters, to increase the performance and accuracy of model and optimize the score from 0.267 to 0.017.

## Neural Style Transfer

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Neural-Style-Transfer>
- Built the VGG-19 model pre-trained on the ImageNet dataset to extract image content and style features.
- Used a Gram matrix to represent the style output by the style layer.
- Defined loss function including Content Loss, Style Loss and Total Variance Loss, which achieve composite image style transfer and noise reduction.

## Object Detection Based on Single Shot Multibox Detection Model

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Object-Detection-Based-on-Single-Shot-Multibox-Detection-Model>
- Built SSD model, use VGG as a base network block and use several multiscale feature blocks to generate anchor boxes and predict their categories and offsets, which achieve object detection.
- Defined loss and evaluation function, use L1 norm loss as anchor box offset loss and use the average absolute error to evaluate the bounding box prediction results.

## Semantic Segmentation based on Fully Convolutional Networks

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Semantic-Segmentation-based-on-Fully-Convolutional-Networks>
- Used Pascal VOC2012 Dataset to train FCN model.
- Added transposed convolution layer to build Fully Convolutional Network model, which achieve Semantic Segmentation.

## Lyric Creation based on Recurrent Neural Network

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Lyric-Creation-based-on-Recurrent-Neural-Network>
- Used one-hot encoding to represent word and use lyrics created by Jay Chou as dataset.
- Built Recurrent Neural Network model, use SoftmaxCrossEntropy as loss function, and use Perplexity to evaluate the model, which achieve lyric creation.
- Used gradient clipping to stablize training and prevent gradient explosion.

## Neural machine translation

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Neural-machine-translation>
- Built a sequence to sequence model(trained by English to French dataset) with attention mechanisms to achieve machine translation.

## Google auto completion

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Google-auto-completion>
- Implemented two Hadoop Mapreduce jobs to build the N-Gram Model from the wiki dataset.
- Used JQurey Ajax to call the database data that achieved autoComplete function on the search engine web page.

## Movie Recommender System

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Movie-Recommender-System>
- Conducted data processing for Netflix dataset and implemented 4 Map Reduce Jobs to recommend similar movies that users liked before.
- Used item-based collaborative filtering algorithm to obtained the recommendation movie list.

## Experiment on PJSIP and VOIP

Advisor: Yue Ma, Associate Professor of Computer Science, Beijing University of Posts and Telecommunications

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Experiment-on-PJSIP-and-VOIP>
- Called server with PJSIP
- Used Wireshark to capture and analyze SIP traffic packets related to VOIP sessions.

## Research on Lucence document search tool and Nutch web crawler

Advisor: Chuanchang Liu, Associate Professor of Computer Science, Beijing University of Posts and Telecommunications

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Research-on-Lucence-document-search-tool-and-Nutch-web-crawler>
- Used Nutch multi-threaded crawler to crawl multiple websites in LAN and Internet.
- Used API interface of Lucence to design and implement a small information retrieval system (support txt, doc, pdf, html, ppt, xls, xml).

## Numerical and Symbolic Computation Experiment: LU decomposition and QR decomposition algorithm

Advisor: Tao Qi, Associate Professor of Computer Science, Beijing University of Posts and Telecommunications

03/2017-06/2017

- Source code:<https://github.com/jingtiangao/Numerical-and-Symbolic-Computation-Experiment-LU-decomposition-and-QR-decomposition-algorithm>

- Developed matrix LU decomposition algorithm using C++ language, and used gaussian elimination method to calculate linear algebraic equations.
- Developed matrix QR decomposition algorithm using C++ language and Hessenberg transform that can calculate linear algebraic equations.

### **Blackjoker game program**

09/2016-12/2016

- Source code:<https://github.com/jingtiangao/blackjoker>
- Implemented a card game like blackjack.

### **Anime entry search engine**

Advisor: Lei Li, Associate Professor of Comouter Science, Beijing University of Posts and Telecommunications

07/2016-09/2016

- Source code:<https://github.com/jingtiangao/Anime-entry-search-engine>
- paper Chinese Ver., Machine Translation English Ver.
- Implemented crawler program that have grabed 4287 items related to animation content at moegirl.org
- Conducted data processing such as word cutting and statistics to get document tf-idf weight and inverted index.
- Implemented vector space model to calculate the relevance of query statements and documents, which help to display the most similar 10 documents on web page.
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### **Experiment on Broadband Communication Network**

Advisor: Xin Li, Associate Professor of Comouter Science, Beijing University of Posts and Telecommunications

07/2016-09/2016

- Source code:<https://github.com/jingtiangao/Experiment-on-Broadband-Communication-Network>
- Used Wireshark to analyze the number of URL first packets and RTT time.
- Calculated the theoretical fastest time to transmit 128KB without server delay response (slow-start algorithm is exponential growth) under conditions of 50ms delay, no packet loss, jitter free network.
- Used iptables to analyze characteristics of TCP retransmission timer respectively under the system of CENTOS-5, CENTOS-6, WIN7.
- Used Dns Tunnel tool (like iodine) to traverse the campus gateway billing system to access Internet bypassing WEB portal authentication.

### **Design and implementation of Android real-time data publishing system**

Advisor: Chenghui Liang, Associate Professor of Electronic Engineering, Shandong University

12/2015-06/2016

- Source code

- Proposed a mobile solution for real-time data monitoring to meet the needs of real-time and mobile release of battle data in computer game: League of Legends.
- R&D server using Mina communication framework to support high concurrent multi-client access.
- R&D client using Android Chart Engine to achieve chart drawing and network data communication.

### **Research and Simulation on Image Communication System using MATLAB**

Advisor: Chengyou Wang, Associate Professor of Electronic Engineering, Shandong University

05/2015-07/2015

- Source code:<https://github.com/jingtiangao/Research-and-Simulation-on-Image-Communication-System-using-MATLAB>
- Study performance of JPEG image compression and reconstruction algorithm with different compression ratios, the analysis result obtained from the rate-distortion curve is that the JPEG algorithm is more suitable for compressing and reconstructing images with many low-frequency components.
- Study the effect of different filtering algorithms (mean filtering, median filtering, Wiener filtering) on the performance of image compression and reconstruction, concluded that JPEG encoding is more suitable for compressing and reconstructing the median filtered image.
- Study effects of different interpolation algorithms (nearest neighbor, bilinear, cubic convolution interpolation) after downSampling by factor 2 on the performance of image compression and reconstruction, the result is that nearest neighbor interpolation algorithm reduces compression performance the most.
- Study the effect of rotation attack and noise attack on the performance of watermark embedding and extraction for grayscale image and 24-bit color image. Used Arnold Image-Scrambling and chaotic scrambling to achieve water embedding. Concluded that the watermarking algorithm is robust to JPEG compression, Gaussian noise attack, and rotation attack.

### **Research on Intelligent Greenhouse Model Based on Internet of Things**

Advisor: Qingfu Du, Associate Professor of Control Engineering, Shandong University

05/2015-06/2015

- Study the technical solutions for monitoring, communication and early warning of environmental perception data in greenhouses that won school-level second prize in "challenges the cup " the national university student extracurricular academic science and technology work competition in China.

### **Simple graphical editor based on MFC**

Advisor: Chenghui Liang, Associate Professor of Electronic Engineering, Shandong University

12/2014-01/2015

- Source code
- Implemented interactive graphics rendering interface that includes rendering line, rectangle, text, ellipse.
- Developed function of graphic selection, attribute modification and graphic deletion, properties of which includes position, size, color, linear, font.
- Implemented function of graphics persistence.

## **Keyboard typing game based on Windows SDK**

Advisor: Chenghui Liang, Associate Professor of Electronic Engineering, Shandong University

9/2014-11/2014

- Source code
- Developed function of typing tasks random generation function.
- Implemented a cumulative point reward mechanism.

## **Development and design of simulation soft keyboard**

Advisor: Chenghui Liang, Associate Professor of Electronic Engineering, Shandong University

9/2014-11/2014

- Source code
- Developed window soft keyboard based on Windows SDK.

## **Speech signal processing course design**

Advisor: Ruolun Liu, Professor of Electronic Engineering, Shandong University

9/2014-11/2014

- Study and experimented model of cascaded and nondestructive acoustic tubes.
- Study and experimented judgement of voiced and unvoiced sound.
- Study and experimented LPC speech coding.
- Study and experimented speaker recognition based on cepstrum.

## **Embedded System Development: FPGA course design**

Advisor: Sumei Li, Associate Professor of Electronic Engineering, Shandong University

9/2014-11/2014

- Source code:<https://github.com/jingtiangao/Embedded-System-Development-FPGA-course-design>
- Used CYCLONE II series FPGA chip of Altera company to complete the design.
- Developed 4-bit serial carry adder using FPGA.
- Developed " 123 " rolling subtitles using FPGA.

## **Embedded development: Two-wheel intelligent car upright balancing program based on Freescale Kinetis K60 chip**

Advisor: Xiaoli Wang, Associate Professor of Electronic Engineering, Shandong University

06/2013-12/2013

- Source code:<https://github.com/jingtiangao/Embedded-development-Two-wheel-intelligent-car-upright-balancing-program-based-on-Freescale-Kinetis>
- Developed function of intelligent car angle balance control and speed control using PID Algorithm.

## **Personal dynamic website based on J2EE**

03/2017-06/2017

- Developed a small personal dynamic website with information publishing, retrieval and maintenance functions.

### **Course Design of Analog circuit and Digital circuit**

Advisor: Likai Liang, Associate Professor of Electronic Engineering, Shandong University

06/2013-07/2013

- Source code:<https://github.com/jingtiangao/Course-Design-of-Analog-circuit-and-Digital-circuit>
- Made AM broadcast signal radio hardware circuit.
- Implemented answering machine of four groups vies using Multism.

### **Registration and login function page based on ASP.NET**

Advisor: Kun Su, Associate Professor of Software Engineering, Shandong University

06/2014-07/2014

- Source code:<https://github.com/jingtiangao/CSharplearing>
- Developed registration and login function using C# that includes username and password verification.

### **Simple data management software based on C language**

Advisor: Chenghui Liang, Associate Professor of Electronic Engineering, Shandong University

06/2013-07/2013

- Source code:<https://github.com/jingtiangao/Simple-data-management-software-based-on-C-language>
- Developed functions of reading and storing files using C language.
- Implemented the function of adding, deleting, modifying and checking students' course data, and added exception handling mechanism.

### **Embedded development: design and implementation of light control lamp, electronic piano and electronic clock based on 80C51 single chip microcomputer**

Advisor: Qi Sun, Associate Professor of Electronic Engineering, Shandong University

03/2013-05/2013

- Source code:<https://github.com/jingtiangao/Embedded-development-design-and-implementation-of-light-control-lamp-electronic-piano-and-electr>
- Developed hardware circuit and software program of light control lamp, electronic piano and electronic clock using 80C51 single chip microcomputer.

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## **THESIS SUMMARY**

Design and Implementation of Real Time and History multi-view IoT trend Display and Control System  
Chuyang Gao, Shuai Zhao, Bo Cheng

The Internet of Things technology has brought a lot of convenience to regional situation monitoring. Facing complex and interrelated monitoring methods, IoT systems need to access a variety of sensor devices. It is necessary to comprehensively display a large number of multi-source heterogeneous sensing data. The existing work can access multi-source heterogeneous sensor devices and display the sensing data of different devices on different visual interfaces. However, the information displayed by the system lacks relevance, and it is difficult to clarify the relationship between different sensor data, and it is impossible to display comprehensive information after merging multi-sensor data. Moreover,

there is few work that meet the needs of query and playback of historical data. This paper designs and implements a real-time and historical multi-view IoT trend system to deal with the mentioned problems. Using the target information graph, it displays the relationship between different sensor data, and using the method combined real time and history, it proposes a buffered batch data loading algorithm to form a dual-display mode system. An IoT trend simulation platform based on B/S-MVC-MVVM architecture was built. Based on this platform, multi-source heterogeneous sensor data is accessed. The experimental results show that the system can display the relevance of the information and realize the historical data playback effect.

## COURSEWORK

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Game theory : 92/100

Non-smooth optimization theory: 85/100

Theory and Techniques in Mobile Internet of Things: 92/100

Machine Learing: 84/100

Big Data Lectures of Microsoft Asia Research Institute(MOOC):90/100

## HONORS

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- **Best Paper Award**, IEEE WoWMoM 2025, Fort Worth, USA
- **Best Paper Award**, IEEE WCNC 2023, Glasgow, UK
- **First Prize**, Wu Wenjun Artificial Intelligence Technology Invention Award, 2019 (Graduate Research Contributor)
- **First Prize**, Technical Inventions Category, China Communications Association Award, 2018 (Graduate Research Contributor)
- **Graduate Scholarships**, Beijing University of Posts and Telecommunications, 2016–2018 (First-Class 2018; Second-Class 2016 & 2017)
- **Second Prize (University Level)**, 14th “Challenge Cup” National Undergraduate Extracurricular Academic and Scientific Works Competition, Shandong University, 2014, for *An IoT-Based Greenhouse Monitoring and Control System*

## TEACHING AND ADVISING

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### Teaching Experience

**University of Bern**, Bern, Switzerland

- Teaching Assistant, *Internet of Things* (433470), Fall 2025
- Teaching Assistant, *Internet of Things* (11043), Spring 2023

**Southern University of Science and Technology**, Shenzhen, China

- Teaching Assistant, *Artificial Intelligence B* (CS303B), Fall 2021
- Teaching Assistant, *Research Methods*, Fall 2020

### Supervision of BSc Theses

- Ilyas Noa Woo, BSc Thesis, University of Bern, *Evaluation of Forwarding Strategies in Named Data Networking: A Simulation-Based Approach*, November 2025

## SERVICES & PROFESSIONAL MEMBERSHIPS

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## Professional Memberships

- Student Member, IEEE

## Journal Reviewer

- *IEEE Journal on Selected Areas in Communications (JSAC)*
- *Digital Communications and Networks*

## Conference Reviewer

- IEEE International Conference on Communications (ICC), 2026
- Wireless On-Demand Network Systems and Services Conference (WONS), 2025
- IEEE International Conference on Network Softwarization (NetSoft), 2025
- IEEE Global Communications Conference (GLOBECOM), 2025
- IEEE Global Communications Conference (GLOBECOM), 2023

## TALKS

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- **CDS Seminar (Fall 2025)**, University of Bern, Bern, Switzerland, Nov. 24, 2025. *Game Theory for 360° Video Edge Caching*
- **BENEFRI Summer School 2025**, Prangins, Switzerland, Aug. 29, 2025. *Computational Acceleration for Deep Reinforcement Learning and 360° VR Video Caching*
- **IEEE WoWMoM 2025**, Fort Worth, TX, USA, May 28, 2025. *Two-Stage Hybrid Edge Caching Framework for 360° VR Video*
- **CDS Seminar (Spring 2025)**, University of Bern, Bern, Switzerland, May 12, 2025. *XAI and DRL for 360° VR Video Edge Caching*
- **CDS Seminar (Fall 2024)**, University of Bern, Bern, Switzerland, Sept. 23, 2024. *FoV-Adaptive 360° Video Streaming and In-Network Caching with Network Coding Enabled Named Data Networking*
- **BENEFRI Summer School 2024**, Brienz, Switzerland, Sept. 3, 2024. *Dual-Engine Intelligent Caching: A Joint Optimization Framework for 360° Mobile VR Video Edge Caching*
- **CDS Seminar (Spring 2024)**, University of Bern, Bern, Switzerland, Feb. 26, 2024. *Dual-Engine Intelligent Caching: A Joint Optimization Framework for 360° Video Edge Caching*
- **BENEFRI Summer School 2023**, Les Rasses / Sainte-Croix, Switzerland, Aug. 9, 2023. *Reinforcement Learning-Based Joint Optimization for Edge Caching in Mobile Immersive Communication*
- **CDS Seminar (Spring 2023)**, University of Bern, Bern, Switzerland, Apr. 24, 2023. *Amalgamation of Optimization and Reinforcement Learning Algorithms for 360° Video Edge Caching in Immersive Communication Networks*
- **CDS Seminar (Fall 2022)**, University of Bern, Bern, Switzerland, Oct. 24, 2022. *Related Work on Delay Minimization in Immersive Communication*

## TECHNICAL STRENGTHS

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**programming language  
technology stack**

Python, Java, Javascript, MATLAB  
React.js, Node.js, Caffe, PyTorch , Hadoop, Spark, L<sup>A</sup>T<sub>E</sub>X, TikZ  
SpringMVC, MySQL, Nosql(Neo4j, ArangoDB)

## **HIKING AND SNOWBOARDING**

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**Hiking:** Mürren (Lauterbrunnen), Iseltwald to Giessbach, Le Chasseron, Switzerland

**Snowboarding:** Elsigenalp (Lenk), Sörenberg (Lucerne), First, Männlichen, Switzerland